



# TEST REPORT



Report No. : KES-RF250356

Page 1 / 58

**KES Co., Ltd.**

#3002, #3503, #3701, 40, Simin-daero365beon-gil, Dongan-gu,  
Anyang-si, Gyeonggi-do, 14057, Republic of Korea  
Tel : +82-31-425-6200, Fax : +82-31-341-3838

## ■ FCC & IC TEST REPORT

### 1. Client

- Name : Hanwha Vision Co., Ltd.
- Address : 6, Pangyo-ro 319beon-gil, Bundang-gu, Seongnam-si,  
Gyeonggi-do, South Korea

### 2. Sample Description

- Product item : Rugged Body Worn Camera
- Model name : TWC-S6010
- Manufacturer etc. : 1. HANWHA VISION VIETNAM COMPANY LIMITED  
2. D-TECH CO.,LTD.

3. Date of test : 2025.06.27 ~ 2025.07.29

4. Location of Test :  Permanent Testing Lab  On Site Testing  
○ Address : 473-21, Gayeo-ro, Yeoju-si, Gyeonggi-do, Korea

5. Test method used : Part 15 Subpart C 15.247,  
RSS-247 (Issue 4) & RSS-Gen (Issue 5)

6. Test result : PASS

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

This laboratory is not accredited for the test results marked \*.

This test report is not related to KOLAS accreditation.

Affirmation	Tested by	Technical Manager	
	Name : Gu-Bong, Kang (Signature)	Name : Yeong-Jun Cho (Signature)	

2025. 08. 27.

**KES Co., Ltd.**

**Accredited by KOLAS, Republic of KOREA**



## REPORT REVISION HISTORY

Date	Test Report No.	Revision History
2025.08.27	KES-RF250356	Initial

*This report shall not be reproduced except in full, without the written approval of KES Co., Ltd. This document may be altered or revised by KES Co., Ltd. personnel only, and shall be noted in the revision section of the document. Any alteration of this document not carried out by KES Co., Ltd. will constitute fraud and shall nullify the document.*

### Use of uncertainty of measurement for decisions on conformity (decision rule):

- No decision rule is specified by the standard, when comparing the measurement result with the applicable limit according to the specification in that standard. The decisions on conformity are made without applying the measurement uncertainty("simple acceptance" decision rule, previously known as "accuracy method").
- Other (to be specified, for example when required by the standard or client)



## TABLE OF CONTENTS

1.	General information .....	4
1.1.	EUT description .....	4
1.2.	Test configuration.....	5
1.3.	Information about derivative model .....	5
1.4.	Accessory information .....	5
1.5.	Device modifications.....	5
1.6.	Requirements for Bluetooth transmitter.....	6
1.7.	Sample calculation .....	7
1.8.	Measurement Uncertainty .....	7
1.9.	Frequency/channel operations .....	8
2.	Summary of tests .....	9
3.	Test results .....	10
3.1.	99% Occupied Bandwidth .....	10
3.2.	20 dB bandwidth .....	15
3.3.	Output power .....	20
3.4.	Carrier frequency separation.....	22
3.5.	Number of hopping frequency .....	24
3.6.	Time of occupancy.....	26
3.7.	Radiated restricted band and emissions .....	30
3.8.	Conducted band edge and out of band emissions.....	48
3.9.	AC conducted emissions .....	54
3.10.	Antenna Requirement.....	56
	Appendix A. Measurement equipment.....	57



## 1. General information

Applicant: Hanwha Vision Co., Ltd.  
Applicant address: 6, Pangyo-ro 319beon-gil, Bundang-gu, Seongnam-si, Gyeonggi-do, South Korea  
Test site: KES Co., Ltd.  
Test site address:  #3002, #3503, #3701, 40, Simin-daero365beon-gil, Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Republic of Korea  
 473-21, Gayeo-ro, Yeoju-si, Gyeonggi-do, Korea  
Test Facility FCC Accreditation Designation No.: KR0100, Registration No.: 444148  
ISED Registration No.: 23298  
FCC rule part(s): 15.247  
FCC ID: 2BNRG-TWCS6010  
IC rule part(s): RSS-247 (Issue 4), RSS-Gen (Issue 5)  
IC Number: 33572-TWCS6010  
Test device serial No.:  Production  Pre-production  Engineering

### 1.1. EUT description

Equipment under test Rugged Body Worn Camera  
Frequency range & Number of channels **2 402 MHz ~ 2 480 MHz (BDR/EDR) : 79 ch**  
2 402 MHz ~ 2 480 MHz (LE 1 Mbps) : 40 ch  
2 412 MHz ~ 2 462 MHz (802.11b/g/n\_HT20) : 11 ch  
UNII-1 (FCC only) 5 180 MHz ~ 5 240 MHz (802.11a/n\_HT20/ac\_VHT20) : 4 ch  
UNII-2A (FCC only) 5 260 MHz ~ 5 320 MHz (802.11a/n\_HT20/ac\_VHT20) : 4 ch  
UNII-2C (FCC & IC) 5 500 MHz ~ 5 720 MHz (802.11a/n\_HT20/ac\_VHT20) : 12 ch  
UNII-3 (FCC & IC) 5 745 MHz ~ 5 825 MHz (802.11a/n\_HT20/ac\_VHT20) : 5 ch  
Model TWC-S6010  
Modulation technique **GFSK, π/4DQPSK, 8DPSK, DSSS, OFDM**  
Antenna specification 2.4 GHz band FPCB Antenna // Peak gain: 0.23 dBi  
5.15 ~ 5.35 GHz FPCB Antenna // Peak gain: 2.07 dBi  
5.47 ~ 5.85 GHz FPCB Antenna // Peak gain: 2.52 dBi  
Power source DC 3.8 V (Battery)  
H/W version PV2  
S/W version 25.00.58\_250626\_155221  
Serial Number ZW7Z70GY400008A



## 1.2. Test configuration

The Hanwha Vision Co., Ltd. // Compact Body Worn Camera // TWC-S6010 // FCC ID: 2BNRG-TWCS6010 // IC Number: 33572-TWCS6010 was tested according to the specification of EUT, the EUT must comply with following standards and KDB documents.

FCC Part 15.247

IC RSS-247 Issue 4 and RSS-Gen Issue 5

KDB 558074 D01 v05 r02

ANSI C63.10-2013

## 1.3. Information about derivative model

N/A

## 1.4. Accessory information

Equipment	Manufacturer	Model	Serial No.	Power source
Docking station (optional)	-	TWA-SD010	-	DC 12 V
Docking station (optional)	-	TWA-SD080	-	DC 12 V
Battery Pack (optional)		TWASB42500	-	-

## 1.5. Device modifications

N/A



## 1.6. Requirements for Bluetooth transmitter

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

### **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.

### **Equal hopping frequency use**

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

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

69, 33, 75, 4, 13, 0, 16, 41, 46, 26, 25, 45, 64, 60, 34, 43, 78, 59, 29, 42, 12, 30, 49, 10, 71, 58, 19, 73, 28, 3, 50, 55, 70, 31, 20, 15, 76, 21, 44, 74, 1, 54, 53, 5, 14, 66, 35, 65, 6, 51, 2, 11, 47, 7, 8, 38, 36, 63, 40, 9, 39, 48, 56, 32, 23, 27, 17, 61, 22, 72, 37, 62, 24, 57, 67, 18, 68, 77, 52, 0, 1, 18, 64, 71, 27, 38, 56, 36, 35, 4, 25, 17, 26, 46, 10, 70, 14, 13, 39, 68, 47, 49, 72, 66, 77, 8, 42, 33, 58, 32, 15, 60, 9, 45, 48, 50, 37, 34, 22, 29, 76, 31, 75, 55, 2, 5, 54, 61, 63, 11, 12, 21, 44, 53, 69, 23, 59, 74, 3, 7, 41, 43, 62, 16, 51, 57, 67, 30, 73, 65, 19, 78, 52, 28, 20, 6, 24, 40

### **System receiver input bandwidth**

Each channel bandwidth is 1 MHz.

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.

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 its 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.



### 1.7. Sample calculation

Where relevant, the following sample calculation is provided  
For all conducted test items :

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

$$\begin{aligned}\text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)} \\ &= 0.82 + 20 = 20.82(\text{dB})\end{aligned}$$

For Radiation test :

Field strength level ( $\text{dB}\mu\text{V/m}$ ) = Measured level ( $\text{dB}\mu\text{V}$ ) + Antenna factor ( $\text{dB}$ ) + Cable loss ( $\text{dB}$ ) – Amplifier gain ( $\text{dB}$ )

### 1.8. Measurement Uncertainty

Test Item	Uncertainty	
Uncertainty for Conduction emission test		2.22 dB ( SHIELD ROOM #6 )
Uncertainty for Radiation emission test (include Fundamental emission)	Below 1 GHz	4.04 dB ( SAC #6 )
	Above 1 GHz	5.32 dB ( SAC #5 )
Note. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$ .		



### 1.9. Frequency/channel operations

Ch.	Frequency (MHz)	Rate(Mbps)
00	2 402	BDR 1 Mbps, EDR 2 Mbps, EDR 3 Mbps
.	.	.
40	2 442	BDR 1 Mbps, EDR 2 Mbps, EDR 3 Mbps
.	.	.
78	2 480	BDR 1 Mbps, EDR 2 Mbps, EDR 3 Mbps

Ch.	Frequency (MHz)	Rate(Mbps)
00	2 402	LE 1 Mbps
.	.	.
20	2 442	LE 1 Mbps
.	.	.
39	2 480	LE 1 Mbps

Ch.	Frequency (MHz)	Mode
1	2 412	802.11b/g/n_HT20
.	.	.
6	2 437	802.11b/g/n_HT20
.	.	.
11	2 462	802.11b/g/n_HT20

#### UNII-1 (FCC only)

Ch.	Frequency (MHz)
36	5 180
44	5 220
48	5 240

#### UNII-2A (FCC only)

Ch.	Frequency (MHz)
52	5 260
56	5 280
64	5 320

#### UNII-2C (FCC & IC)

Ch.	Frequency (MHz)
100	5 500
120	5 600
144	5 720

#### UNII-3 (FCC & IC)

Ch.	Frequency (MHz)
149	5 745
157	5 785
165	5 825

802.11a/n\_HT20/ac\_VHT20 mode



## 2. Summary of tests

Section in FCC Part 15	Section in RSS-247 & Gen	Test description	Test results
-	RSS-Gen 6.7	99% Occupied bandwidth	Pass
15.247(a)(1)(iii)	-	20 dB bandwidth	Pass
15.247(b)(1)	RSS-247 6.2.3.1 (a), 6.2.3.2 (a)	Output power	Pass
15.247(a)(1)	RSS-247 6.2.3.1 (a)	Channel separation	Pass
15.247(a)(1)(iii)	RSS-247 6.2.3.1 (b)	Number of channels	Pass
15.247(a)(1)(iii)	RSS-247 6.2.3.1 (b)	Time of occupancy	Pass
15.205, 15.209	RSS-247 6.6, RSS-Gen 8.9, 8.10	Radiated restricted band and emission	Pass
15.207(a)	RSS-Gen 8.8	AC Conducted emissions	Pass
15.247(d)	RSS-247 6.6	Conducted spurious emission and band edge	Pass
15.203	-	Antenna Requirement	Pass

Note.

1. By the request of applicant, test is performed with power setting value below :

Mode	Frequency (MHz)	Setting value
BDR 1 Mbps	2 402 ~ 2 480	1
EDR 2 Mbps		1
EDR 3 Mbps		1

2. The EUT does not operate BT and WLAN simultaneously. Therefore, testing for simultaneous operation mode was not performed.



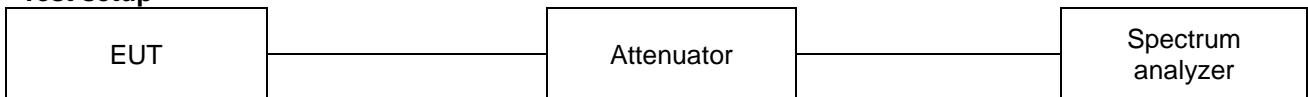
### 3. Test results

#### 3.1. 99% Occupied Bandwidth

##### Test procedure

ANSI C63.10-2013 clause 6.9.2 and 6.9.3

##### Test setup



##### Test setting

1. Span = The instrument center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be between 1.5 times and 5.0 times the OBW.
2. RBW = The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW
3. VBW = shall be approximately three times the RBW
4. Sweep = auto
5. Detector function = Peak
6. Trace = Max hold

##### Limit

None; for reporting purpose only.

**Mode : BDR 1 Mbps**

Frequency(MHz)	99% occupied bandwidth(MHz)	Limit(MHz)
2 402	0.90	
2 442	0.91	-
2 480	0.91	

**Mode : EDR 2 Mbps**

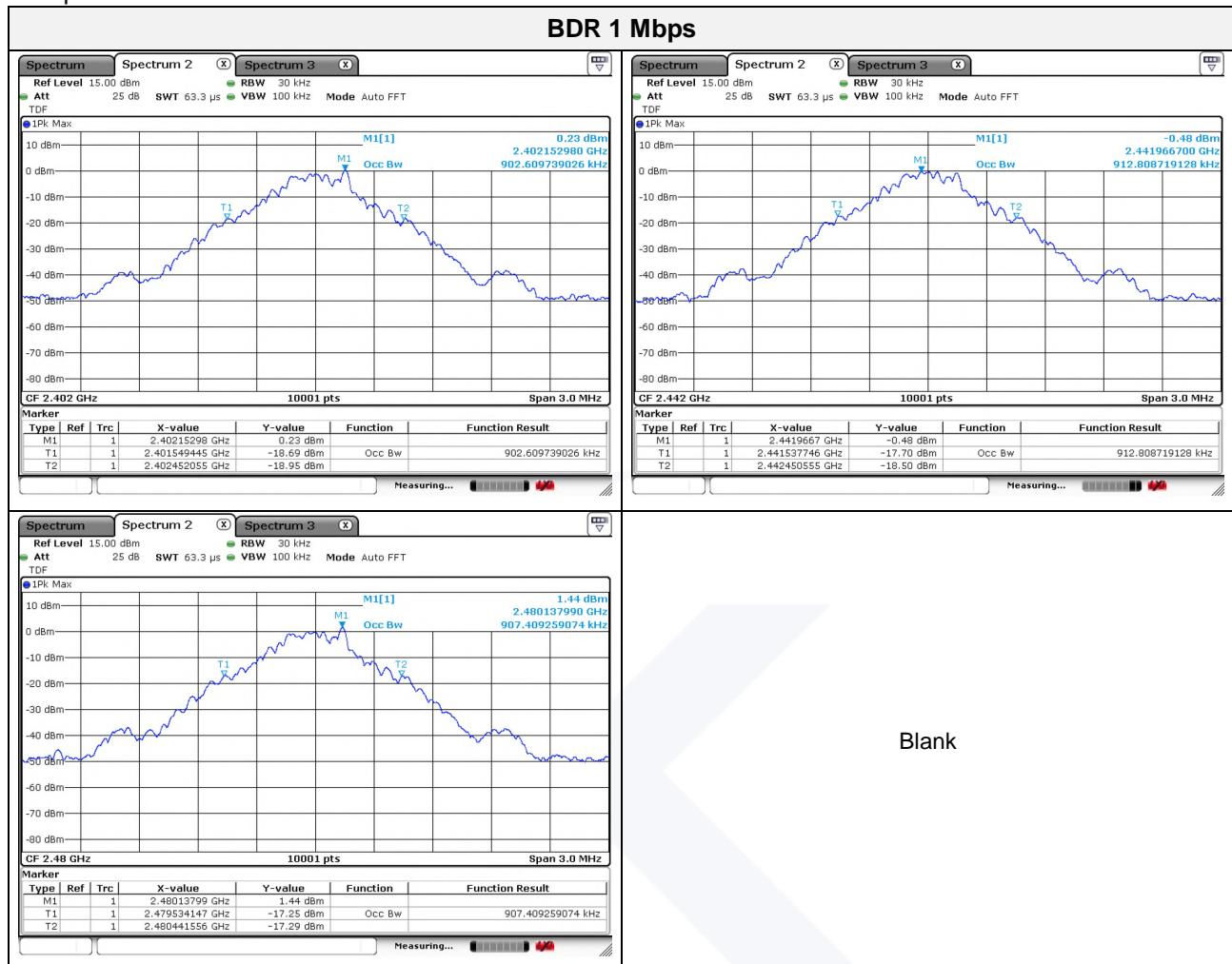
Frequency(MHz)	99% occupied bandwidth(MHz)	Limit(MHz)
2 402	1.20	
2 442	1.20	-
2 480	1.20	

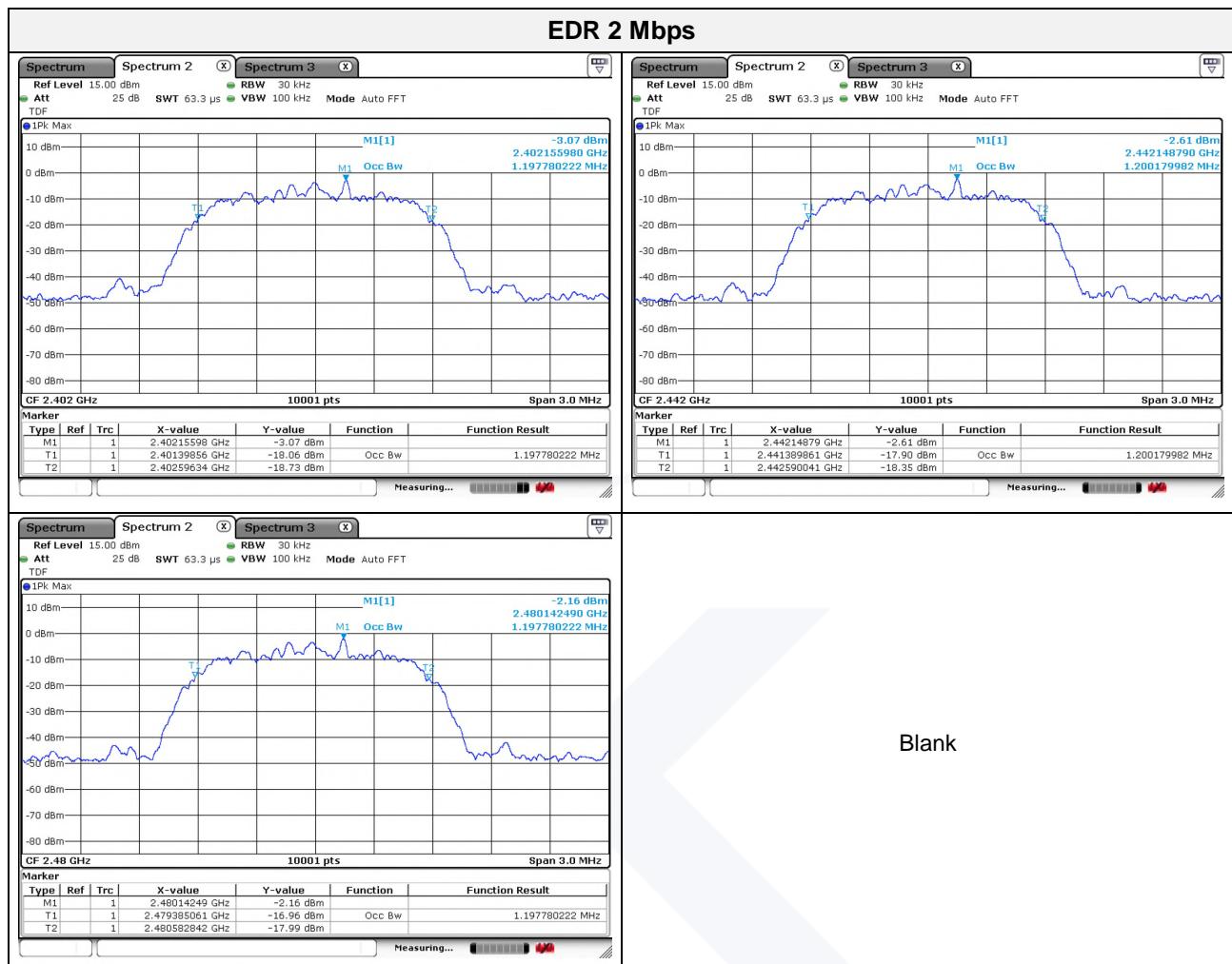
**Mode : EDR 3 Mbps**

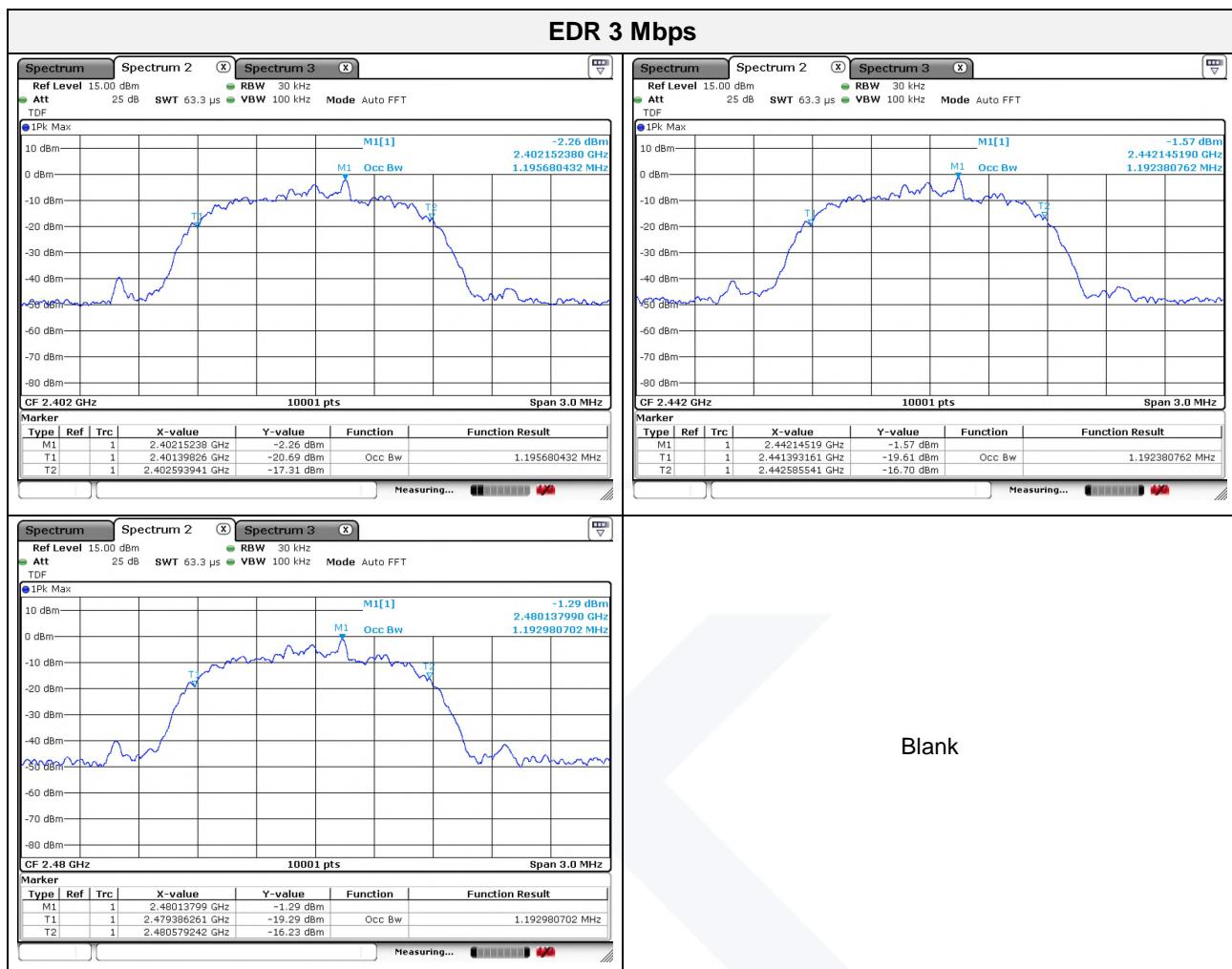
Frequency(MHz)	99% occupied bandwidth(MHz)	Limit(MHz)
2 402	1.20	
2 442	1.19	-
2 480	1.19	



## Test plots







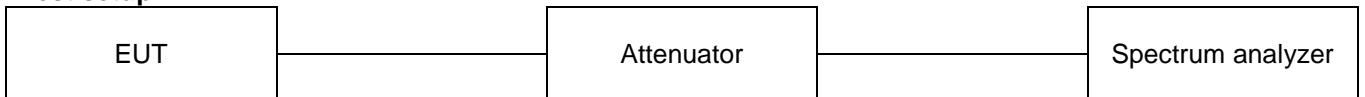


### 3.2. 20 dB bandwidth

#### Test procedure

ANSI 63.10-2013

#### Test setup



#### Test setting

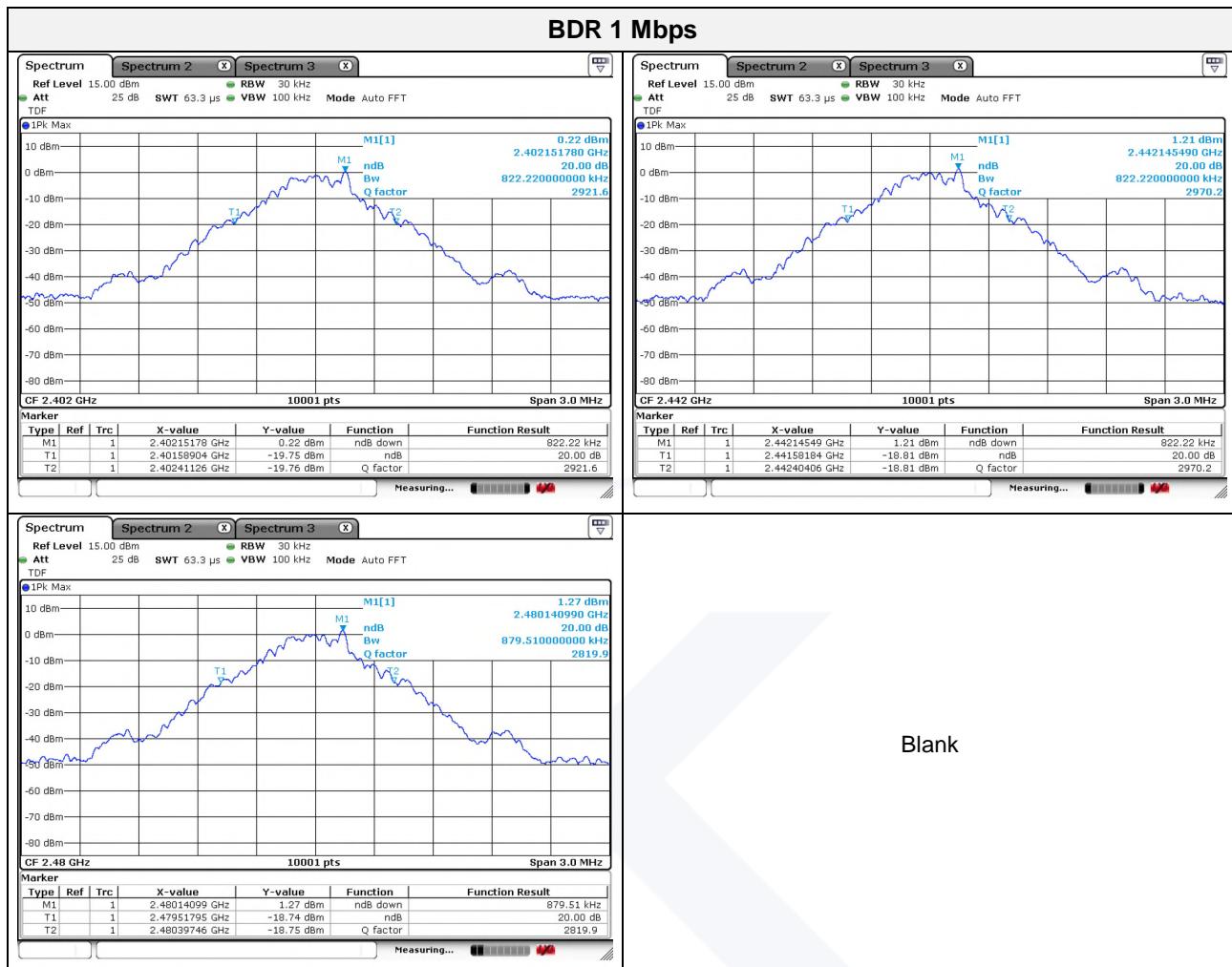
1. Span = Set between two times and five times the OBW
2. RBW  $\geq$  1 % to 5 % of the OBW
3. VBW  $\geq$  3 \* RBW
4. Sweep = Auto
5. Detector function = Peak
6. Sweep = Auto couple
7. Trace mode = Max hold
8. All the trace to stabilize

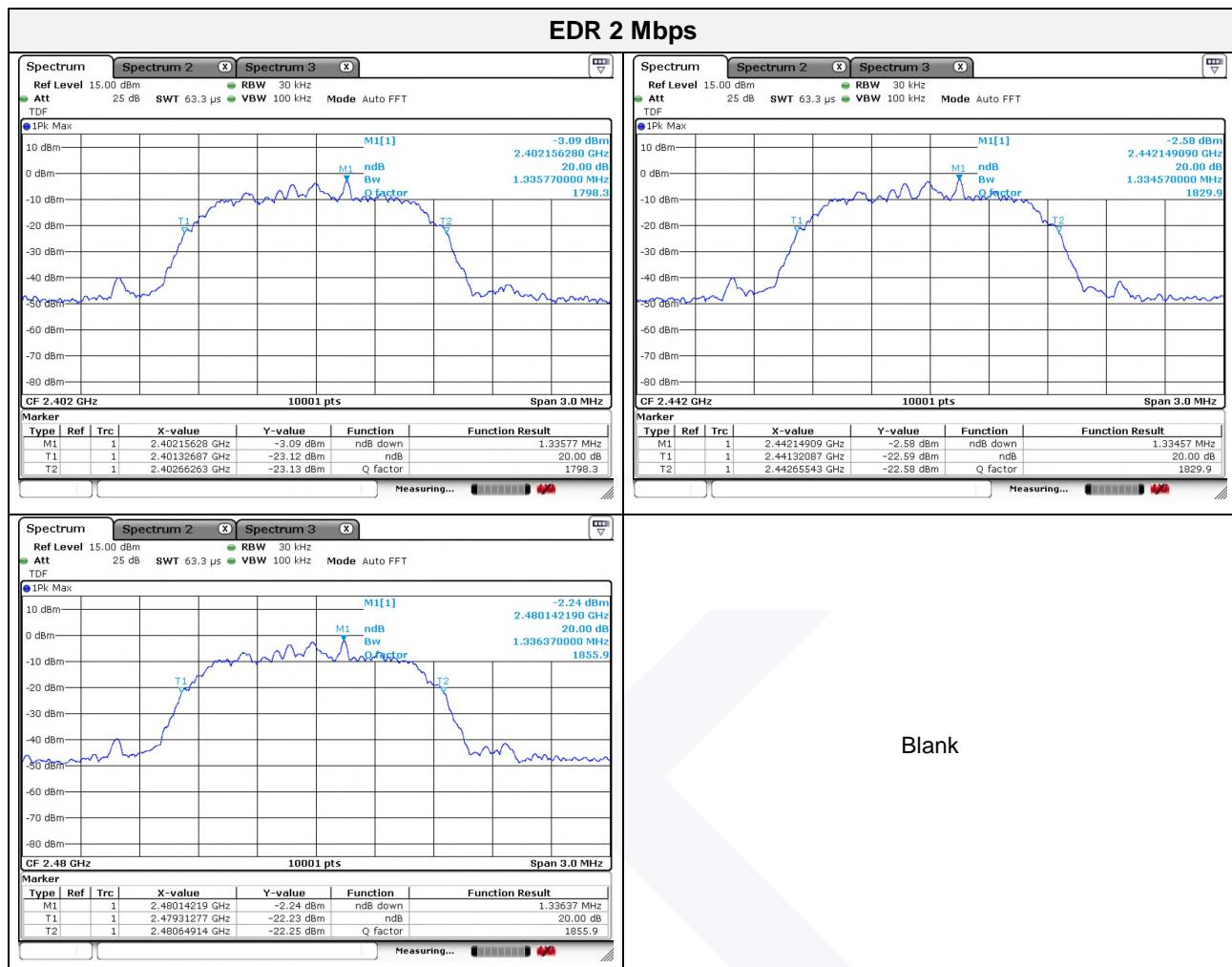
#### Limit

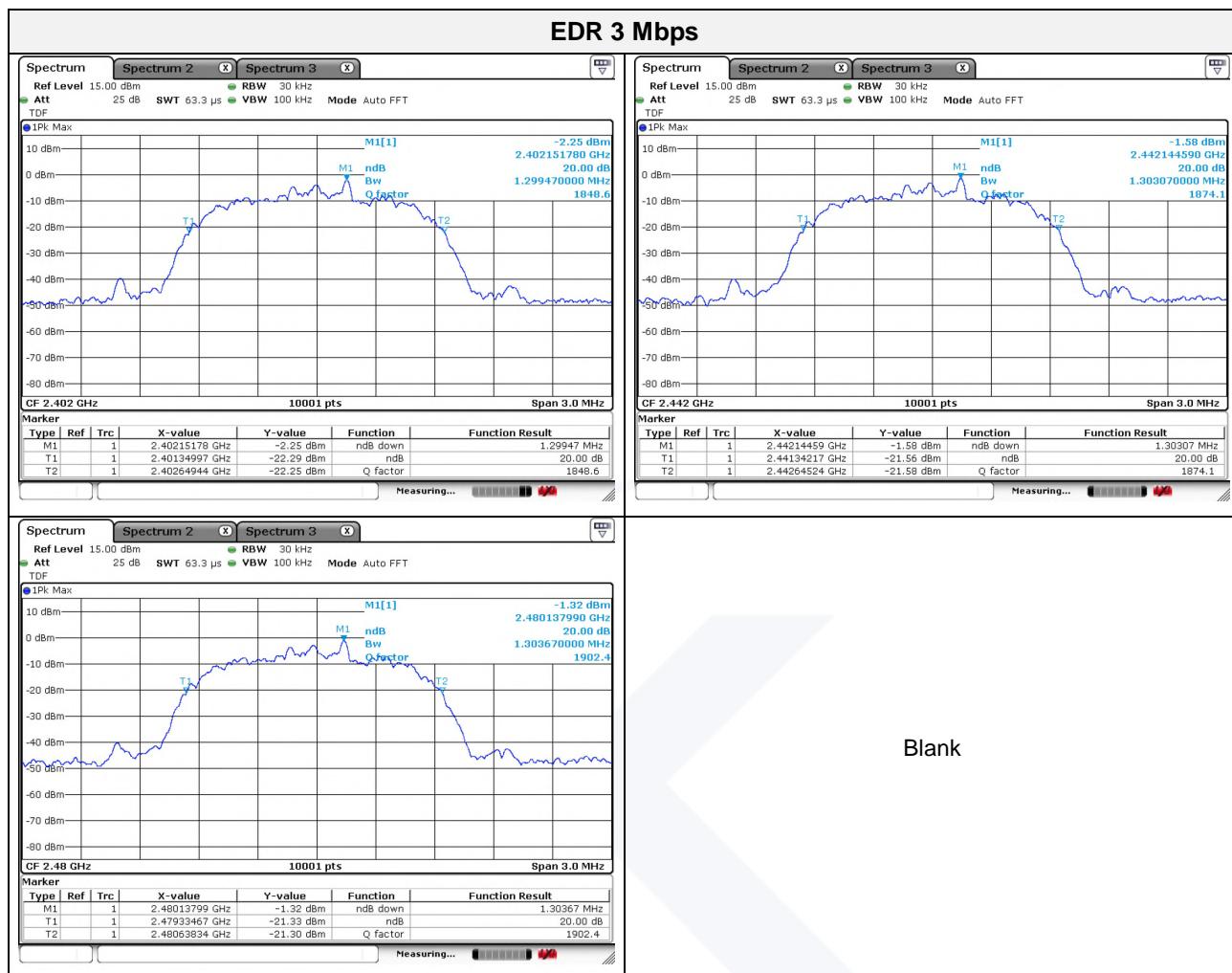
Not applicable



Frequency(MHz)	Channel no.	Data rate(Mbps)	Measured bandwidth(MHz)
2 402	00	BDR 1 Mbps	0.82
2 442	40		0.82
2 480	78		0.88
2 402	00	EDR 2 Mbps	1.34
2 442	40		1.33
2 480	78		1.34
2 402	00	EDR 3 Mbps	1.30
2 442	40		1.30
2 480	78		1.30







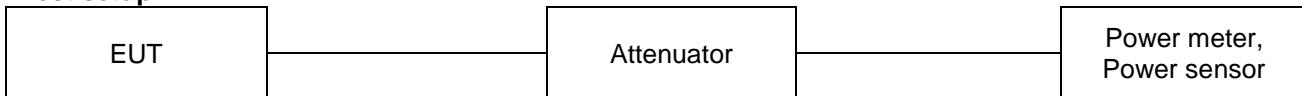


### 3.3. Output power

#### Test procedure

KDB 558074 v05r02 & ANSI 63.10-2013 – Section 11.9.2.1 and 11.9.2.3.2

#### Test setup



#### Test setting

Alternatively, measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Because the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required.

#### FCC Limit

According to §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

According to §15.247(b)(1), For frequency hopping systems operating in the 2 400 ~ 2 483.5 MHz employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5 725 ~ 5 805 MHz band: 1 Watt.

According to §15.247(a)(4), The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi.

#### IC Limit

According to RSS-247 6.2.3.1 (a), FHS operating in the band 2400-2483.5 MHz 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 that the systems operate with an output power no greater than 0.125 W.

According to RSS-247 6.2.3.2 (a), if the hopset uses 75 or more hopping channels, the maximum peak conducted output power shall not exceed 1.0 W.

**Test results**

Frequency(MHz)	Channel no.	Data rate(Mbps)	Average Power (dBm)	Peak Power (dBm)	Power Limit (dBm)
2 402	00	BDR 1 Mbps	2.51	3.84	20.97
2 442	40		3.26	4.42	20.97
2 480	78		3.44	4.56	20.97
2 402	00	EDR 2 Mbps	0.29	3.35	20.97
2 442	40		0.58	3.64	20.97
2 480	78		1.10	4.19	20.97
2 402	00	EDR 3 Mbps	0.31	3.67	20.97
2 442	40		0.58	3.86	20.97
2 480	78		1.14	4.20	20.97

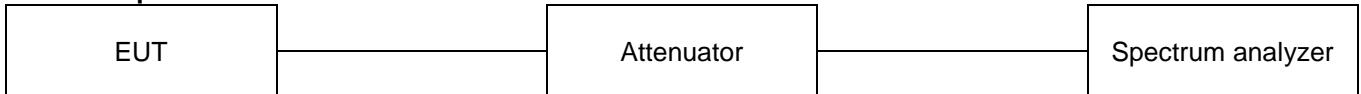


### 3.4. Carrier frequency separation

#### Test procedure

KDB 558074 v05r02 & ANSI 63.10-2013

#### Test setup



#### Test Setting

1. The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:
2. Span = wide enough to capture the peaks of two adjacent channels
3. RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
4. Video (or Average) Bandwidth (VBW)  $\geq$  RBW
5. Sweep = auto
6. Detector function = peak
7. Trace = max hold
8. Allow the trace to stabilize.

Use the marker-delta function to determine the separation between the peaks of the adjacent channels. Compliance of an EUT with the appropriate regulatory limit shall be determined. A plot of the data shall be included in the test report.

#### FCC Limit

According to 15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping system operating in 2 400 ~ 2 483.5 MHz. Band may have hopping channel carrier frequencies that are separated by 25 kHz or two-third of 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

#### IC Limit

According to RSS-247 6.2.3.1 (a), FHS operating in the band 2400-2483.5 MHz 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 that the systems operate with an output power no greater than 0.125 W.



## Test results

Frequency(MHz)	Channel no.	Data rate(Mbps)	Channel Separation (MHz)	Limit (MHz)
2.442	40	BDR 1 Mbps	0.999	≥ 0.55
2.442	40	EDR 2 Mbps	0.997	≥ 0.89
2.442	40	EDR 3 Mbps	1.000	≥ 0.87



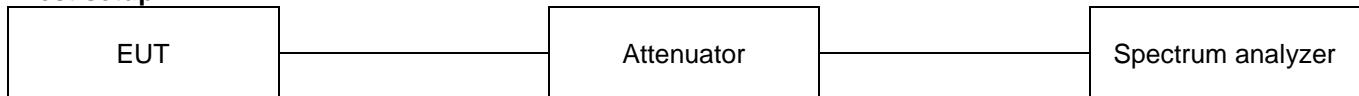


### 3.5. Number of hopping frequency

#### Test procedure

KDB 558074 v05r02 & ANSI 63.10-2013

#### Test setup



#### Test setting

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings.

1. Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
2. RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
3. VBW  $\geq$  RBW.
4. Sweep = auto
5. Detector function = peak
6. Trace = max hold

All the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

#### FCC Limit

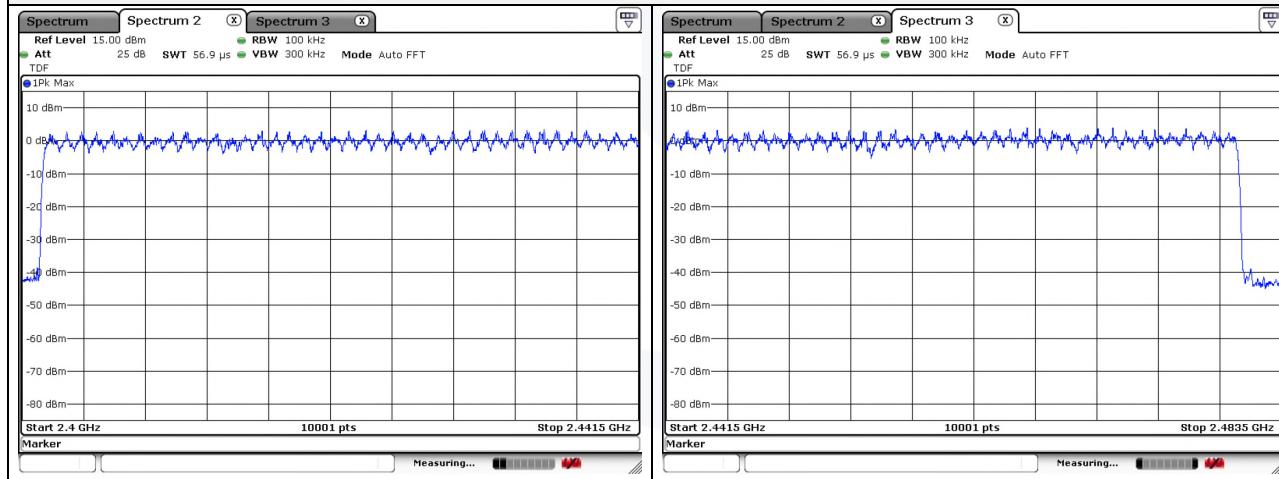
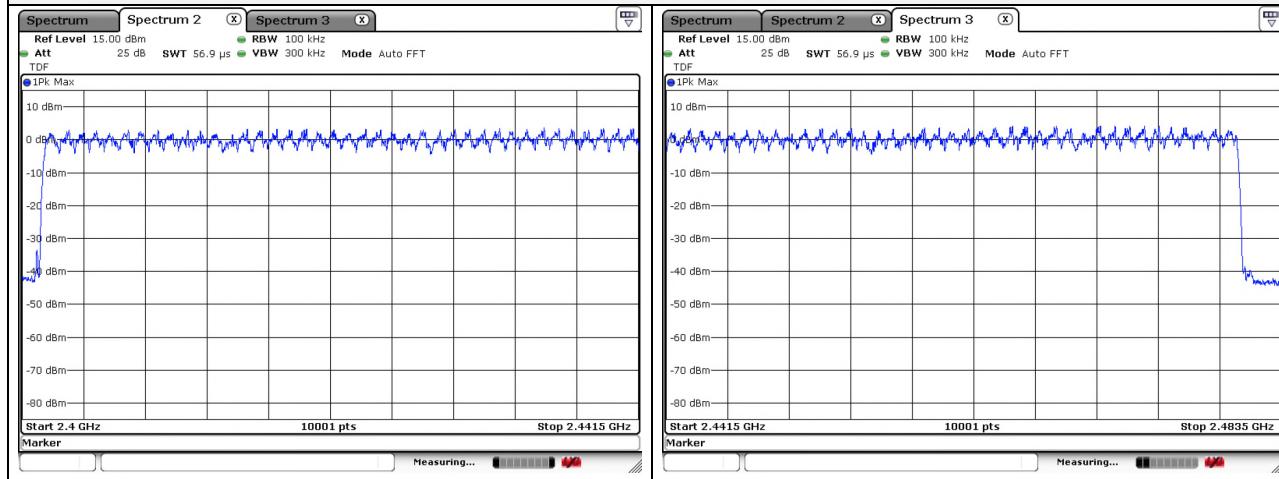
According to 15.247(a)(1)(iii), for frequency hopping system operating in the 2 400 ~ 2 483.5 MHz bands shall use at least 15 hopping frequencies.

#### IC Limit

According to RSS-247 6.2.3.1(b), FHS operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels. The average time of occupancy on any channel shall not be greater than 0.4 s within a period of 0.4 s, multiplied by the number of hopping channels employed. Transmissions on particular hopping frequencies may be avoided or suppressed provided that at least 15 hopping channels are used.



frequency	Data rate(Mbps)	Number of hopping frequency	Limit
2 402 ~ 2 480 MHz	BDR 1 Mbps	79	≥ 15
2 402 ~ 2 480 MHz	EDR 2 Mbps	79	≥ 15
2 402 ~ 2 480 MHz	EDR 3 Mbps	79	≥ 15

**Test results****Hopping mode\_BDR(1 Mbps)****Hopping mode\_EDR(2 Mbps)****Hopping mode\_EDR(3 Mbps)**

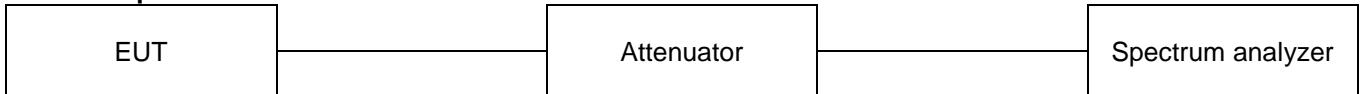


### 3.6. Time of occupancy

#### Test procedure

KDB 558074 v05r02 & ANSI 63.10-2013

#### Test setup



#### Test setting

1. The EUT must have its hopping function enabled.
2. Span = zero span, centered on a hopping channel
3. RBW shall be  $\leq$  channel spacing and where possible RBW should be set  $\gg 1 / T$ , where T is the expected dwell time per channel.
4. Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.
5. Detector function = peak
6. Trace = max hold

#### FCC Limit

According to 15.247(a)(1)(iii), for frequency hopping system operating in the 2 400 ~ 2 483.5 MHz band, the average time of occupancy on any frequency shall not be greater than 0.4 second within a 31.6 second period.

A period time =  $0.4(s) \times 79 = 31.6(s)$

Time of occupancy on the TX channel in 31.6 sec

= time domain slot length  $\times$  (hop rate  $\div$  number of hop per channel)  $\times$  31.6

#### IC Limit

According to RSS-247 6.2.3.1(b), FHS operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels. The average time of occupancy on any channel shall not be greater than 0.4 s within a period of 0.4 s, multiplied by the number of hopping channels employed. Transmissions on particular hopping frequencies may be avoided or suppressed provided that at least 15 hopping channels are used.

A period time =  $0.4(s) \times 79 = 31.6(s)$

Time of occupancy on the TX channel in 31.6 sec

= time domain slot length  $\times$  (hop rate  $\div$  number of hop per channel)  $\times$  31.6



Packet type	Frequency (MHz)	Dwell time (ms)	Time of occupancy on the Tx channel in 31.6 sec (ms)	Limit for time of occupancy on the Tx channel in 31.6 sec (ms)
DH1	2 442	0.384	122.88	400
DH3	2 442	1.641	262.56	400
DH5	2 442	2.889	308.16	400
2-DH1	2 442	0.391	125.12	400
2-DH3	2 442	1.644	263.04	400
2-DH5	2 442	2.892	308.48	400
3-DH1	2 442	0.391	125.12	400
3-DH3	2 442	1.644	263.04	400
3-DH5	2 442	2.893	308.59	400

Operation mode: GFSK,  $\pi/4$ DQPSK, 8DPSK

**Note:**

**Normal Mode**

DH1: Dwell time (ms)  $\times$   $[(1600 \div 2) \div 79] \times 31.6(s) = 122.88$  (ms)

DH3: Dwell time (ms)  $\times$   $[(1600 \div 4) \div 79] \times 31.6(s) = 262.56$  (ms)

DH5: Dwell time (ms)  $\times$   $[(1600 \div 6) \div 79] \times 31.6(s) = 308.16$  (ms)

2-DH1: Dwell time (ms)  $\times$   $[(1600 \div 2) \div 79] \times 31.6(s) = 125.12$  (ms)

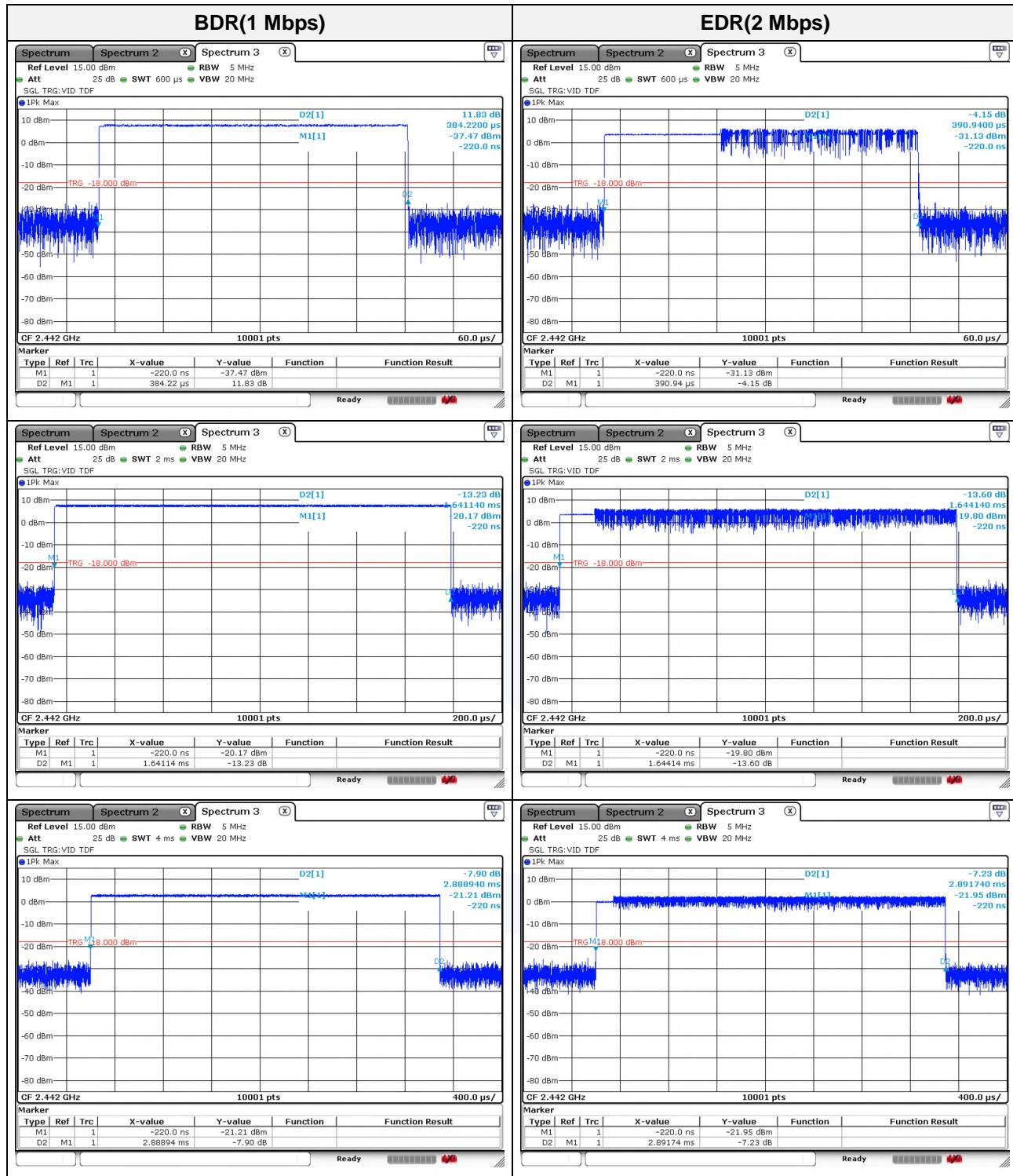
2-DH3: Dwell time (ms)  $\times$   $[(1600 \div 4) \div 79] \times 31.6(s) = 263.04$  (ms)

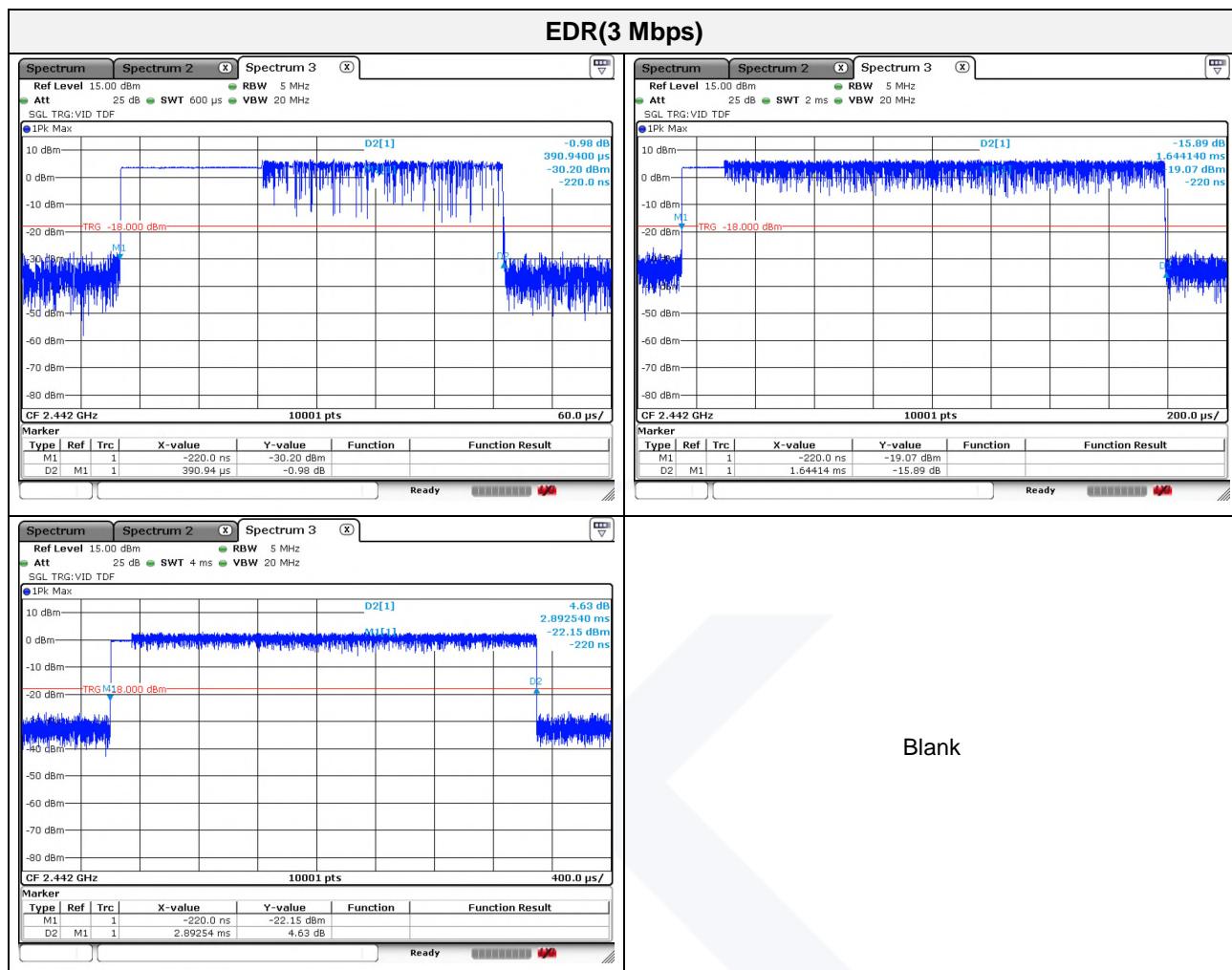
2-DH5: Dwell time (ms)  $\times$   $[(1600 \div 6) \div 79] \times 31.6(s) = 308.48$  (ms)

3-DH1: Dwell time (ms)  $\times$   $[(1600 \div 2) \div 79] \times 31.6(s) = 125.12$  (ms)

3-DH3: Dwell time (ms)  $\times$   $[(1600 \div 4) \div 79] \times 31.6(s) = 263.04$  (ms)

3-DH5: Dwell time (ms)  $\times$   $[(1600 \div 6) \div 79] \times 31.6(s) = 308.59$  (ms)



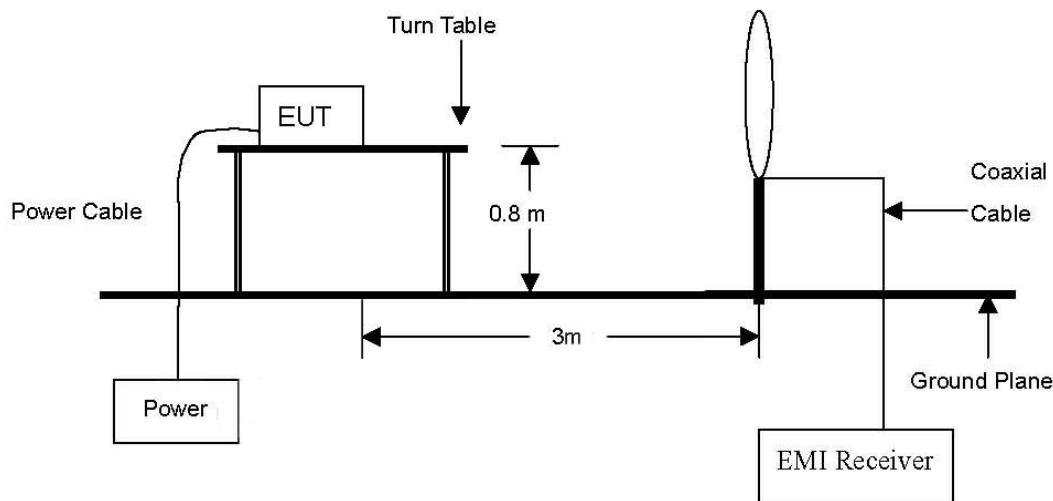




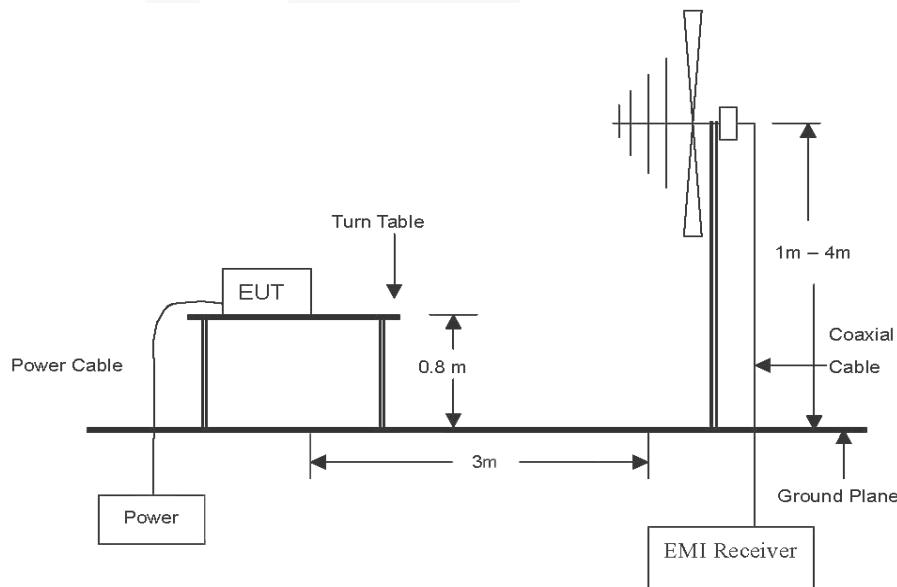
### 3.7. Radiated restricted band and emissions

#### Test setup

The diagram below shows the test setup that is utilized to make the measurements for emission from 9 kHz to 30 MHz Emissions.

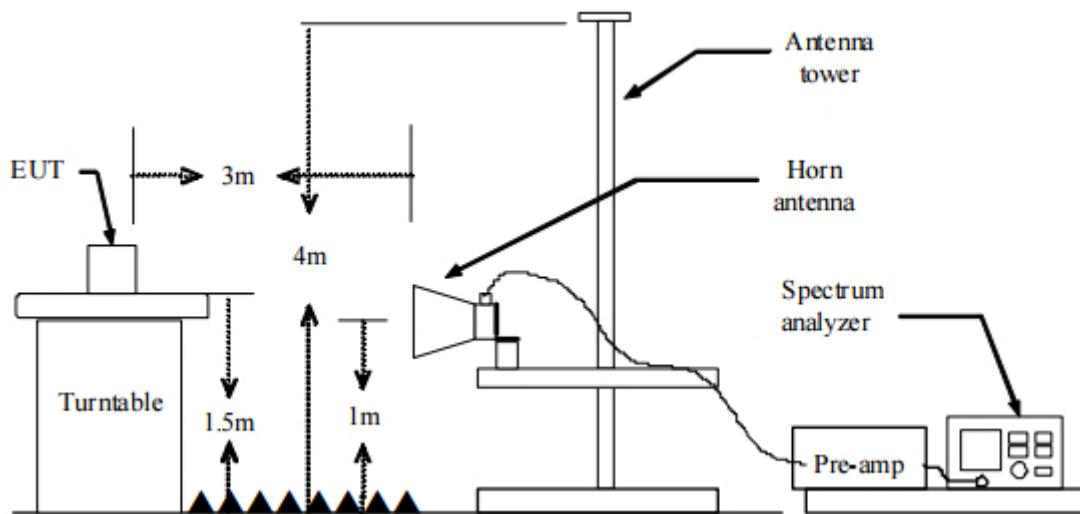


The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz emissions.





The diagram below shows the test setup that is utilized to make the measurements for emission from 1 GHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz emissions, whichever is lower.



### Test procedure

Radiated emissions from the EUT were measured according to the dictates in section 11.11 & 11.12 of ANSI C63.10-2013.

#### Test procedure below 30 MHz

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. Then antenna is a loop antenna is fixed at one meter above the ground to determine the maximum value of the field strength. Both parallel, ground parallel and perpendicular of the antenna are set to make the measurement. It was determined that parallel was worst-case orientation; therefore, all final radiated testing was performed with the EUT in parallel.
3. For each suspected emission, the EUT was arranged to its worst case and then the table was turned from 0 degrees to 360 degrees to find the maximum reading.
4. The test-receiver system was set to average or quasi peak detect function and Specified Bandwidth with Maximum hold mode.

#### Test procedure above 30 MHz

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground for 30 MHz-1 GHz and 1.5 meters for above 1 GHz at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The antenna is a bi-log antenna, a horn antenna, and its height are 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.
3. 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 table was turned from 0 degrees to 360 degrees to find the maximum reading.
4. The test receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
5. Spectrum analyzer settings for  $f < 1$  GHz:
  - ① Span = wide enough to fully capture the emission being measured
  - ② RBW = 120 kHz
  - ③ VBW  $\geq$  RBW
  - ④ Detector = quasi peak
  - ⑤ Sweep time = auto
  - ⑥ Trace = max hold

6. Spectrum analyzer settings for  $f \geq 1$  GHz: Peak

- ① Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
- ② RBW = 1 MHz
- ③ VBW  $\geq 3$  MHz
- ④ Detector = peak
- ⑤ Sweep time = auto
- ⑥ Trace = max hold
- ⑦ Trace was allowed to stabilize

7. Spectrum analyzer settings for  $f \geq 1$  GHz: Average

- ① Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
- ② RBW = 1 MHz
- ③ VBW  $\geq 3 \times$  RBW
- ④ Detector = RMS, if span/(# of points in sweep)  $\leq$  (RBW/2). Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If this condition cannot be satisfied, then the detector mode shall be set to peak.
- ⑤ Averaging type = power(i.e., RMS)
  - 1) As an alternative, the detector and averaging type may be set for linear voltage averaging.
  - 2) Some instruments require linear display mode in order to use linear voltage averaging. Log or dB averaging shall not be used.
- ⑥ Sweep = auto
- ⑦ Trace = max hold
- ⑧ Perform a trace average of at least 100 traces.
- ⑨ A correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 percent duty cycle. The correction factor is computed as follows:
  - 1) If power averaging (RMS) mode was used in step ⑤, then the applicable correction factor is  $10 \log(1/x)$ , where x is the duty cycle.
  - 2) If linear voltage averaging mode was used in step ⑤, then the applicable correction factor is  $20 \log(1/x)$ , where x is the duty cycle.
  - 3) If a specific emission is demonstrated to be continuous ( $\geq 98$  percent duty cycle) rather than turning on and off with the transmit cycle, then no duty cycle correction is required for that emission.

**Note.**

1.  $f < 30$  MHz, extrapolation factor of 40 dB/decade of distance.  $F_d = 40 \log(D_m/D_s)$   
 $f \geq 30$  MHz, extrapolation factor of 20 dB/decade of distance.  $F_d = 20 \log(D_m/D_s)$   
Where:
  - $F_d$  = Distance factor in dB
  - $D_m$  = Measurement distance in meters
  - $D_s$  = Specification distance in meters
2. Field strength(dB $\mu$ V/m) = Level(dB $\mu$ V) + CF (dB) + or DCF(dB)
3. Margin(dB) = Limit(dB $\mu$ V/m) - Field strength(dB $\mu$ V/m)
4. Emissions below 18 GHz were measured at a 3 meter test distance while emissions above 18 GHz were measured at a 1 meter test distance with the application of a distance correction factor.
5. The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z, it was determined that X orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in X orientation.
6. The worst-case emissions are reported however emissions whose levels were not within 20 dB of respective limits were not reported.
7. According to exploratory test no any obvious emission were detected from 9 kHz to 30 MHz. Although these tests were performed other than open field site, adequate comparison measurements were confirmed against 30 m open field 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.

**FCC Limit**

According to 15.209(a), for an intentional radiator devices, the general required of field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values :

Frequency (MHz)	Distance (Meters)	Radiated ( $\mu$ V/m)
0.009 ~ 0.490	300	2400/F(kHz)
0.490 ~ 1.705	30	24000/F(kHz)
1.705 ~ 30.0	30	30
30 ~ 88	3	100**
88 ~ 216	3	150**
216 ~ 960	3	200**
Above 960	3	500

\*\*Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54 ~ 72 MHz, 76 ~ 88 MHz, 174 ~ 216 MHz or 470 ~ 806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

**IC Limit**

According to RSS-Gen, Except when the requirements applicable to a given device state otherwise, emissions from licence-exempt transmitters shall comply with the field strength limits :

Frequency (MHz)	Distance (Meters)	Radiated ( $\mu$ V/m)
0.009 ~ 0.490	300	2 400 / F(kHz)
0.490 ~ 1.705	30	24 000 / F(kHz)
1.705 ~ 30.0	30	30
30 ~ 88	3	100
88 ~ 216	3	150
216 ~ 960	3	200
Above 960*	3	500

\* Unless otherwise specified, for all frequencies greater than 1 GHz, the radiated emission limits for licence-exempt radio apparatus stated in applicable RSSs (including RSS-Gen) are based on measurements using a linear average detector function having a minimum resolution bandwidth of 1 MHz. If an average limit is specified for the EUT, then the peak emission shall also be measured with instrumentation properly adjusted for such factors as pulse desensitization to ensure the peak emission is less than 20 dB above the average limit.

**Note:** Transmitting devices are not permitted in restricted frequency bands unless stated otherwise in the specific RSS.

**Duty cycle**

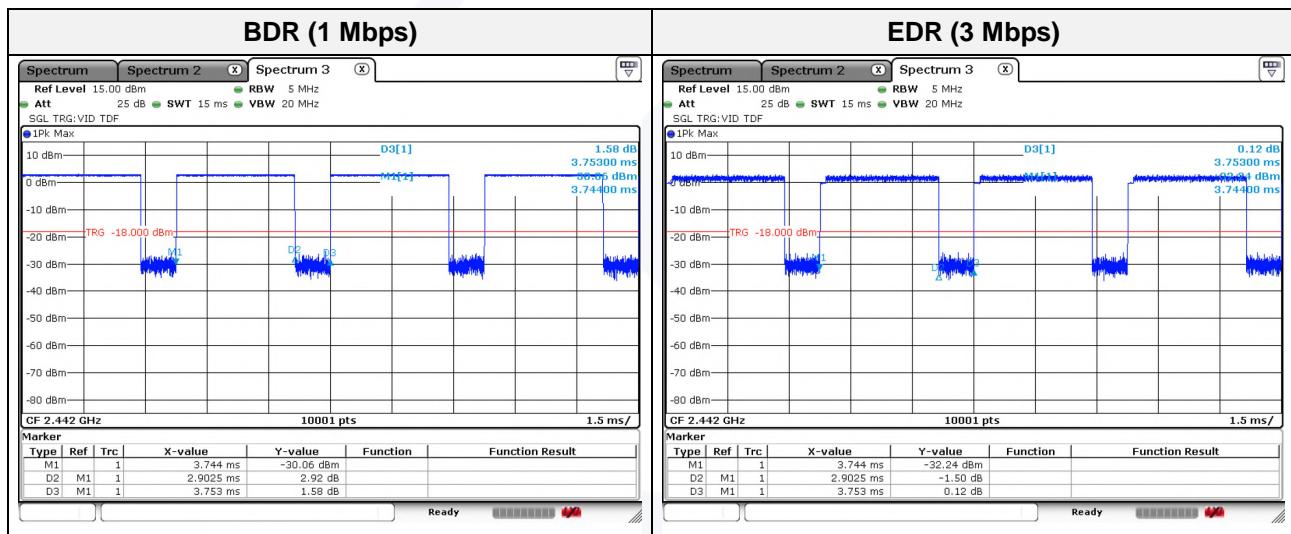
Regarding to KDB 558074 D01\_v05 r02, 6. Measurements of duty cycle and transmission duration shall be performed using one of the following techniques:

- A diode detector and an oscilloscope that together have sufficiently short response time to permit accurate measurements of the on- and off-times of the transmitted signal.
- The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on- and off-times of the transmitted signal.

Mode	T <sub>on</sub> time (ms)	Period (ms)	Duty cycle (Linear)	Duty cycle (%)	Duty cycle correction factor (dB)
BDR(1 Mbps)	2.90	3.750	0.77	77.33	1.14
EDR(3 Mbps)	2.90	3.750	0.77	77.33	1.14

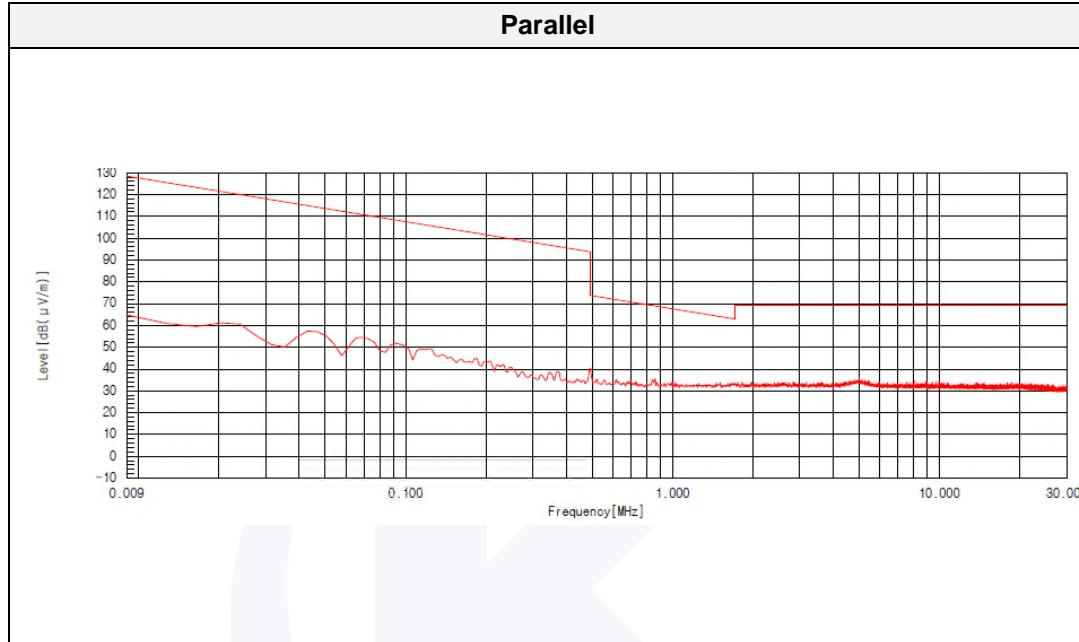
Duty cycle (Linear) = T<sub>on</sub> time/Period

DCF(Duty cycle correction factor (dB)) = 10log(1/duty cycle)



**Test results (Below 30 MHz)**

Mode:	BDR (Worst case)
Transfer rate:	1 Mbps
Distance of measurement:	3 meter
Channel:	78 (Worst case)



Note.

1. No spurious emission were detected under 30 MHz.