

ing Labe 1309 Page: 1 / 58 00 Rev.:

FCC ID: 2ALSZ-CLNSV2 Report No.: T181016E01-RP2

# RADIO TEST REPORT

FCC 47 CFR PART 15 SUBPART C

Test Standard FCC Part 15.247

Product name NearSky 360

CIMCON Brand name

Model No. NS360V2

Test Result Pass

The test Result was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were given in ANSI C63.10: 2013 and compliance standards.

The test results of this report relate only to the tested sample (EUT) identified in this report.

The test Report of full or partial shall not copy. Without written approval of Compliance Certification Services Inc. (Wugu Laboratory)

Approved by:

Reviewed by:

Konil Tsoi

Kevin Tsai **Deputy Manager** 

Dally . Hong

Dally Hong Engineer

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only. 除非另有說明,此報告結果僅對測試之樣品負責,同時此樣品僅保留90天。本報告未經本公司書面許可,不可部分複製。

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# **Revision History**

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	April 9, 2019	Initial Issue	ALL	Becca Chen



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# 1. GENERAL INFORMATION

# **1.1 EUT INFORMATION**

Applicant	CIMCON Lighting, Inc.
	35 Crosby Drive, Bedford, MA 01730, USA
	CIMCON Lighting, Inc.
Manufacturer	35 Crosby Drive, Bedford, MA 01730, USA
Equipment	NearSky 360
Model Name	NS360V2
	11000012
Model Discrepancy	N/A
Trada Nama	CIMCON
Trade Name	CIMCON
Dessived Data	Ostahar 10, 0010
Received Date	October 16, 2018
Date of Test	November 23, 2018 ~ March 27, 2019
	GFSK : 0.0068
Output Power (W)	8DPSK : 0.0076
Power Supply	AC 120V

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# **1.2 INFORMATION ABOUT THE FHSS CHARACTERISTICS**

### **1.2.1 Pseudorandom Frequency Hopping Sequence**

The channel is represented by a pseudo-random hopping sequence hopping through the 79 RF channels. The hopping sequence is unique for the piconet and is determined by the Bluetooth device address of the master; the phase in the hopping sequence is determined by the Bluetooth clock of the master. The channel is divided into time slots where each slot corresponds to an RF hop frequency. Consecutive hops correspond to different RF hop frequencies. The nominal hop rate is 1 600 hops/s.

# 1.2.2 Equal Hopping Frequency Use

The channels of this system will be used equally over the long-term distribution of the hopsets.

# **1.2.3** Example of a 79 hopping sequence in data mode:

02, 05, 31, 24, 20, 10, 43, 36, 30, 23, 40, 06, 21, 50, 44, 09, 71, 78, 01, 13, 73, 07, 70, 72, 35, 62, 42, 11, 41, 08, 29, 60, 15, 34, 61, 58, 04, 67, 12, 22, 53, 57, 18, 27, 76, 39, 32, 17, 77, 52, 33, 56, 46, 37, 47, 64, 49, 45, 38, 69, 14, 51, 26, 79, 19, 28, 65, 75, 54, 48, 03, 25, 66, 16, 68, 74, 59, 63, 55

# 1.2.4 System Receiver Input Bandwidth

Each channel bandwidth is 1MHz.

The system receivers have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

# **1.2.5 Equipment Description**

15.247(a)(1) that the Rx input bandwidths shift frequencies in synchronization with the transmitted signals.

15.247(g): In accordance with the Bluetooth Industry Standard, the system is designed to comply with all of the regulations in Section 15.247 when the transmitter is presented with a continuous data (or information) system.

15.247(h): In accordance with the Bluetooth Industry Standard, the system does not coordinate it channels selection/ hopping sequence with other frequency hopping systems for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters.



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# **1.3 EUT CHANNEL INFORMATION**

Frequency Range	2402MHz-2480MHz
Modulation Type	<ol> <li>GFSK for BDR-1Mbps</li> <li>π/4-DQPSK for EDR-2Mbps</li> <li>8DPSK for EDR-3Mbps</li> </ol>
Number of channel	79 Channels

#### Remark:

Refer as ANSI C63.10: 2013 clause 5.6.1 Table 4 test channels

Number of frequencies to be tested					
Frequency range inNumber ofLocation in frequencywhich device operatesfrequenciesrange of operation					
1 MHz or less	1	Middle			
1 MHz to 10 MHz	2	1 near top and 1 near bottom			
More than 10 MHz	3	1 near top, 1 near middle, and 1 near bottom			

# **1.4 ANTENNA INFORMATION**

Antenna Type	PIFA PCB Dipole Coils
Antenna Gain	3.32 dBi
Antenna Connector	Ipex MHF



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# **1.5 MEASUREMENT UNCERTAINTY**

PARAMETER	UNCERTAINTY
AC Powerline Conducted Emission	+/- 1.2575
Emission bandwidth, 20dB bandwidth	+/- 0.0014
RF output power, conducted	+/- 1.14
Power density, conducted	+/- 1.40
3M Semi Anechoic Chamber / 30M~200M	+/- 4.12
3M Semi Anechoic Chamber / 200M~1000M	+/- 4.68
3M Semi Anechoic Chamber / 1G~8G	+/- 5.18
3M Semi Anechoic Chamber / 8G~18G	+/- 5.47
3M Semi Anechoic Chamber / 18G~26G	+/- 3.81
3M Semi Anechoic Chamber / 26G~40G	+/- 3.87

#### Remark:

1. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

2. ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report.

# **1.6 FACILITIES AND TEST LOCATION**

All measurement facilities used to collect the measurement data are located at

No.11, Wugong 6th Rd., Wugu Dist., New Taipei City 24891, Taiwan. (R.O.C.)

Test site	Test Engineer	Remark
AC Conduction Room	Dally Hong	-
Radiation	Kane Tseng	-
RF Conducted	Dally Hong	-

**Remark:** The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.



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# **1.7 INSTRUMENT CALIBRATION**

RF Conducted Test Site							
Equipment Manufacturer Model S/N Cal Date Cal Due							
Power Meter	Anritsu	ML2495A	1149001	02/12/2019	02/11/2020		
Power Seneor	Anritsu	MA2491A	030982	02/12/2019	02/11/2020		
Signal Analyzer	R&S	FSV 40	101073	09/27/2018	09/26/2019		
Software	N/A						

3M 966 Chamber Test Site						
Equipment	Manufacturer	Model	S/N	Cal Date	Cal Due	
Band Reject Filters	MICRO TRONICS	BRM 50702	120	02/26/2019	02/25/2020	
Bilog Antenna	Sunol Sciences	JB3	A030105	07/13/2018	07/12/2019	
Cable	HUBER SUHNER	SUCOFLEX 104PEA	25157	02/26/2019	02/25/2020	
Cable	HUBER SUHNER	SUCOFLEX 104PEA	20995	02/26/2019	02/25/2020	
Digital Thermo-Hygro Meter	WISEWIND	1206	D07	01/30/2019	01/29/2020	
double Ridged Guide Horn Antenna	ETC	MCTD 1209	DRH13M020 03	08/20/2018	08/19/2019	
Loop Antenna	ETS.LINDGREN	6502	00148045	10/08/2018	10/07/2019	
Pre-Amplifier	EMEC	EM330	060609	02/26/2019	02/25/2020	
Pre-Amplifier	HP	8449B	3008A00965	02/26/2019	02/25/2020	
PSA Series Spectrum Analyzer	Agilent	E4446A	MY46180323	05/31/2018	05/30/2019	
Antenna Tower	CCS	CC-A-1F	N/A	N.C.R	N.C.R	
Controller	CCS	CC-C-1F	N/A	N.C.R	N.C.R	
Turn Table	CCS	CC-T-1F	N/A	N.C.R	N.C.R	
Software		e3 6.11-	20180413			

AC Conducted Emissions Test Site						
Equipment Manufacturer Model S/N Cal Date Cal Due						
CABLE	EMCI	CFD300-NL	CERF	06/29/2018	06/28/2019	
EMI Test Receiver	R&S	ESCI	100064	07/24/2018	07/23/2019	
LISN	SCHWARZBECK	NSLK 8127	8127-541	02/09/2018	02/08/2019	
LISN	SCHAFFNER	NNB41	03/10013	02/06/2018	02/05/2019	
Software	EZ-EMC(CCS-3A1-CE)					

Remark: Each piece of equipment is scheduled for calibration once a year.



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# **1.8 SUPPORT AND EUT ACCESSORIES EQUIPMENT**

	EUT Accessories Equipment							
No. Equipment Brand Model Series No. FCC ID								
	N/A							

Support Equipment					
No.	Equipment	Brand	Model	Series No.	FCC ID
1	NB(B)	Toshiba	PORTEGE R30-A	N/A	PD97260H

# **1.9 TEST METHODOLOGY AND APPLIED STANDARDS**

The test methodology, setups and results comply with all requirements in accordance with ANSI C63.10:2013, FCC Part 2, FCC Part 15.247.



# 2. TEST SUMMERY

FCC Standard Section	Report Section	Test Item	Result
15.203	1.3	Antenna Requirement	Pass
15.207(a)	5.1	AC Conducted Emission	Pass
15.247(a)(1)	5.2	20 dB Bandwidth	Pass
-	5.2	Occupied Bandwidth (99%)	Pass
15.247(b)(1)	5.3	Output Power Measurement	Pass
15.247(a)(1)	5.4	Frequency Separation	Pass
15.247(a)(1)(iii)	5.5	Number of Hopping	Pass
15.247(d)	5.6	Conducted Band Edge	Pass
15.247(d)	5.6	Conducted Emission	Pass
15.247(a)(1)(iii)	5.7	Time of Occupancy	Pass
15.247(d)	5.8	Radiation Band Edge	Pass
15.247(d)	5.8	Radiation Spurious Emission	Pass



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# 3. DESCRIPTION OF TEST MODES

# **3.1 THE WORST MODE OF OPERATING CONDITION**

Operation mode	GFSK for BDR-1Mbps (DH5) 8DPSK for EDR-3Mbps (3DH5)
Test Channel Frequencies	GFSK for BDR-1Mbps: 1. Lowest Channel : 2402MHz 2. Middle Channel : 2441MHz 3. Highest Channel : 2480MHz
Test Channel Frequencies	8DPSK for EDR-3Mbps: 1. Lowest Channel : 2402MHz 2. Middle Channel : 2441MHz 3. Highest Channel : 2480MHz



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# **3.2 THE WORST MODE OF MEASUREMENT**

AC Power Line Conducted Emission		
Test Condition AC Power line conducted emission for line and neutral		
Power supply Mode	Mode 1: AC 120V.	
Worst Mode I Mode 1 Mode 2 Mode 3 Mode 4		

Radiated Emission Measurement Above 1G			
Test Condition	Test ConditionBand edge, Emission for Unwanted and Fundamental		
Power supply Mode Mode 1: AC 120V.			
Worst Mode 🛛 🖾 Mode 1 🗌 Mode 2 🗌 Mode 3 🗌 Mode 4			
Worst Position       Placed in fixed position.         Worst Position       Placed in fixed position at X-Plane (E2-Plane)         Placed in fixed position at Y-Plane (E1-Plane)         Placed in fixed position at Z-Plane (H-Plane)			
Worst Polarity I Horizontal Vertical			

Radiated Emission Measurement Below 1G		
Test Condition	Test Condition Radiated Emission Below 1G	
Power supply Mode	Mode 1: AC 120V.	
Worst Mode I Mode 1 Mode 2 Mode 3 Mode 4		

#### Remark:

- 1. The worst mode was record in this test report.
- 2. EUT pre-scanned in three axis, X, Y, Z and two polarity, Horizontal and Vertical for radiated measurement. The worst case (X-Plane and Vertical) were recorded in this report
- 3. AC power line conducted emission and for below 1G radiation emission were performed the EUT transmit at the highest output power channel as worse case.



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# 4. EUT DUTY CYCLE

Duty Cycle			
Configuration	TX ON (ms)	TX ALL (ms)	Duty Cycle (%)
BDR-1Mbps	1.0000	1.0000	100.00%
EDR-3Mbps	1.0000	1.0000	100.00%

BDR-1N	1bps	ED	R-3Mbps
* Agilent 18:48:29 Dec 30, 2018	R T Span	🔆 Agilent 18:49:47 Dec 30, 2018	R T Sweep
Ref 107 dB <b>µ</b> V	Mkr1 50 ms 94.56 dBµV 0.00000000 Hz	#Peak	Mkr1 50 ms 94.76 dBpV Sweep Tim 100.0 m
Log 10 dB/	Span Zoom	Log 10 dB/	Swee Single Cor
	Full Span		Auto Swee Tim Nor
LgAv	Zero Span	LgAv	0n <u>0</u>
W1 \$2 \$3 F\$	Last Span	H1 \$2 \$3 F\$	Gate Setur
E(f):		£(f): FTun	Point 60
Center 2.402 000 GHz Res BW 1 MHz #VBW 3 MHz	Span 0 Hz Sweep 100 ms (601 pts)	Center 2.402 000 GHz Res BW 1 MHz #VBW 3 M	Span 0 Hz MHz Sweep 100 ms (601 pts)
Illegal parameter value		Copyright 2000-2012 Agilent Techno	logies



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# 5. TEST RESULT

# 5.1 AC POWER LINE CONDUCTED EMISSION

# 5.1.1 Test Limit

According to §15.207(a),

Frequency Range	Limits(dBµV)	
(MHz)	Quasi-peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5	56	46
5 to 30	60	50

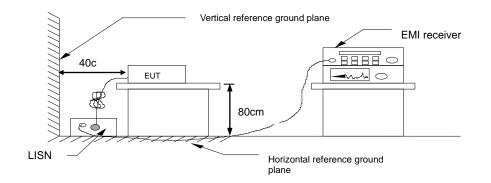
\* Decreases with the logarithm of the frequency.

### 5.1.2 Test Procedure

Test method Refer as ANSI C63.10: 2013 clause 6.2

- 1. The EUT was placed on a non-conducted table, which is 0.8m above horizontal ground plane and 0.4m above vertical ground plane.
- 2. EUT connected to the line impedance stabilization network (LISN)
- 3. Receiver set RBW of 9kHz and Detector Peak and note as quasi-peak and average.
- 4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 5. Recorded Line for Neutral and Line.

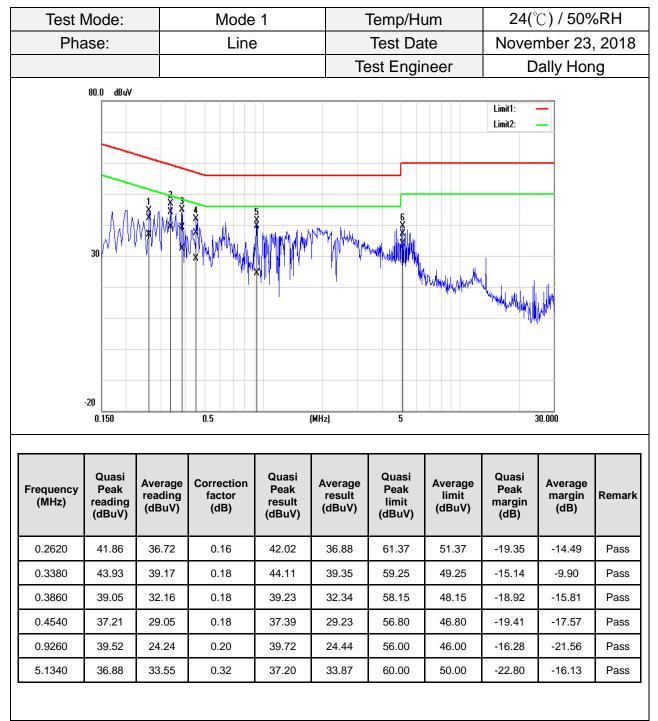
# 5.1.3 Test Setup



# 5.1.4 Test Result PASS



#### Test Data





1.5820

1.8100

2.4660

5.4180

32.07

34.12

33.58

34.10

19.20

17.88

21.02

30.33

0.23

0.24

0.25

0.33

32.30

34.36

33.83

34.43

19.43

18.12

21.27

30.66

56.00

56.00

56.00

60.00

46.00

46.00

46.00

50.00

-23.70

-21.64

-22.17

-25.57

-26.57

-27.88

-24.73

-19.34

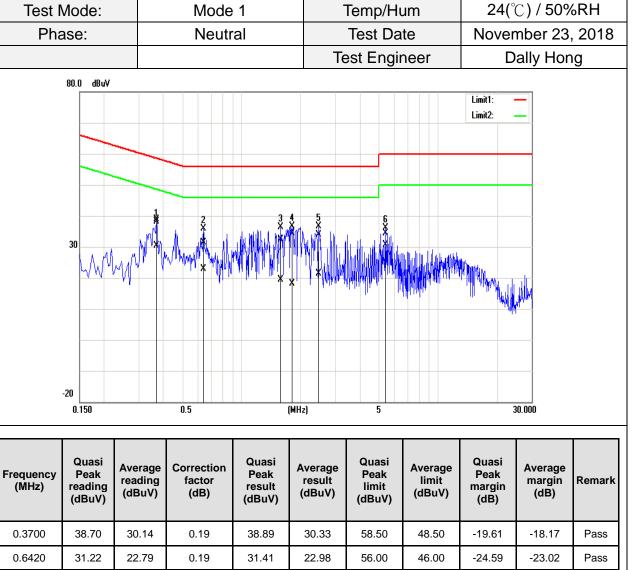
Pass

Pass

Pass

Pass

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# 5.2 20dB BANDWIDTH AND OCCUPIED BANDWIDTH (99%)

# 5.2.1 Test Limit

According to §15.247(a) (1),

20 dB Bandwidth : For reporting purposes only.

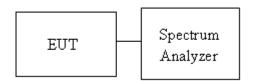
**Occupied Bandwidth(99%)** : For reporting purposes only.

# 5.2.2 Test Procedure

Test method Refer as Section 8.1 and ANSI C63.10: 2013 clause 7.8.7,

- 1. The EUT RF output connected to the spectrum analyzer by RF cable.
- 2. Setting maximum power transmit of EUT
- 3. SA set RBW =30kHz, VBW = 100kHz and Detector = Peak, to measurement 20dB Bandwidth.
- 4. SA set RBW = 1% ~ 5% OBW, VBW = three times the RBW and Detector = Peak, to measurement 99% Bandwidth.
- 5. Measure and record the result of 20 dB Bandwidth and 99% Bandwidth. in the test report.

# 5.2.3 Test Setup





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# 5.2.4 Test Result

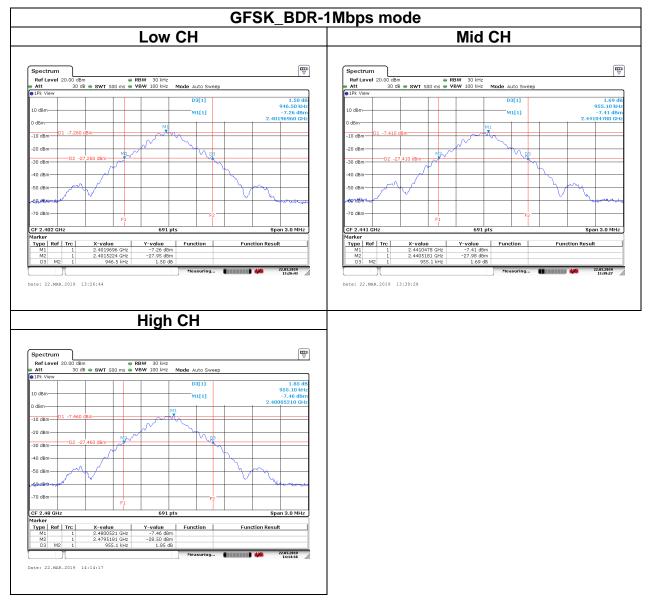
Test mode: GFSK_BDR-1Mbps mode / 2402-2480 MHz				
Channel	Frequency (MHz)	OBW (99%) (MHz)	20dB BW (MHz)	
Low	2402	0.8423	0.9465	
Mid	2441	0.8857	0.9551	
High	2480	0.8726	0.9551	

Test mode: 8DPSK_EDR-3Mbps mode / 2402-2480 MHz				
Channel	Frequency (MHz)	OBW (99%) (MHz)	20dB BW (MHz)	
Low	2402	1.2243	1.3589	
Mid	2441	1.2243	1.3632	
High	2480	1.2330	1.3589	

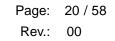


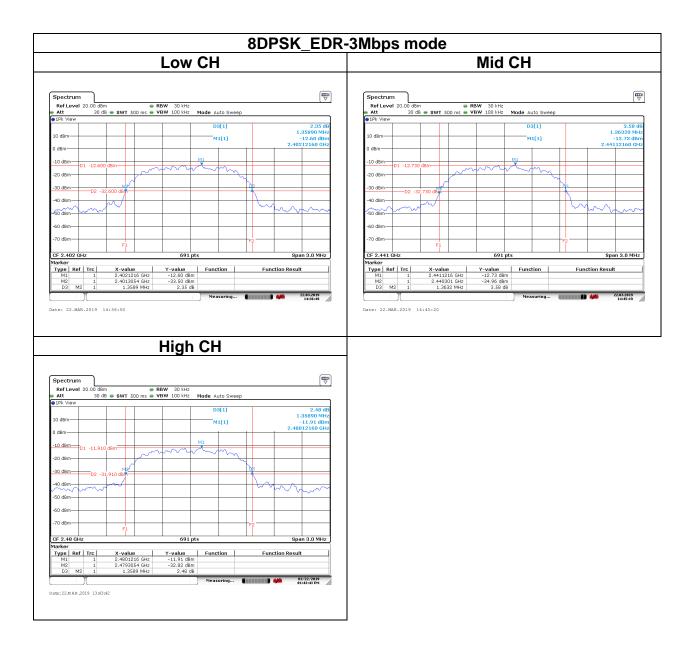
# Test Data

### 20 dB Bandwidth



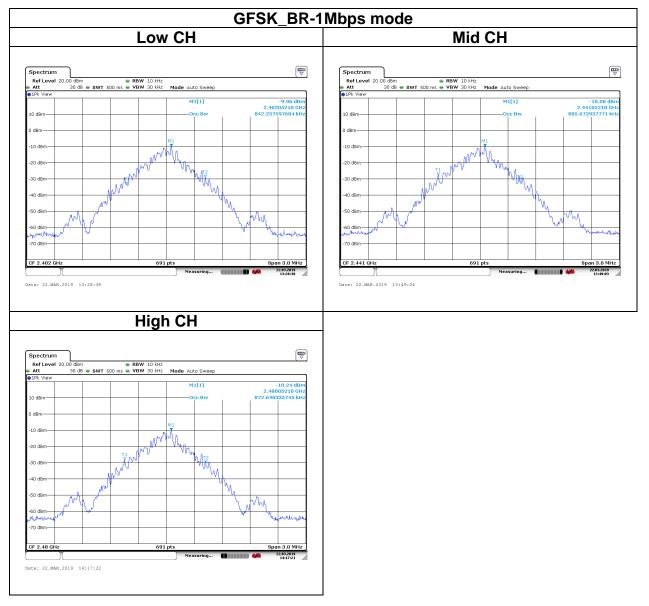




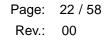


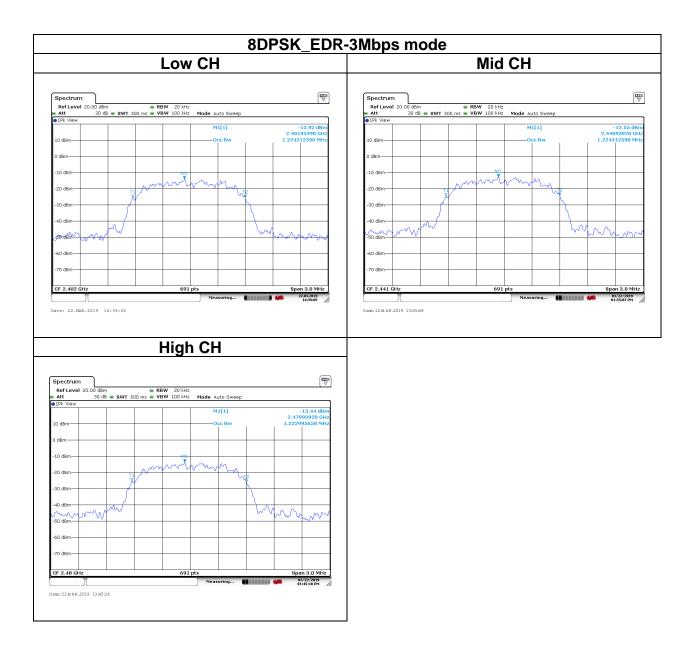


# 99% Bandwidth











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# 5.3 OUTPUT POWER MEASUREMENT

# 5.3.1 Test Limit

According to §15.247(b)(1).

#### Peak output power :

#### FCC

Alternatively, 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, provided the systems operate with an output power no greater than 125 mW.

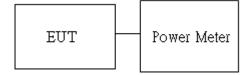
	🛛 Antenna not exceed 6 dBi : 21dBm
Limit	Antenna with DG greater than 6 dBi : 21dBm
	[Limit = 30 - (DG - 6)]

Average output power : For reporting purposes only.

#### 5.3.2 Test Procedure

- 1. The EUT RF output connected to the power meter by RF cable.
- 2. Setting maximum power transmit of EUT.
- 3. The path loss was compensated to the results for each measurement.
- 4. Measure and record the result of Peak output power and Average output power. in the test report.

# 5.3.3 Test Setup





# 5.3.4 Test Result

#### Peak output power :

BT					
Config.	СН	Freq. (MHz)	PK Power (dBm)	PK Power (W)	Limit (dBm)
GFSK BR-1Mbps (DH5)	0	2402	8.33	0.0068	
	39	2441	8.1	0.0065	
	78	2480	7.86	0.0061	21
8DPSK	0	2402	8.52	0.0071	21
EDR- 3Mbps	39	2441	8.79	0.0076	
(DH5)	78	2480	8.4	0.0069	

#### Average output power :

BT					
Config.	СН	Freq. (MHz)	AV Power (dBm)		
GFSK BR-1Mbps (DH5)	0	2402	8.25		
	39	2441	8.01		
	78	2480	7.78		
8DPSK	0	2402	6.16		
EDR- 3Mbps	39	2441	5.83		
(DH5)	78	2480	5.34		

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# 5.4 FREQUENCY SEPARATION

# 5.4.1 Test Limit

According to §15.247(a)(1),

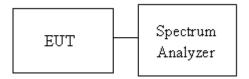
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

Limit >	> two-thirds of the 20 dB bandwidth

### 5.4.2 Test Procedure

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. EUT RF output port connected to the SA by RF cable.
- 3. Set the spectrum analyzer as RBW = 100kHz, VBW = 300kHz, Sweep = auto. Max hold, mark 3 peaks of hopping channel and record the 3 peaks frequency

# 5.4.3 Test Setup





# 5.4.4 Test Result

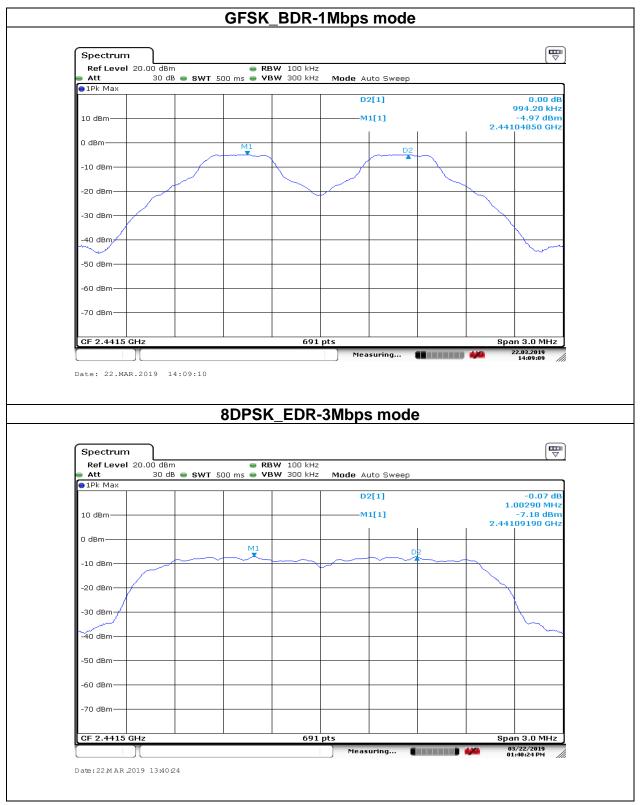
Test mode: GFSK_BDR-1Mbps mode / 2402-2480 MHz						
Channel	Frequency (MHz)	Result				
Low	2402	0.9942	0.631	PASS		
Mid	2441	0.9942	0.637	PASS		
High	2480	0.9942	0.637	PASS		

Test mode: 8DPSK_EDR-3Mbps mode / 2402-2480 MHz						
Channel	Frequency (MHz) Channe Separati (MHz)		Channel Separation Limits (MHz)	Result		
Low	2402	1.0029	0.906	PASS		
Mid	2441	1.0029	0.909	PASS		
High	2480	1.0029	0.906	PASS		



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### Test Data





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# 5.5 NUMBER OF HOPPING

### 5.5.1 Test Limit

According to §15.247(a)(1)(iii)

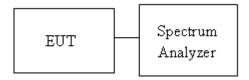
Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

# 5.5.2 Test Procedure

Test method Refer as ANSI C63.10: 2013 clause 7.8.3

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. EUT RF output port connected to the SA by RF cable.
- 3. Set spectrum analyzer Start Freq. = 2400 MHz, Stop Freq. = 2483.5 MHz, RBW =100KHz, VBW = 300KHz.
- 4. Max hold, view and count how many channels in the band.

# 5.5.3 Test Setup





# 5.5.4 Test Result

Number of Hopping						
Mode	Frequency Hopping (MHz) Channel Number		Hopping Channel Number Limits	Result		
BDR-1Mbps	2402-2480	79	15	Deee		
EDR-3Mbps	2402-2480	79	15	- Pass		

#### REMARK:

The frequency spectrum was broken up in to two sub-range to clearly show all of the hopping frequencies. In the AFH mode, this device operation was using 20 channels, so the requirement for minimum number of hopping channels is satisfied

# Test Data

Number of Hopping						
GFSK_B	3DR-1Mbps mod	8DPSK_EDR-3Mbps mode				
Spectrum           Ref Level 20.00 dbm           Att 30 db SWT 100 ms           DBP View           10 dbm           -10 bbm           -20 dbm           -30 dbm           -40 dbm           -50 dbm           -60 dbm           -70 dbm	RBW 100 HH2 VBW 300 HH2 M1[1] M2[1]		1Pk View     10 dBm		-5.35 dbm 2.400300 GHz -0.09 dbm 2.401990 GHz WMW WWW WY W	
Start 2.4 GHz	691 pts	Stop 2.4835 GHz	Start 2.4 GHz	691 pts	Stop 2.4835 GHz	



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# 5.6 CONDUCTED BANDEDGE AND SPURIOUS EMISSION

### 5.6.1 Test Limit

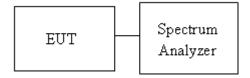
According to §15.247(d),

Limit	-20 dBc	
-------	---------	--

#### 5.6.2 Test Procedure

- 1. EUT RF output port connected to the SA by RF cable, and the path loss was compensated to result.
- 2. SA setting, RBW=100kHz, VBW=300kHz, Detector=Peak, Trace mode = max hold, SWT = Auto.
- 3. The Band Edge at 2.4GHz and 2.4835GHz are investigated with normal hopping mode.

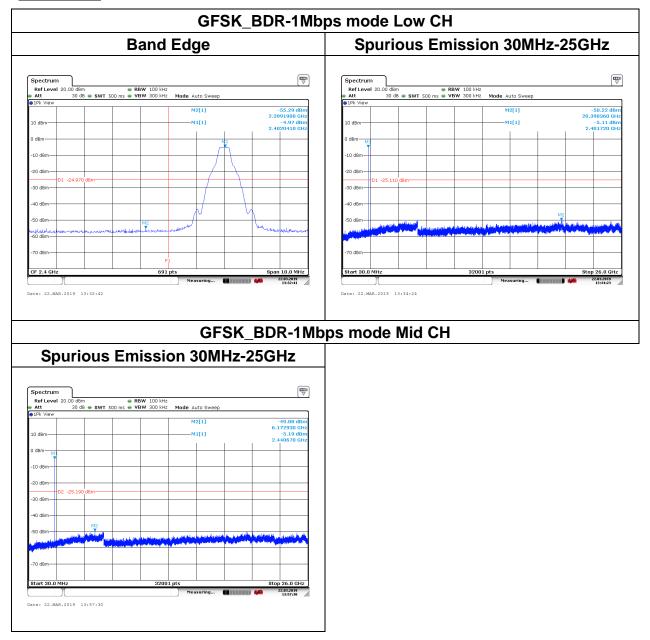
### 5.6.3 Test Setup



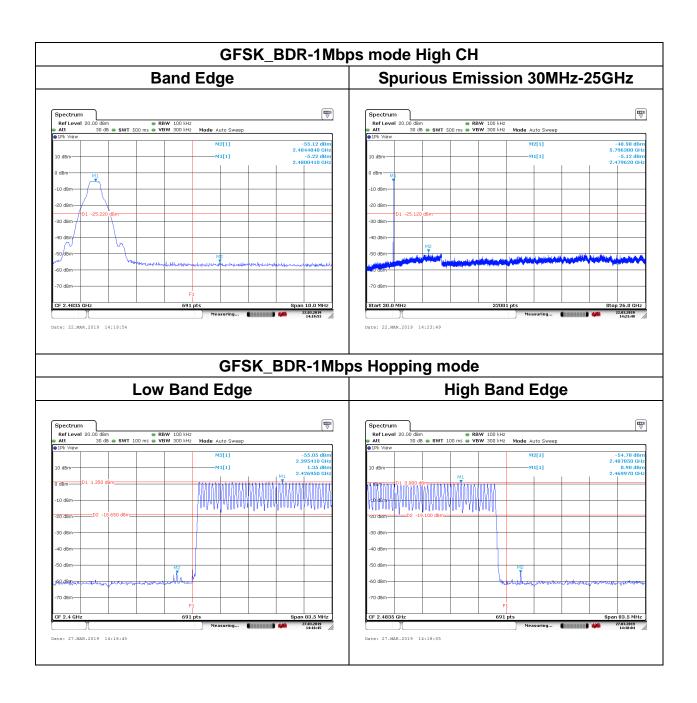


#### 5.6.4 Test Result

#### Test Data

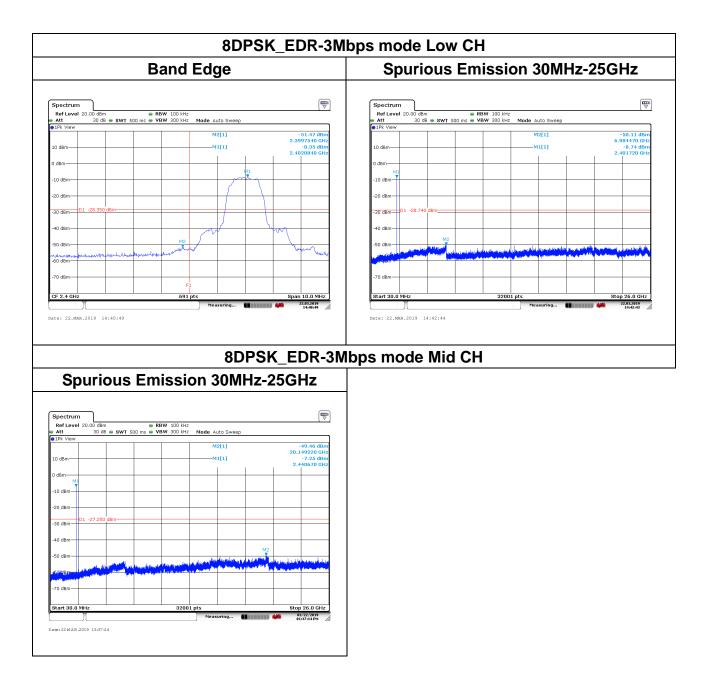




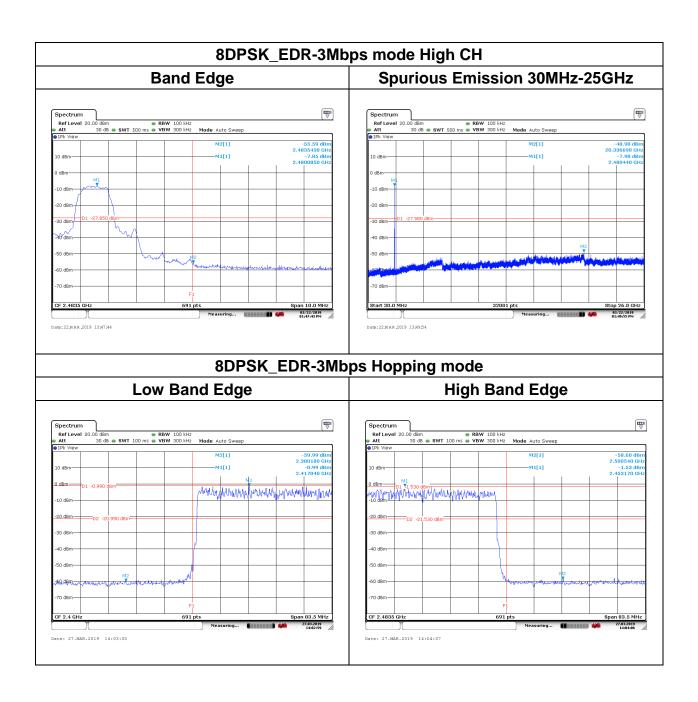




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# 5.7 TIME OF OCCUPANCY (DWELL TIME)

# 5.7.1 Test Limit

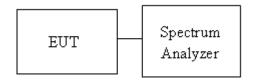
According to §15.247(a)(1)(iii),

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

#### 5.7.2 Test Procedure

- 1. EUT RF output port connected to the SA by RF cable.
- 2. Set center frequency of spectrum analyzer = operating frequency.
- 3. Set the spectrum analyzer as RBW, VBW=1MHz, Sweep = 1 ms

### 5.7.3 Test Setup

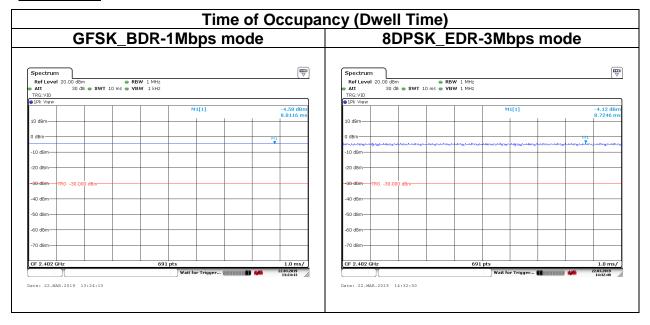


# 5.7.4 Test Result

Time of Occupancy (Dwell Time)								
Mode	(MHz) (ma) Henring From	pulse in IN		Result				
		(ms)	Hopping Freq.	(0.4 * N sec)	(0.4 * N sec)	Limits (s)	s (s)	
BDR-1Mbps	2441	1.0000	79	106.67	0.1067	0.4	Deee	
EDR-3Mbps	2441	1.0000	79	106.67	0.1067	0.4	Pass	
DH5 Packet permit maximum 1600/ 79 / 6 = 3.37 hops per second in each channel (5 time slots RX, 1 time slot TX). So, the dwell time is the time duration of the pulse times 3.37 * 0.4 *79 = 106.6								



#### Test Data





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# 5.8 RADIATION BANDEDGE AND SPURIOUS EMISSION

### 5.8.1 Test Limit

FCC according to §15.247(d), §15.209 and §15.205,

In any 100 kHz bandwidth outside the authorized frequency band, all harmonic and spurious must be least 20 dB below the highest emission level with the authorized frequency band. Radiation emission which fall in the restricted bands must also follow the FCC section 15.209 as below limit in table.

#### Below 30 MHz

Frequency	Field Strength (microvolts/m)	Magnetic H-Field (microamperes/m)	Measurement Distance (metres)
9-490 kHz	2,400/F (F in kHz)	2,400/F (F in kHz)	300
490-1,705 kHz	24,000/F (F in kHz)	24,000/F (F in kHz)	30
1.705-30 MHz	30	N/A	30

#### Above 30 MHz

Frequency	Field Strength microvolts/m at 3 metres (watts, e.i.r.p.)				
(MHz)	Transmitters	Receivers			
30-88	100 (3 nW)	100 (3 nW)			
88-216	150 (6.8 nW)	150 (6.8 nW)			
216-960	200 (12 nW)	200 (12 nW)			
Above 960	500 (75 nW)	500 (75 nW)			

#### Remark:

Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 30 m open are test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.



## 5.8.2 Test Procedure

1. The EUT is placed on a turntable, Above 1 GHz is 1.5m and below 1 GHz is 0.8m above ground plane. The EUT Configured un accordance with ANSI C63.10: 2013, and the EUT set in a continuous mode.

2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level. And EUT is set 3m away from the receiving antenna, which is scanned from 1m to 4m above the ground plane to find out the highest emissions. Measurement are made polarized in both the vertical and the horizontal positions with antenna.

3. Span shall wide enough to full capture the emission measured. The SA from 9kHz to 26.5GHz set to the low, Mid and High channels with the EUT transmit.

Note: No emission found between lowest internal used/generated frequency to 30MHz(9KHz~30MHz)

4. For harmonic, the worst case of output power was BDR-1Mbps. Therefore only BDR-1Mbps record in the report.

5. The SA setting following :

- (1) Below 1G : RBW = 100kHz, VBW ≥ 3 RBW, Sweep = Auto, Detector = Peak, Trace = Max hold.
- (2) Above 1G :
  - (2.1) For Peak measurement : RBW = 1MHz, VBW ≥ 3 RBW, Sweep = Auto, Detector = Peak, Trace = Max hold.
  - (2.2) For Average measurement : RBW = 1MHz, VBW

If Duty Cycle  $\geq$  98%, VBW=10Hz.

If Duty Cycle < 98%, VBW≥1/T.

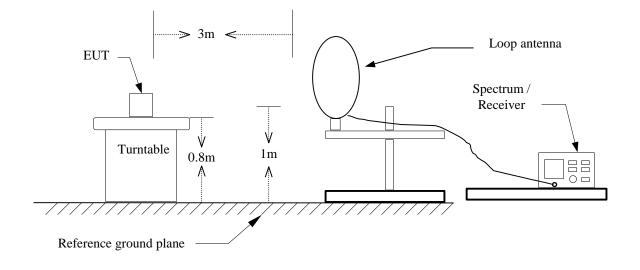
Configuration	Duty Cycle (%)	T(ms)	1/T (kHz)	VBW setting
GFSK_BDR-1Mbps	100%	1.0000	-	10
8DPSK_EDR-3Mbps	100%	1.0000	-	10

- Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 30 m open are test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.
- 2. No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz).

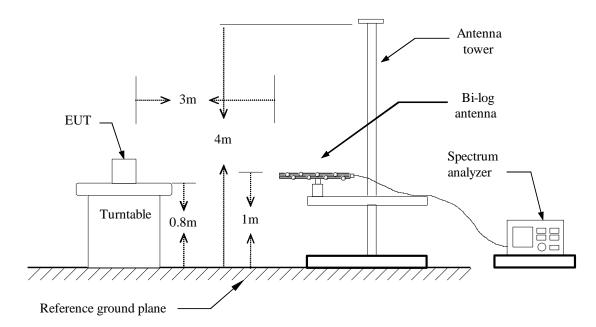


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# 5.8.3 Test Setup <u>9kHz ~ 30MHz</u>

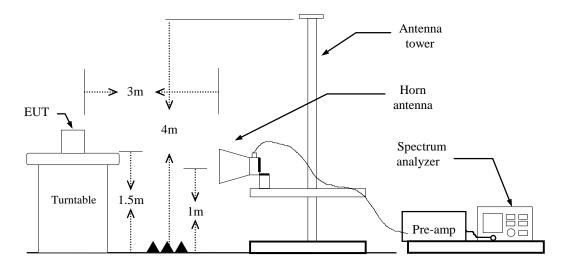


### <u>30MHz ~ 1GHz</u>





### Above 1GHz

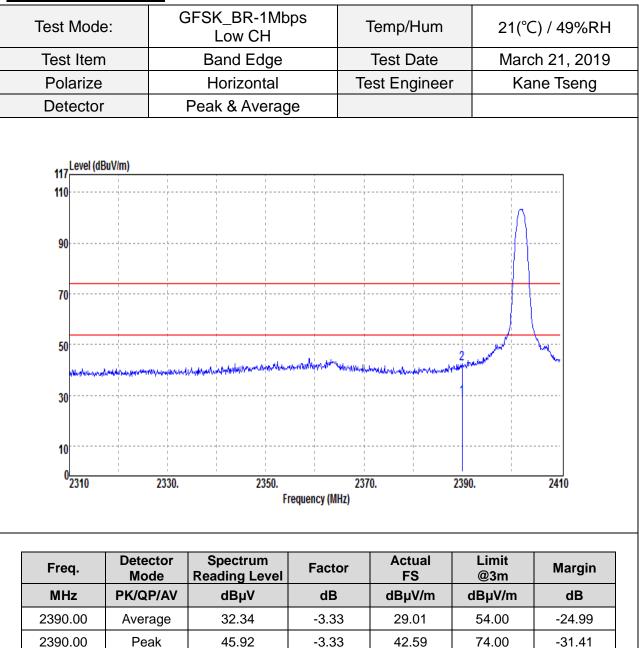


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### 5.8.4 Test Result

### Band Edge Test Data



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Test Mode	):		BR-1Mb∣ ∣h CH	os	Temp/Hum	21(	°C) / 49%Rł
Test Item	I	Band Edge Tes		Test Date	Mai	rch 21, 201	
Polarize		Hori	izontal	Г	est Engine	er K	ane Tseng
Detector		Peak 8	Averag	e			
117 Level (dB 110 90 70	luV/m)		2				
50 Annieline			Property and while	und the work work with the second second	hummen management and the	urraviansky vyskanský svina	ellade-depledere
30							
10							
0 <sup>_</sup> 2475	2480.		2485. Fr	24 equency (MHz)	490.	2495.	2500
Freq.	Detector Mode		ctrum Ig Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dE	βμV	dB	dBµV/m	dBµV/m	dB
		38	.72	-2.72	36.00	54.00	-18.00
2483.50	Average	00					



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Test Mode	e: 80	PSK_EDR-3M Low CH	bps .	Temp/Hum	21(°0	C) / 49%RH
Test Item		Band Edge		Test Date	Marc	ch 21, 2019
Polarize		Horizontal	Te	est Engineer	<sup>.</sup> Ka	ine Tseng
Detector		Peak & Averag	e			
117 Level (dB 110 90 70 50	kuV/m)			mundeline and a second s	2	
чү <sup>л</sup> үшмгчил 30 <sup></sup>	un son ut un Attatu hitedan hitedahari	gan dhaad ah	48		•	
10						
<sup>0</sup> 2310	2330.	2350.	237 equency (MHz)	<b>'</b> 0.	2390.	2410
		п	equency (mnz)			
	Defector				1 * * <b>1</b>	
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2390.00	Average	35.46	-3.33	32.13	54.00	-21.87
		57.15	-3.33	53.82	74.00	-20.18



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Test Mod	e: <sup>8L</sup>	PSK_EDR-3M High CH	ibps .	Temp/Hum	21(°0	C) / 49%Rł
Test Item	1 I	Band Edge		Test Date	Marc	ch 21, 201
Polarize	•	Horizontal	Te	est Engineer	r Ka	ine Tseng
Detector	r	Peak & Averag	e			
117 Level (dl 110 90	BuV/m)					
70 50 <mark>androsenall</mark> 30			nonennitade Maanaan en ee	Mhaitritein an the an an taile	andat-warayapates	10-10-10-10-10-10-10-10-10-10-10-10-10-1
50			nongangtado nga kaja orga	Allandormool Maan an Inde	and at more the polarization of	₩ <b>₩~~~~</b>
50 <mark>mbrostante</mark> 30	2480.	2485.	۲۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰۰		<sup>2495.</sup>	יאָזיעיליאַאַל 2500
50 mbrostant 30	2480.	2485.	245			
50 mbrostant 30	2480.	2485.	245			
50 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	Detector	2485. Fr	249 requency (MHz)	00.	2495.	2500
50 mbrowwell 30 10 0 2475	Detector Mode	2485. Fr Spectrum Reading Level	requency (MHz) Factor	0. Actual FS	2495. Limit @3m	2500 Margin



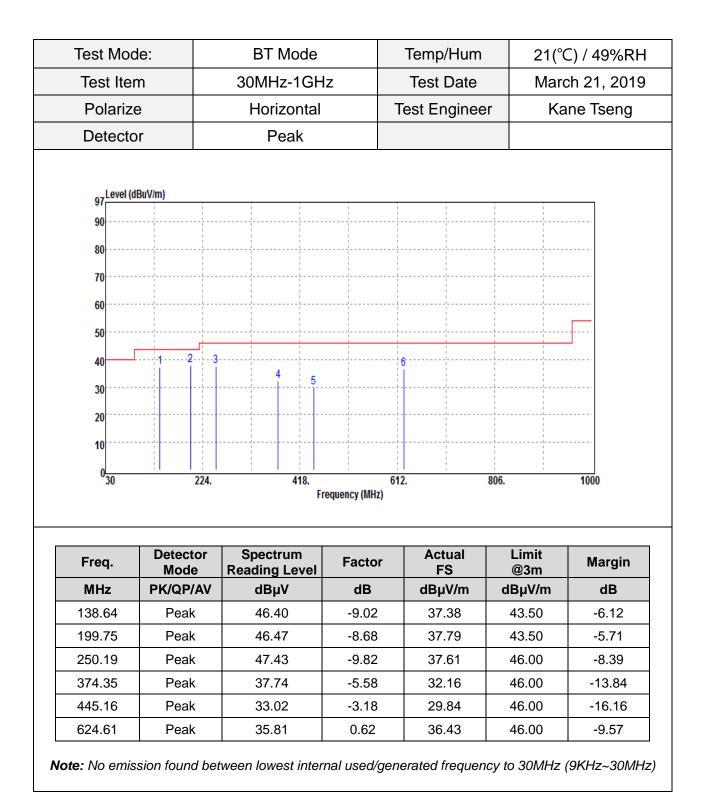
#### Below 1GHz Test Data **BT Mode** Temp/Hum 21(°C) / 49%RH Test Mode: March 21, 2019 Test Item 30MHz-1GHz **Test Date** Kane Tseng Polarize Vertical **Test Engineer** Detector Peak 97 Level (dBuV/m) 90 80 70 60 50 40 Ä 3 5 6 30 20 10 0<mark>\_\_\_\_\_</mark>30 224. 418. 612. 806. 1000 Frequency (MHz)

Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
138.64	Peak	40.58	-9.02	31.56	43.50	-11.94
199.75	Peak	38.85	-8.68	30.17	43.50	-13.33
374.35	Peak	39.65	-5.58	34.07	46.00	-11.93
445.16	Peak	38.07	-3.18	34.89	46.00	-11.11
495.60	Peak	35.58	-2.10	33.48	46.00	-12.52
624.61	Peak	32.13	0.62	32.75	46.00	-13.25

Note: No emission found between lowest internal used/generated frequency to 30MHz (9KHz~30MHz)



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### Above 1GHz Test Data

Test Mode:	GFSK_BR-1Mbps Low CH	Temp/Hum	21(°C) / 49%R	
Test Item	Harmonic	Test Date	March 21, 201	
Polarize	Vertical	Test Engineer	Kane Tseng	
Detector	Peak and Average			
97_Level (dBuV/m)				
90				
80				
70				
60				
502				
40				
30				
20				
10				
0 <mark></mark> 1000	6100. 11200. Frequency (Mi	16300. 21400. iz)	. 26500	

Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
4804.00	Average	42.10	3.11	45.21	54.00	-8.79
4804.00	Peak	44.79	3.11	47.90	74.00	-26.10

- 1. Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency.
- 2. For above 1GHz, the EUT peak value was under average limit, therefore the Average value compliance with the average limit



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Test Mod	le:	GFSK_BR-1Mbps Low CH		Temp/Hum	21(°0	21(°C) / 49%RI	
Test Iter	n	Harmonic		Test Date	Marc	ch 21, 2019	
Polarize	e	Horizontal	-	Test Engine	er Ka	ne Tseng	
Detecto	r	Peak and Aver	age				
97 Level (d	BuV/m)						
90							
80					· · · · · · · · · · · · · · · · · · ·		
70	· · · · · · · · · · · · · · · · · · ·						
60	- 2 -						
50							
40							
30				 	1 1 1 1 1 1		
20							
10	I I I I I I I I I I	· · · · · · · · · · · · · · · · · · ·	     				
0							
0 <mark></mark>	6100		163 requency (MHz)	300.	21400.	26500	
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin	
MHz	Mode PK/QP/AV	Reading Level dBµV	dB	FS dBµV/m	@3m dBµV/m	dB	
4804.00	Average	46.35	3.11	49.46	54.00	-4.54	
4804.00	Peak	48.08	3.11	51.19	74.00	-22.81	
	l			1	1	1	

- 1. Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency.
- 2. For above 1GHz, the EUT peak value was under average limit, therefore the Average value compliance with the average limit



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Test Mod	le:	GFSK_BR-1Mbps Mid CH		Temp/Hum	21(°0	21(°C) / 49%Rł	
Test Iter	n	Harmonic		Test Date	Marc	ch 21, 2019	
Polarize	e	Vertical		Test Enginee	er Ka	ne Tseng	
Detecto	or	Peak and Avera	age				
97	dBuV/m)						
90							
80							
70							
60	·····	L		L			
50				· · · · · · · · · · · · · · · · · · ·			
40				 			
30							
20							
10							
0 <sup>L</sup> 1000	6100.	11200. Fr	16 equency (MHz)	300.	21400.	26500	
			oquonoj (				
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin	
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB	
4882.00	Average	43.08	3.46	46.54	54.00	-7.46	
4885.00	Peak	44.83	3.49	48.32	74.00	-25.68	

- 1. Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency.
- 2. For above 1GHz, the EUT peak value was under average limit, therefore the Average value compliance with the average limit



Test Moc	le:	GFSK_BR-1Mbps Mid CH		Temp/Hum	21(°0	21(°C) / 49%R	
Test Iter	n	Harmonic		Test Date	Marc	ch 21, 201	
Polarize	Э	Horizontal	7	Test Enginee	er Ka	ne Tseng	
Detecto	or	Peak and Ave	rage				
97 Level (d	BuV/m)						
97							
80	· · · · · · · · · · · · · · · · · · ·			· · · · · · · · · · · · · · · · · · ·			
70	· · · · · · · · · · · · · · · · · · ·		       	 			
60	· · · · · · · · · · · · · · · · · · ·						
50							
40							
30							
20							
10				       			
0							
0 <mark>1000</mark>	6100.	11200. F	163 requency (MHz)	500.	21400.	26500	
	Detector	Spectrum		Actual	Limit		
Freq.	Mode	Reading Level	Factor	FS	@3m	Margin	
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB	
4882.00	Average	45.95	3.46	49.41	54.00	-4.59	
4885.00	Peak	47.40	3.49	50.89	74.00	-23.11	

- 1. Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency.
- 2. For above 1GHz, the EUT peak value was under average limit, therefore the Average value compliance with the average limit



Test Mode:	GFSK_BR-1Mbps High CH	Temp/Hum	21(°C) / 49%R
Test Item	Harmonic	Test Date	March 21, 201
Polarize	Vertical	Test Engineer	Kane Tseng
Detector	Peak and Average		
97Level (dBuV/m)			
90			
70			
60			
50			
40			
30			
20		     	
10			
0 <mark></mark> 1000 61	00. 11200. Frequency		400. 26500

Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
4960.00	Average	41.63	4.48	46.11	54.00	-7.89
4960.00	Peak	43.08	4.48	47.56	74.00	-26.44

- 1. Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency.
- 2. For above 1GHz, the EUT peak value was under average limit, therefore the Average value compliance with the average limit



Test Mod	de:	GFSK_BR-1Mbps High CH		Temp/Hum	21(°0	21(°C) / 49%R	
Test Iter	m	Harmonic		Test Date	Mar	ch 21, 201	
Polariz	е	Horizontal	-	Test Enginee	er Ka	ane Tseng	
Detecto	or	Peak and Aver	age				
97 Level (c	IBuV/m)	: :					
90			     				
80			     	       			
70							
60	2	· · · · · · · · · · · · · · · · · · ·			· · · · · · · · · · · · · · · · · · ·		
50		· · · · · · · · · · · · · · · · · · ·	 	 	· · · · · · · · · · · · · · · · · · ·		
40							
30							
20							
10							
0	6100.	11200.	16	300.	21400.	26500	
			requency (MHz)				
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin	
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB	
4960.00	Average	45.97	4.48	50.45	54.00	-3.55	
	Peak	47.66	4.48	52.14	74.00	-21.86	
4960.00							

frequency.2. For above 1GHz, the EUT peak value was under average limit, therefore the Average value compliance with the average limit



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		DPSK_EDR-3N Low CH	PSK_EDR-3Mbps Low CH Temp/Hum		21(°0	C) / 49%F
Test Iter	m	Harmonic		Test Date	Marc	ch 21, 20 <sup>2</sup>
Polariz	e	Vertical		Test Enginee	er Ka	ine Tseng
Detecto	or	Peak and Avera	age			
97	IBuV/m)					
90	1 1 1  1 				1 1 1 1 1 1 1 1	
80						
70						
60						
50	2			1 1 1 1 1 1	· +	
40	 J I					
30				       		
20				1 1 1 1 4 	I I I I I I I I I I I I I I I I I I I I	
10					· · · · · · · · · · · · · · · · · · ·	
0				I I I I I I I		
<sup>0</sup> 1000	6100.	11200. Fre	16 equency (MHz)	300.	21400.	26500
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
4804.00	Average	37.15	3.11	40.26	54.00	-13.74
4804.00	Peak	43.13	3.11	46.24	74.00	-27.76
ark:						

2. For above 1GHz, the EUT peak value was under average limit, therefore the Average value compliance with the average limit



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Test Mode:		DPSK_EDR-3N Low CH	Vbps	Temp/Hum	21(°	C) / 49%RH
Test Iten	n	Harmonic		Test Date	Marc	ch 21, 2019
Polarize	;	Horizontal		Test Engine	er Ka	ane Tseng
Detecto	r	Peak and Avera	age			
97 Level (dB	uV/m)					
90	· · · · · · · · · · · · · · · · · · ·				· · · · · · · · · · · · · · · · · · ·	
80			1			
70			     			
60			J			
50	2		J		· <del>-</del>	
40	1 1 		J		· · · · · · · · · · · · · · · · · · ·	
30				i 1 1 1 1 1 1	·	
20	· · · · · · · · · · · · · · · · · · ·				·	
10	· · · · · · · · · · · · · · · · · · ·			· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	
0						
0 <mark>1000</mark>	6100.	11200. Fr	16 equency (MHz)	300.	21400.	26500
	Detector	Crease transme		Astual	Limit	
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	@3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
4804.00	Average	40.47	3.11	43.58	54.00	-10.42
4804.00	Peak	46.03	3.11	49.14	74.00	-24.86

- 1. Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency.
- 2. For above 1GHz, the EUT peak value was under average limit, therefore the Average value compliance with the average limit



Test Mod	de: 8	8DPSK_EDR-3Mbps Mid CH		Temp/Hum	21(°0	C) / 49%RI
Test Iter	m	Harmonic		Test Date	Marc	ch 21, 201
Polariz	е	Vertical	-	Test Enginee	er Ka	ane Tseng
Detecto	or	Peak and Avera	age			
97 Level (dB	uV/m)					
80						
70						
60						
50	21					
40						
30 20						
10			       			
0 <mark></mark>	6100.	11200.	16: equency (MHz)	300.	21400.	26500
			equency (mnz)			
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
4882.00	Average	38.48	3.46	41.94	54.00	-12.06
4882.00	Peak	43.55	3.46	47.01	74.00	-26.99

- 1. Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency.
- 2. For above 1GHz, the EUT peak value was under average limit, therefore the Average value compliance with the average limit



Test Mode:		8DPSK_EDR-3Mbps Mid CH		Temp/Hum	21(°0	21(°C) / 49%F	
Test Iter	m	Harmonic		Test Date	Marc	ch 21, 20′	
Polariz	e	Horizontal		Test Enginee	er Ka	ne Tseng	
Detecto	or	Peak and Avera	age				
97 Level (d	BuV/m)						
90							
80							
70	· · · · · · · · · · · · · · · · · · ·			     			
60							
50	2						
40							
30					· · · · · · · · · · · · · · · · · · ·		
20	·····			- - - - - - - - - - - - - - - - - - -	· · · · · · · · · · · · · · · · · · ·		
10				I I A I I I I I			
0							
0L 1000	6100.	11200. Fre	16: equency (MHz)	300.	21400.	26500	
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin	
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB	
4882.00	Average	41.27	3.46	44.73	54.00	-9.27	
4882.00	Peak	46.28	3.46	49.74	74.00	-24.26	

- 1. Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency.
  - 2. For above 1GHz, the EUT peak value was under average limit, therefore the Average value compliance with the average limit



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Test Mod	le: 8	DPSK_EDR-3N High CH	Vbps	Temp/Hum	21(°0	21(°C) / 49%RI	
Test Iter	n	Harmonic		Test Date	Marc	ch 21, 2019	
Polarize	e	Vertical	-	Test Enginee	er Ka	ne Tseng	
Detecto	or	Peak and Avera	age				
97 Level (dB	luV/m)						
90							
80							
70							
60							
50	2			 	1 1 		
40				       			
30		1 1 1 		     			
20							
10				       			
0 <mark></mark>	6100.	11200.		300.	21400.	26500	
		FO	equency (MHz)				
	Detector	Spectrum		Actual	Limit		
Freq.	Mode	Reading Level	Factor	FS	@3m	Margin	
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB	
4960.00	Average	37.83	4.48	42.31	54.00	-11.69	
4960.00	Peak	43.46	4.48	47.94	74.00	-26.06	

- 1. Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency.
- 2. For above 1GHz, the EUT peak value was under average limit, therefore the Average value compliance with the average limit



Test Mod	e: 8	DPSK_EDR-31 High CH	Vbps	Temp/Hum	21(°0	C) / 49%R
Test Iten	n	Harmonic		Test Date	Marc	ch 21, 201
Polarize	÷	Horizontal	7	Fest Enginee	er Ka	ane Tseng
Detecto	r	Peak and Aver	age			
97	uV/m)					
90						
80						
70	- J					
60						
50						
40						
30				, , , , , , , , , , , , , , , , , , ,		
20						
10						
0 <mark></mark> 1000	<mark>6100.</mark>	11200.		300.	21400.	26500
		Fr	equency (MHz)			
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	Mode PK/QP/AV	Reading Level dBµV	dB	FS dBµV/m	@3m dBµV/m	dB
4960.00	Average	43.02	4.48	47.50	54.00	-6.50
4960.00	Peak	46.81	4.48	51.29	74.00	-22.71

### Remark:

- 1. Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency.
- 2. For above 1GHz, the EUT peak value was under average limit, therefore the Average value compliance with the average limit

# --End of Test Report--