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Test Report FCC Part 15.247

Equipment under testbrid.zzzModel nameSLDHF1FCC ID2A2OI-SLDHF1ApplicantDEVICEDESIGN CO.,LTDManufacturerDEVICEDESIGN CO.,LTDDate of test(s)2023.03.21 ~ 2023.04.10Date of issue2023.04.11

Issued to DEVICEDESIGN CO. ,LTD

#815 AceGwanggyoTower, 17, Daehak 4-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, Korea Tel: +82- 031-221-1655 / Fax: +82-031-221-1641

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Test and report completed by :	Report approval by :	
At	lel	
Do-won, Ahn	Young-Jin Lee	
Test engineer	Technical manager	

This test report is not related to KS Q ISO/IEC 17025 and KOLAS.



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Revision history

Revision	Date of issue	Test report No.	Description	
-	2023.04.11	KES-RF-23T0053	53 Initial	

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1. General information

Applicant:	DEVICEDESIGN CO.,LT	D			
Applicant address:	#815 AceGwanggyoTower, 17, Daehak 4-ro, Yeongtong-gu, Suwon-si, Gyeonggi-				
T , '	do, Korea				
Test site:	KES Co., Ltd.				
Test site address:	3701, 40, Simin-daero 3	65beon-gil, Dongan-gu, Anyang-	si,		
	Gyeonggi-do, 14057, Korea	ı			
	🖂 473-21, Gayeo-ro, Yeoju-si, Gyeonggi-do, Korea				
Test Facility	FCC Accreditation Designation No.: KR0100, Registration No.: 444148				
	ISED Registration No.: 232	98			
FCC rule part(s):	15.247				
FCC ID:	2A2OI-SLDHF1				
Test device serial No.:	Production	Pre-production	Engineering		

1.1. EUT description

Equipment under test	brid.zzz
Frequency range	2 402 MHz ~ 2 480 MHz (BDR/EDR)
	2 402 MHz ~ 2 480 MHz (LE 1Mbps)
Model	SLDHF1
Modulation technique	GFSK, π/4DQPSK, 8DPSK
Number of channels	2 402 M拉 ~ 2 480 M拉 (BDR/EDR): 79ch
	2 402 MHz ~ 2 480 MHz (LE 1Mbps) : 40ch
Antenna specification	FPCB Antenna // Peak gain: 0.73 dBi (Left)
	FPCB Antenna // Peak gain: 1.11 dBi (Right)
Power source	DC 3.7 V
H/W Version	1.2
S/W Version	1.0
Serial Number	BZ23100001

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1.2. 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:

67, 41, 2, 34, 4, 8, 73, 22, 50, 3, 56, 11, 77, 54, 7, 35, 27, 40, 62, 42, 29, 14, 72, 53, 36, 13, 12, 17, 48, 70, 26, 16, 19, 31, 18, 25, 60, 23, 30, 45, 46, 6, 52, 44, 75, 74, 55, 65, 00, 68, 57, 63, 1, 37, 38, 33, 64, 78, 47, 51, 20, 15, 32, 76, 49, 21, 61, 71, 69, 10, 5, 39, 66, 58, 43, 59, 9, 28, 24, 72, 50, 18, 25, 54, 22, 23, 39, 33, 37, 29, 13, 56, 74, 78, 49, 40, 1, 7, 63, 6, 46, 57, 15, 36, 16, 5, 28, 4, 69, 26, 30, 77, 9, 3, 52, 67, 47, 68, 73, 44, 64, 45, 42, 41, 70, 8, 31, 34, 00, 58, 35, 43, 24, 61, 76, 11, 27, 38, 71, 66, 32, 60, 20, 55, 21, 48, 12, 65, 10, 51, 53, 17, 75, 14, 59, 62, 19, 2

System receiver input bandwidth

Each channel bandwidth is 1 Mtz.

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 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. Test configuration

The DEVICEDESIGN CO. ,LTD // brid.zzz // SLDHF1 // FCC ID: 2A2OI-SLDHF1

was tested according to the specification of EUT, the EUT must comply with following standards and KDB documents.

FCC Part 15.247 KDB 558074 D01 v05 r02 ANSI C63.10-2013

1.4. Information about derivative model

N/A

1.5. Accessory information

Equipment	Manufacturer	Model	Serial No.	Power source
-	-	-	-	-

1.6. 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.

Offset(dB) = RF cable loss(dB) + attenuator factor(dB).

= 0.56 + 10 = 10.56 (dB)

For Radiation test :

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

1.7. Measurement Uncertainty

Test Item		Uncertainty	
Uncertainty for Conduction emission test		2.38 dB	
Uncertainty for Radiation emission test (include Fundamental emission)	Below 16Hz	4.50 dB	
	Above 10Hz	4.90 dB	
Note. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.			

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1.8. Frequency/channel operations

Ch.	Frequency (Mz)	Mode
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 (Mb)	Mode
00	2 402	BLE 1 Mbps
•		•
20	2 442	BLE 1 Mbps
39	2 480	BLE 1 Mbps



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Test results

Pass

Pass

Pass

Pass

Pass

Pass N/A⁽¹⁾

Pass

Summary of tests 2. Section in Parameter FCC Part 15 15.247(a)(1)(iii) 20 dB bandwidth 15.247(b)(1) Output power 15.247(a)(1) Channel separation 15.247(a)(1)(iii) Number of channels 15.247(a)(1)(iii) Time of occupancy 15.205, 15.209 Radiated restricted band and emission

Note.

15.207(a)

15.207(d)

1. This product is powered by lithium coin battery DC 3.7V.

2. By the request of the applicant, test was performed with condition below:

AC Conducted emissions

Conducted spurious emission and band edge

EDR 3 Mbps: 5

Setting power : BDR 1 Mbps: 5 EDR 2 Mbps: 5

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3. Test results

3.1. 20 dB bandwidth

Test procedure

ANSI 63.10-2013

Test setup

EUT Attenuator Spectrum analyz	HI!!
--------------------------------	------

Test setting

- 1. Span = Set between two times and five times the OBW
- 2. $RBW \ge 1$ % to 5 % of the OBW
- 3. VBW \ge 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

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Right)			
Frequency(Mb)	Channel no.	Data rate(Mbps)	Measured bandwidth(Mz)
2 402	00		0.819
2 442	40	BDR 1 Mbps	0.814
2 480	78		0.814
2 402	00		1.329
2 442	40	EDR 2 Mbps	1.329
2 480	78		1.329
2 402	00		1.284
2 442	40	EDR 3 Mbps	1.289
2 480	78	7	1.279

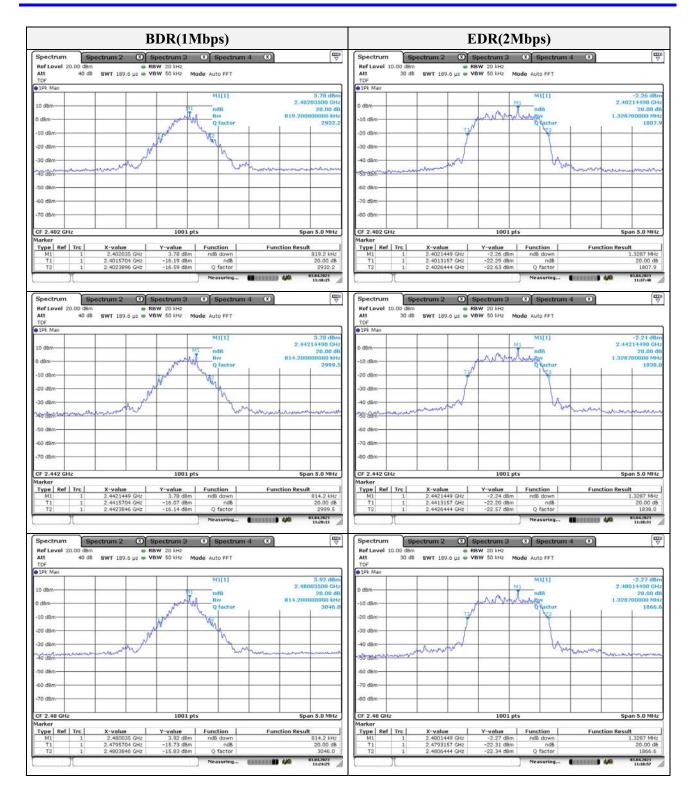
(Left)	

Frequency(Mz)	Channel no.	Data rate(Mbps)	Measured bandwidth(Mbz)
2 402	00		0.819
2 442	40	BDR 1 Mbps	0.844
2 480	78		0.819
2 402	00		1.329
2 442	40	EDR 2 Mbps	1.329
2 480	78		1.329
2 402	00		1.289
2 442	40	EDR 3 Mbps	1.294
2 480	78		1.289

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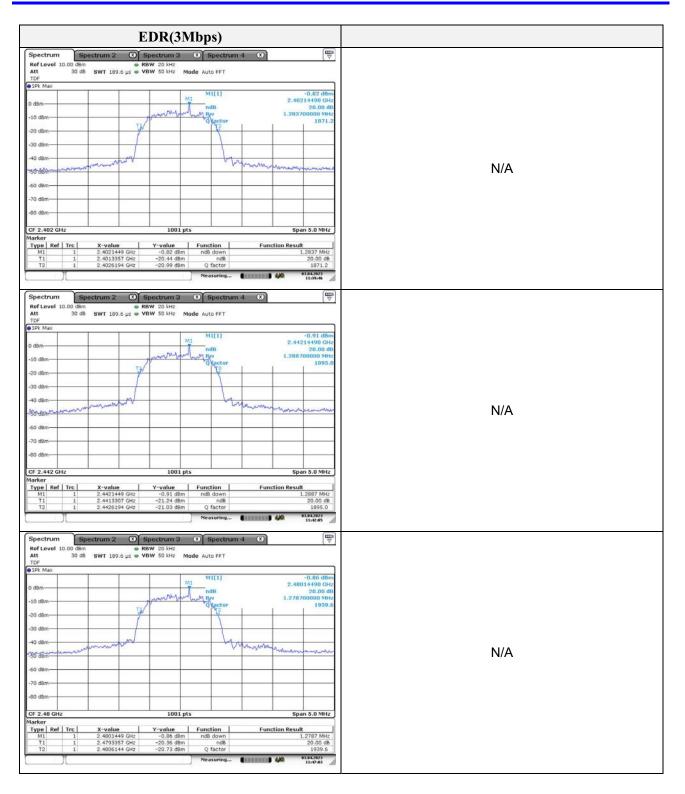


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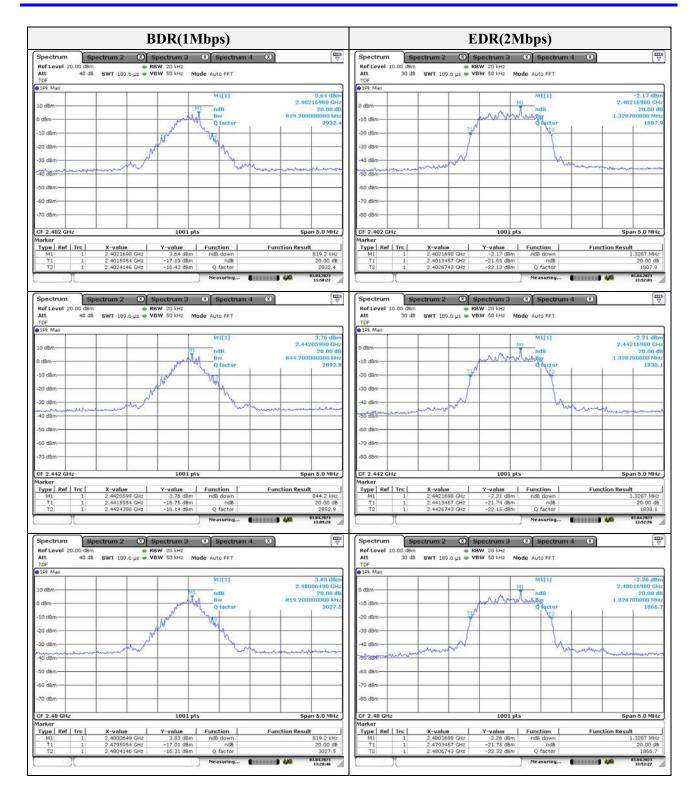


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EDR(3Mbps)	
Spectrum Spectrum 2 Spectrum 3 Spectrum 4 Image: Control of the sector of the s	N/A
You dim You dim Span 5.0 MHz -80 dBm -0.0 dBm -0.00 pts Span 5.0 MHz Markar Type Ref Trc X-value Y-value Function Function Result M1 1 2.4021696 GHz -0.82 dBm nd8 down 1.2887 MHz T1 1 2.4031696 GHz -0.82 dBm nd8 down 20.00 dB T2 1 2.4026494 GHz -21.03 dBm Q factor 188420 Messuring ************************************	
Att 30 dB SWT 199.6 µs VBW 50 kHz Mode Auto FFT 91Pk Max -0.8 h dBm -0.8 h dBm -0.8 h dBm -0.9 h dBm 0 dBm -0.0 h dBm -0.0 h dBm 20.00 dB 20.00 dB 20.00 dB -10 dBm -0.0 h dBm -0.0 h dBm 20.00 dB 1.293700000 MHz 20.00 dB -20 dBm -0.0 h dBm -0.0 h dBm -0.0 h dBm 1.293700000 MHz 20.00 Hz -30 dBm -0.0 h dBm -40 dBm -0.0 h dBm -40 dBm -0.0 h dBm -40 dBm -0.0 h dBm -40 dBm -0.0 h dBm -40 dBm -0.0 h dBm -70 dBm -0.0 h dBm -0.0 h dB	N/A
Book CF 2.442 GHz 1001 pts Span 5.0 MHz Marker Type [Ref] Trc X-value Y-value Function Result T1 2.4421698 GHz -0.84 dBm nd8 down 1.2937 MHz T1 2.4421698 GHz -20.65 dBm nd8 20.00 dB T2 1 2.4426494 GHz -20.65 dBm nd8 20.00 dB T2 1 2.4426494 GHz -20.65 dBm nd8 20.00 dB 1987.7 Neasuring Wressuring Wressuring Wressuring #161.8233 1987.7 Spectrum Spectrum 2 Spectrum 3 Spectrum 4 CTP TP Ref Level 10.00 dBm # RBW 20 Hz Filterer TP	
Att 30 dB SWT 189.6 µs e VBW 50 KHz Mode Auto FFT 91Pk Max -0.88 dBm -0.88 dBm -0.88 dBm 0 dBm -0.18 mm -0.28 dBm -0.28 dBm -10 dBm -0.18 mm -0.28 dBm -0.28 dBm -0.00 dB -0.28 mm -0.28 mm -0.28 mm -0.00 dB -0.28 mm -0.28 mm -0.28 mm -0.00 dBm -0.28 mm -0.28 mm -0.28 mm -0.00 dBm </td <td>N/A</td>	N/A
-70 d8m -80 d8m -90	



3.2. Output power

Test procedure

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

Test setup Power meter, EUT Attenuator Power sensor

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.

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.

Limit

For FHSs operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W if the hopset uses 75 or more hopping channels; the maximum peak conducted output power shall not exceed 0.125 W if the hopset uses less than 75 hopping channels. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e)

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Test results

(Right)					
Frequency(Mb)	Channel no.	Data rate(Mbps)	Average Power (dBm)	Peak Power (dBm)	Power Limit (dBm)
2 402	00		7.12	7.22	20.97
2 442	40	BDR 1 Mbps	7.19	7.30	20.97
2 480	78		7.20	7.31	20.97
2 402	00		2.18	5.18	20.97
2 442	40	EDR 2 Mbps	2.18	5.19	20.97
2 480	78		2.18	5.19	20.97
2 402	00		2.19	5.69	20.97
2 442	40	EDR 3 Mbps	2.19	5.69	20.97
2 480	78		2.19	5.76	20.97

(Left)					
Frequency(Mz)	Channel no.	Data rate(Mbps)	Average Power (dBm)	Peak Power (dBm)	Power Limit (dBm)
2 402	00		7.08	7.34	20.97
2 442	40	BDR 1 Mbps	7.22	7.47	20.97
2 480	78		7.34	7.58	20.97
2 402	00		2.36	5.26	20.97
2 442	40	EDR 2 Mbps	2.30	5.24	20.97
2 480	78		2.31	5.31	20.97
2 402	00		2.30	5.74	20.97
2 442	40	EDR 3 Mbps	2.31	5.80	20.97
2 480	78		2.33	5.86	20.97

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3.3. 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.

Limit

According to 15.247(a)(1), 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.

Limit

FHSs 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, FHSs 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

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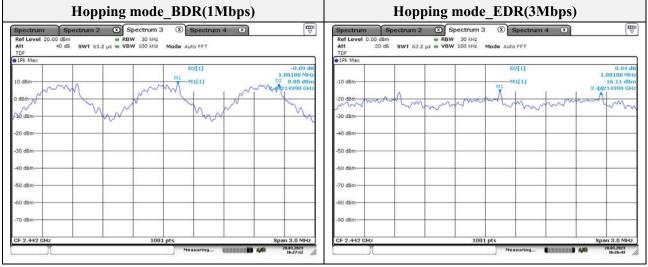
Test results (Right)

Frequency(Mb)	Channel no.	Data rate(Mbps)	Channel Separation (Mz)	Limit (M±z)
2 442	40	BDR 1 Mbps	1.001	≥ 0.543
2 442	40	EDR 3 Mbps	1.001	≥ 0.859

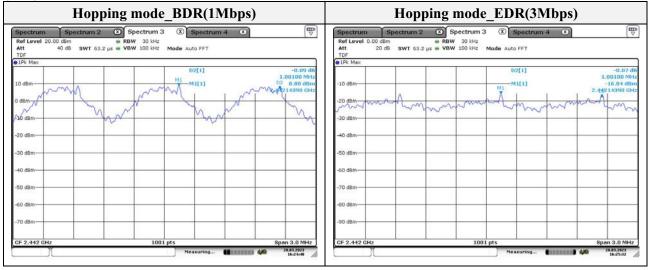
(Left)

Frequency(Mb)	Channel no.	Data rate(Mbps)	Channel Separation (歴)	Limit (Mz)
2 442	40	BDR 1 Mbps	1.001	≥ 0.563
2 442	40	EDR 3 Mbps	1.001	≥ 0.863

(Right)



(Left)





3.4. 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.

Limit

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

Limit

FHSs 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 seconds within a period of 0.4 seconds, 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.

Test results

(Right)

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 3 Mbps	79	≥15

(Left)

Frequency	Data rate(Mbps)	Number of hopping frequency	Limit
$2\ 402 \sim 2\ 480\ \text{MHz}$	BDR 1 Mbps	79	≥15
$2\ 402 \sim 2\ 480$ MHz	EDR 3 Mbps	79	≥15

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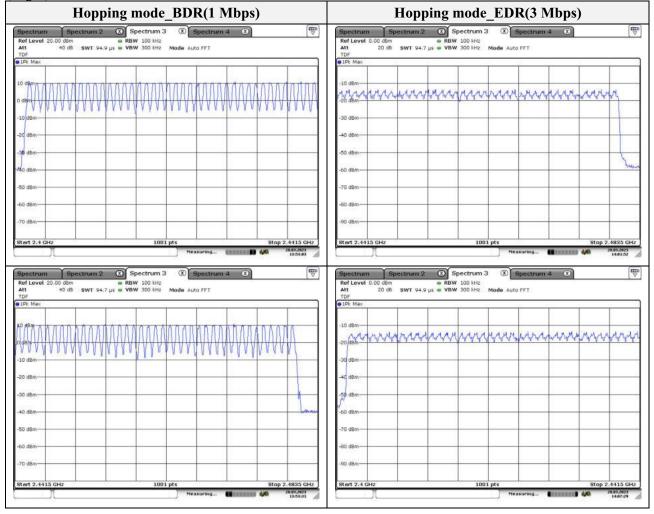
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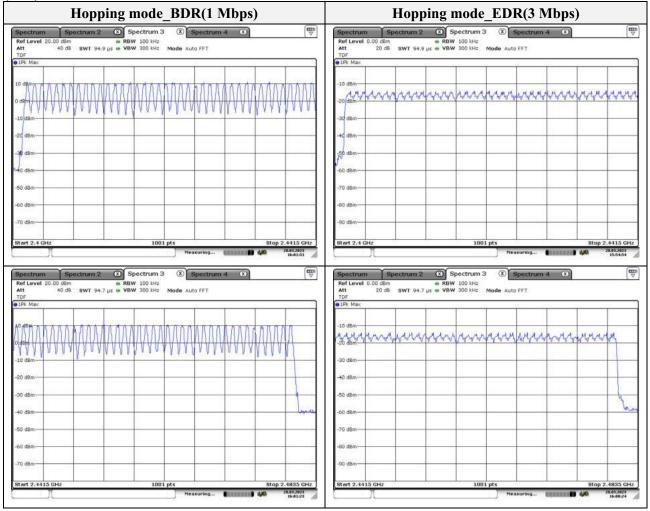
(Right)



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(Left)



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3.5. 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 >> 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

Limit

According to 15.247(a)(1)(iii), for frequency hopping system operating in the 2 400 ~ 2 483.5 Mb 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

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

(Right)				
Packet type	Frequency (배之)	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	0.38	121.6	400
DH3	2 442	1.63	260.8	400
DH5	2 442	2.88	307.2	400
2-DH1	2 442	0.38	121.6	400
2-DH3	2 442	1.63	260.8	400
2-DH5	2 442	2.88	307.2	400
3-DH1	2 442	0.38	121.6	400
3-DH3	2 442	1.63	260.8	400
3-DH5	2 442	2.88	307.2	400

Note:

Normal Mode

DH1: Dwell time (ms) × $[(1\ 600\ \div\ 2)\ \div\ 79]$ × 31.6(s) = 121.6 (ms) DH3: Dwell time (ms) × $[(1\ 600\ \div\ 4)\ \div\ 79]$ × 31.6(s) = 260.8 (ms) DH5: Dwell time (ms) × $[(1\ 600\ \div\ 6)\ \div\ 79]$ × 31.6(s) = 307.2 (ms) 2-DH1: Dwell time (ms) × $[(1\ 600\ \div\ 2)\ \div\ 79]$ × 31.6(s) = 121.6 (ms) 2-DH3: Dwell time (ms) × $[(1\ 600\ \div\ 4)\ \div\ 79]$ × 31.6(s) = 260.8 (ms) 2-DH5: Dwell time (ms) × $[(1\ 600\ \div\ 6)\ \div\ 79]$ × 31.6(s) = 307.2 (ms) 3-DH1: Dwell time (ms) × $[(1\ 600\ \div\ 2)\ \div\ 79]$ × 31.6(s) = 121.6 (ms) 3-DH3: Dwell time (ms) × $[(1\ 600\ \div\ 2)\ \div\ 79]$ × 31.6(s) = 121.6 (ms) 3-DH3: Dwell time (ms) × $[(1\ 600\ \div\ 4)\ \div\ 79]$ × 31.6(s) = 260.8 (ms) 3-DH3: Dwell time (ms) × $[(1\ 600\ \div\ 4)\ \div\ 79]$ × 31.6(s) = 260.8 (ms) 3-DH5: Dwell time (ms) × $[(1\ 600\ \div\ 4)\ \div\ 79]$ × 31.6(s) = 307.2 (ms)



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(Left)				
Packet type	Frequency (Mb)	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	0.38	121.6	400
DH3	2 442	1.63	260.8	400
DH5	2 442	2.88	307.2	400
2-DH1	2 442	0.38	121.6	400
2-DH3	2 442	1.63	260.8	400
2-DH5	2 442	2.88	307.2	400
3-DH1	2 442	0.38	121.6	400
3-DH3	2 442	1.63	260.8	400
3-DH5	2 442	2.88	307.2	400

Note:

(I oft)

Normal Mode

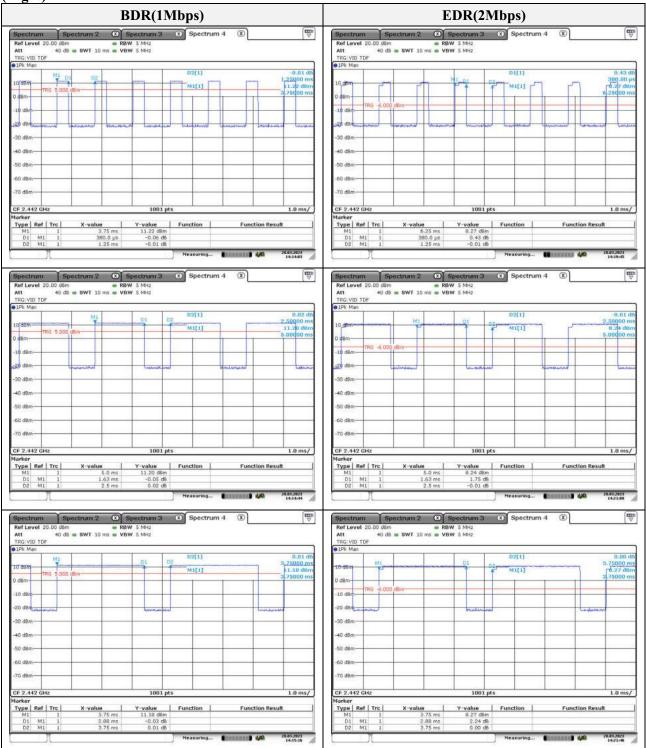
DH1: Dwell time (ms) × $[(1\ 600\ \div\ 2)\ \div\ 79]$ × 31.6(s) = 121.6 (ms) DH3: Dwell time (ms) × $[(1\ 600\ \div\ 4)\ \div\ 79]$ × 31.6(s) = 260.8 (ms) DH5: Dwell time (ms) × $[(1\ 600\ \div\ 6)\ \div\ 79]$ × 31.6(s) = 307.2 (ms) 2-DH1: Dwell time (ms) × $[(1\ 600\ \div\ 2)\ \div\ 79]$ × 31.6(s) = 121.6 (ms) 2-DH3: Dwell time (ms) × $[(1\ 600\ \div\ 4)\ \div\ 79]$ × 31.6(s) = 260.8 (ms) 2-DH5: Dwell time (ms) × $[(1\ 600\ \div\ 6)\ \div\ 79]$ × 31.6(s) = 307.2 (ms) 3-DH1: Dwell time (ms) × $[(1\ 600\ \div\ 2)\ \div\ 79]$ × 31.6(s) = 121.6 (ms) 3-DH3: Dwell time (ms) × $[(1\ 600\ \div\ 2)\ \div\ 79]$ × 31.6(s) = 121.6 (ms) 3-DH3: Dwell time (ms) × $[(1\ 600\ \div\ 4)\ \div\ 79]$ × 31.6(s) = 260.8 (ms) 3-DH3: Dwell time (ms) × $[(1\ 600\ \div\ 4)\ \div\ 79]$ × 31.6(s) = 260.8 (ms) 3-DH5: Dwell time (ms) × $[(1\ 600\ \div\ 4)\ \div\ 79]$ × 31.6(s) = 307.2 (ms)

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(Right)





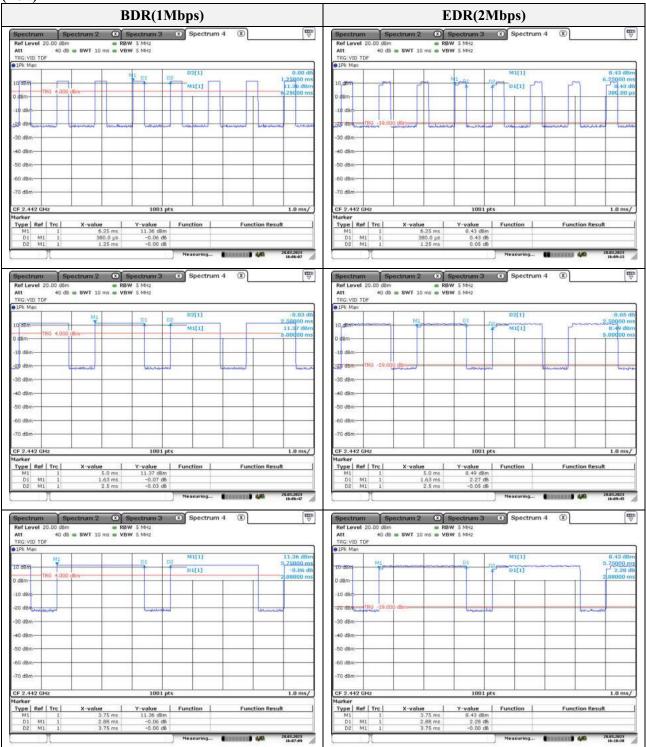
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EDR(3Mbps)	
Spectrum 2 (3) Spectrum 3 (2) Spectrum 4 (3)	
Ref Level 20.00 dBm Image: RBW 5 MHz Att 40 dB image: SWT 10 ms VBW 5 MHz	
TPG:/VID.TDF @1Pk.Max	
N1_01 6.25000 ms	
10 gen 202 do	
-10 dBm	
de de trainer la constant la const	
-30 dBm	N/A
-50 dBm	
-60 d8m	
-70 dBm	
CF 2.442 GHz 1001 pts 1.0 ms/ Marker	
Type Ref Trc X-value Y-value Function Function Result M1 1 6.25 ms 6.31 d8m	
D1 M1 1 380.0 μs 2.02 dB D2 M1 1 1.25 ms -0.01 dB	
Neasuring 10 28.87.2923	
Spectrum 2 3 Spectrum 3 3 Spectrum 4 3	
Ref Level 20.00 dBm Image: RBW 5 MHz Att 40 dB image: SWT 10 ms VBW 5 MHz	
TRG-VID TDF DPK Max	
10 g6mcasescand /// 01/11 62/20 d8m 10 g6mcasescand /// 01/11 62/20 ms 4 d/ 01/11 // 01/11 // 02/08	
0 dém 1.63000 ms	
-10 dBm	
20 dem TRG -19.000 dem United	
-30 dBm	N/A
-50 dBm	
-60 dBm	
-70 d8m	
CF 2.442 GHz 1001 pts 1.0 ms/ Marker	
Type Ref Trc X-value Y-value Function Function Result M1 1 5.0 ms 8.28 dBm	
D1 M1 1 1.63 ms 0.87 dB D2 M1 1 2.5 ms -0.01 dB	
Neasuring 1111111 440 2883.2823	
Spectrum 2 3 Spectrum 3 3 Spectrum 4 3	
Ref Level 20.00 dBm RBW 5 MHz Att 40 dB SWF 10 ms VBW 5 MHz Description Company 5 MHz Company 5 MHz	
TRG:VID TDF @1Pk Max M1[1] 0.31 dBm	
10'08m M1 3.75000.015 10'08m Diana data and an and a 100 111 1.59 dB	
0 d8m	
-10 dBm	
-20 dBm	
-30 dbm	N/A
-50 dBm	
-60 dBm	
-70 dBm	
CF 2.442 GHz 1001 pts 1.0 ms/	
Marker Yung Ref Trc X-value Y-value Function Function Result M1 1 3.75 ms 0.31 d8m Function Function	
D1 M1 1 2.88 ms 1.59 dB D2 M1 1 3.75 ms 0.00 dB	
Neasuring 112402	



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(Left)





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EDR(3Mbps)	
Spectrum 2 3 Spectrum 3 8 Spectrum 4 🛞 🕎	
Ref Level 20.00 dBm @ RBW 5 MHz Att 40 dB @ SWT 10 ms @ VBW 5 MHz	
TRG:VID TDF 1Pk Max	
M1_D1 M1[1] 8,44 dBm 6.25000 ms	
10 dBm-	
39 dom TRG 20.000 Brand have been been been been been been been be	
30 dBm	N/A
40 d8m 50 d8m	
60 dBm	
70 dBm	
CF 2.442 GHz 1001 pts 1.0 ms/	
Type Ref Trc X-value Y-value Function Function Result M1 1 6.25 ms 8.44 d8m	
01 M1 1 380.0 µs 2.20 db 02 M1 1 1.25 ms -0.00 db	
Measuring Measuring	
Spectrum 2 O Spectrum 3 O Spectrum 4 🕐	
Ref Level 20.00 d8m	
Att 40 dB @ SWT 10 ms @ VBW 5 MHz TRG:VID TDF	
91Pk Max M1[1] 8.43 dBm	
10 3511 CONTRACT 10 10 10 10 10 10 10 10 10 10 10 10 10 	
0 dam 1.63000 ms	
10 dBm	
29 dBm TRG -20.000 dBm	
30 dBm	N1/A
40 dBm-	N/A
50 dBm-	
60 dBm	
70 dBm	
CF 2.442 GHz 1.0 ms/	
tarker Type Ref Trc X-value Y-value Function Function Result	
M1 1 5.0 ms 8.43 d8m D1 M1 1 1.63 ms 0.94 d8 C2 M1 1 2.63 ms 0.94 d8	
D2 M1 1 2.5 ms 0.01 dB Heasuring 21.01.223	
Deal in case it which it	
Spectrum Spectrum 2 Spectrum 3 Spectrum 4 Image: Control of the system Image: Control of the syste	
Att 40 dB SWT 10 ms VBW 5 MH2	
TRG:VID TDF ADPK Max	
10'08h M1 8,43 08m 01 02m 03,5000,005 10'08h 01 02m 011	
2,49 de 0 dem	
-10 dBm-	
20 dbmTR020.000 dam	
30 dBm	
40 dBm	N/A
50 dBm	
60 dBm	
70 dBm	
larker	
Type Ref Trc X-value Y-value Function Function Result M1 1 3.75 ms 8.43 d8m	
Mil 1 3.75 ms 0.43 00m D1 M1 2.88 ms 2.49 d8 D2 M1 1 3.75 ms -0.01 d8	
Measuring 10 28.81.2021	

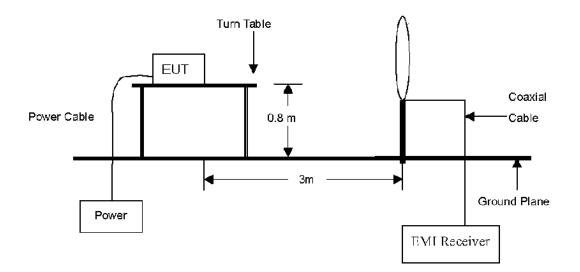


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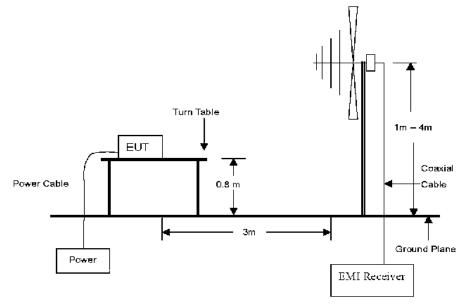
3.6. Radiated restricted band and emissions

Test setup

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



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



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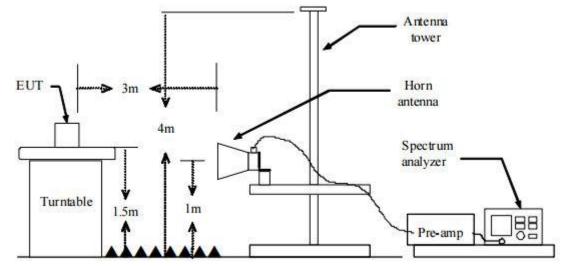


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The diagram below shows the test setup that is utilized to make the measurements for emission from 1 $\mathbb{G}\mathbb{Z}$ to the tenth harmonic of the highest fundamental frequency or to 40 $\mathbb{G}\mathbb{Z}$ emissions, whichever is lower.



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 Mz

- 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 Mbz

- 1. The EUT was placed on the top of a rotating table 0.8 meters(30-1000MHz) / 1.5 meters(above 1GHz)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. .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

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- 2 RBW = 100 kHz
- (3) VBW \geq RBW
- ④ Detector = quasi peak
- (5) Sweep time = auto
- \bigcirc Trace = max hold
- 6. Spectrum analyzer settings for $f \ge 1$ GHz: Peak
 - ① Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
 - 2 RBW = 1 Mz
 - \bigcirc VBW \ge 3 Mz
 - (4) Detector = peak
 - (5) Sweep time = auto
 - (6) Trace = max hold
 - \bigcirc Trace was allowed to stabilize
- 7. Spectrum analyzer settings for $f \ge 1$ GHz: Average
 - ① Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
 - 2 RBW = 1 Mbz

 - (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
 - \bigcirc 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 (≥ 98 percent duty cycle) rather than turning on and off with the transmit cycle, then no duty cycle correction is required for that emission.



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Note.

- 1. f < 30 Mb, extrapolation factor of 40 dB/decade of distance. $F_d = 40\log(D_m/Ds)$ $f \ge 30$ Mb, extrapolation factor of 20 dB/decade of distance. $F_d = 20\log(D_m/Ds)$ Where:
 - F_d = Distance factor in dB
 - D_m = Measurement distance in meters
 - D_s = Specification distance in meters
- 2. Field strength($dB\mu N/m$) = Level($dB\mu N$) + CF (dB) + or DCF(dB)
- 3. Margin(dB) = Limit(dB μ V/m) Field strength(dB μ 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.
- 7. The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z, it was determined that <u>X orientation</u> was worst-case orientation; therefore, all final radiated testing was performed with the EUT in <u>X orientation</u>.
- 8. The worst-case emissions are reported however emissions whose levels were not within 20 dB of respective limits were not reported.
- 9. 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.

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 (Mb)	Distance (Meters)	Radiated (µN/m)
$0.009 \sim 0.490$	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 $54 \sim 72$ Mb, $76 \sim 88$ Mb, $174 \sim 216$ Mb or $470 \sim 806$ Mb. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.



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) 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.

b) 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.

(Right)
(ingine)

Mode	T _{on} time (MS)	Period (ms)	Duty cycle (Linear)	Duty cycle (%)	Duty cycle correction factor (dB)
BDR(1 Mbps)	2.880	3.750	0.768	76.80	1.15
EDR(3 Mbps)	2.880	3.750	0.768	76.80	1.15

(Left)

Mode	T _{on} time (ms)	Period (ms)	Duty cycle (Linear)	Duty cycle (%)	Duty cycle correction factor (dB)
BDR(1 Mbps)	2.880	3.750	0.768	76.80	1.15
EDR(3 Mbps)	2.880	3.750	0.768	76.80	1.15

Duty cycle (Linear) = T_{on} time/Period

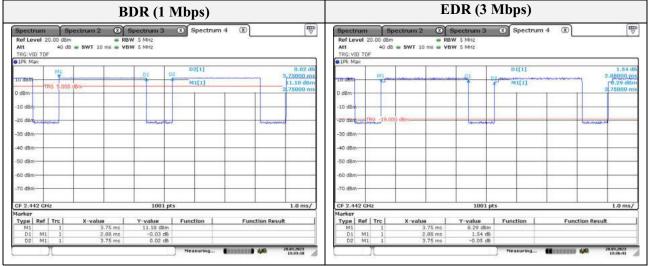
DCF(Duty cycle correction factor (dB)) = 10log(1/duty cycle)

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(Right)



(Left) EDR (3 Mbps) BDR (1 Mbps) (*) Spectrum 4 (X) Spectrum 4 8 () Ø () Att Att TOP ID TO e 1Pk M e 1Pk Mi M1[1] 11.33 dB 3.75000 m -0.07 d M1[1] 8.43 dt 3.75000 g D1[1] D1[1] 10 dE 10 dF I. I. 0 dB F 2.442 CF 2.44 1.0 n Type Ref Trc M1 1 Type Ref Trc Y-value Function Function Result X-value 1 Y-value Function Function Result X-value 1 M1 M1 M1 M1 .88 ms .88 m -0.07 dê -0.01 dê 1.56 dB -0.01 dB 16:03:29 28.01.2023



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Test results (Below 30 Mz)Mode:BDR (Right)Distance of measurement:3 meter

78 (Worst case)

Channel:

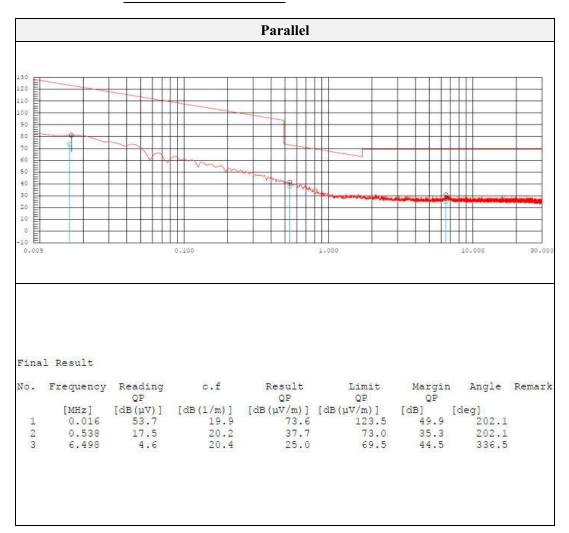
Parallel 130 120 110 90 80 70 60 50 40 19 30 20 10 0 10000 -10 E 0.009 0.100 1.000 10.000 30.0 Final Result Limit No. c.f Result Frequency Reading Margin Angle Remark QP QP QP QP [dB(µV/m)] [dB(µV/m)] 75.8 128.1 59.9 111. 38.7 94.1 [MHz] 0.009 [dB(1/m)] 19.8 19.9 [dB(µV)] [dB] [deg] 157.6 52.7 1 128.5 56.0 23 51.4 0.065 40.0 111.3 244.6 0.463 18.6 20.1 94.3 55.6 68.9

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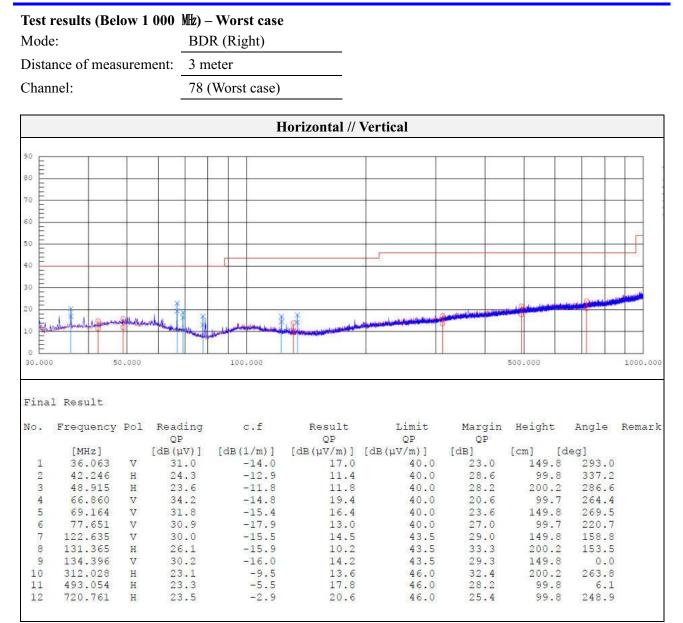
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Mode:	BDR (Left)
Distance of measurement:	3 meter
Channel:	78 (Worst case)



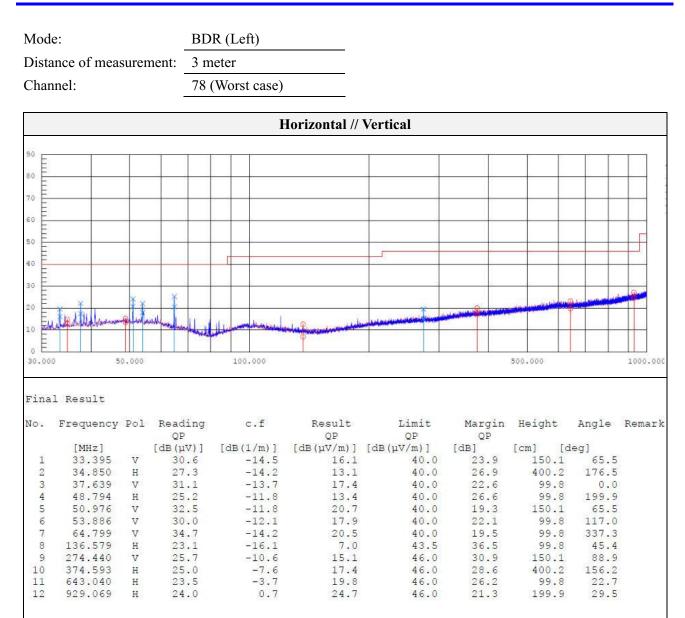


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Test results (Above 1 000 Mb)

Mode:	BDR (Right)
Distance of measurement:	3 meter
Channel:	00

- Spurious

Frequency (Mb)	Level (dBµV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBµN/m)	Limit (dBµN/m)	Margin (dB)
1 073.97	46.47	Peak	Н	-9.48	-	36.99	74.00	37.01
1 732.88	50.25	Peak	V	-4.36	-	45.89	74.00	28.11
3 603.03	46.98	Average	Н	0.70	1.15	48.83	54.00	5.17
3 603.03	56.25	Peak	Н	0.70	-	56.95	74.00	17.05
3 603.03	47.06	Peak	V	0.70	-	47.76	74.00	26.24
4 802.05	48.42	Peak	Н	5.15	-	53.57	74.00	20.43
4 803.93	38.40	Average	Н	5.16	1.15	44.71	54.00	9.29

- Band edge

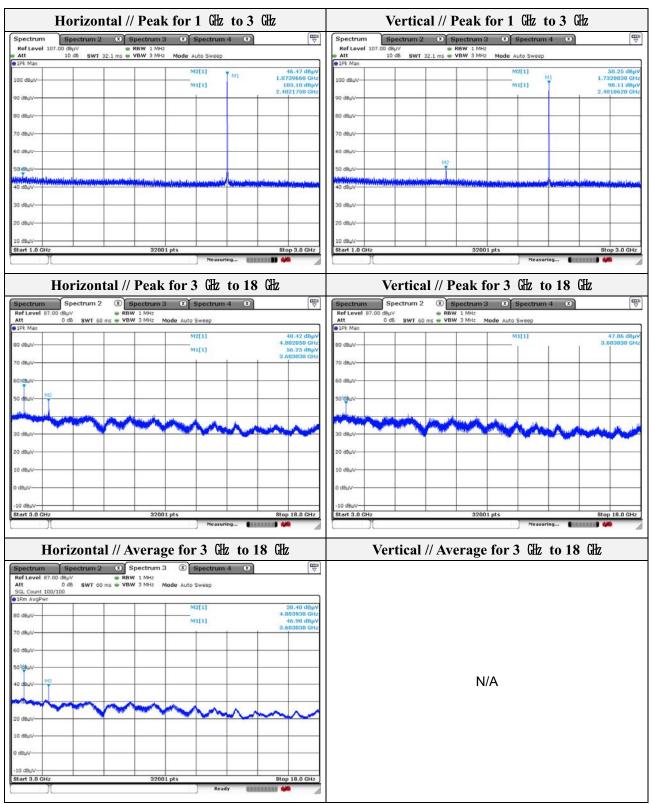
Dunu	uge							
Frequency (Mbz)	Level (dBµV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2 324.38	42.50	Peak	V	-1.88	-	40.62	74.00	33.38
2 373.60	43.01	Peak	Н	-1.87	-	41.14	74.00	32.86

R	estricted	band // H	orizontal /	// Peak		Restric	ted band	// Vertica	al // Pea	ık
Spectrum	Spectrum 2	Spectrum 3	Spectrum 4	⊗ 🖾	Spectrum	Spectrum 2	Spectrum	3 🛞 Spectr	um 4 🛞	E E
Ref Level 87.00 d		 RBW 1 MHz VBW 3 MHz Mo 			Ref Level 87. Att		RBW 1 MHz 4 µs S VBW 3 MHz			
• 1Pk Max	5 06 SWI 11.4 µS	WEW 3 MPIZ MIO	de Auto FFT		1Pk Max	0 05 SWI 11.	4 µs 🖶 VBW 3 MHz	Mode Auto FFT		
80 dBµV			M1[1]	43.01 dBµV 2.37360430 GHz	80 dBµV-			M1[1]	ĩ î	42.50 dBµ\ 2.32437838 GH;
70 dBµV		_	_		70 dBµV	_				
60 dBµV					60 dBµV			-	_	
50 dBµV				ML	50 dBuV	M1				
10 Barrow	mon		man when	mp man	- Cudense	- Vmm	mon		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	www.
30 dBµV					30 dBµV					
20 dBµV					20 dBµV				_	· · · · · · · · · · · · · · · · · · ·
10 dBµV					10 dBµV				_	
0 dBuV					0 dBµV					
-10 dBµV					-10 dBµV-					
Start 2.31 GHz		32001 pt		Stop 2.39 GHz	Start 2.31 GH	2	320	01 pts	-	Stop 2.39 GHz
Л_			Measuring					Ne	asuring 🚺	

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Note.

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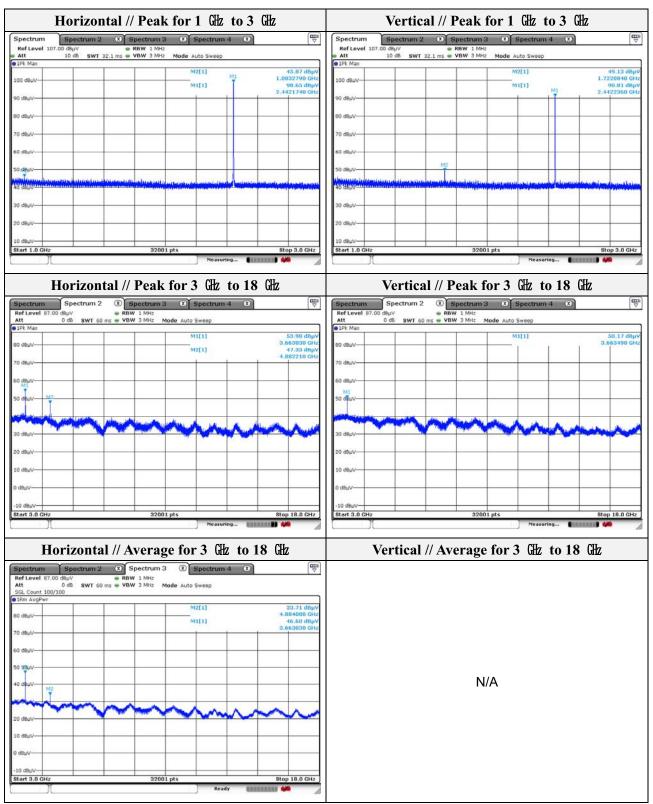
BDR (Right)
3 meter
40

Frequency (Mz)	Level (dBµN)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBµN/m)	Limit (dBµN/m)	Margin (dB)
1 083.28	45.87	Peak	Н	-9.42	-	36.45	74.00	37.55
1 722.88	49.13	Peak	V	-4.49	-	44.64	74.00	29.36
3 663.03	53.98	Peak	Н	1.16	-	55.14	74.00	18.86
3 663.03	46.60	Average	Н	1.16	1.15	48.91	54.00	5.09
3 663.49	50.17	Peak	V	1.17	-	51.34	74.00	22.66
4 882.21	47.33	Peak	Н	5.70	-	53.03	74.00	20.97
4 884.08	33.71	Average	Н	5.71	1.15	40.57	54.00	13.43

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Note.

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

Spurious _

Frequency (Mz)	Level (dBµV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBµV/m)	Limit (dBµN/m)	Margin (dB)
1 044.34	45.50	Peak	V	-9.68	-	35.82	74.00	38.18
1 724.32	46.54	Peak	Н	-4.47	-	42.07	74.00	31.93
3 720.21	46.07	Peak	V	1.61	-	47.68	74.00	26.32
3 720.21	52.17	Peak	Н	1.61	-	53.78	74.00	20.22
4 958.14	44.83	Peak	Н	6.22	-	51.05	74.00	22.95

Band edge

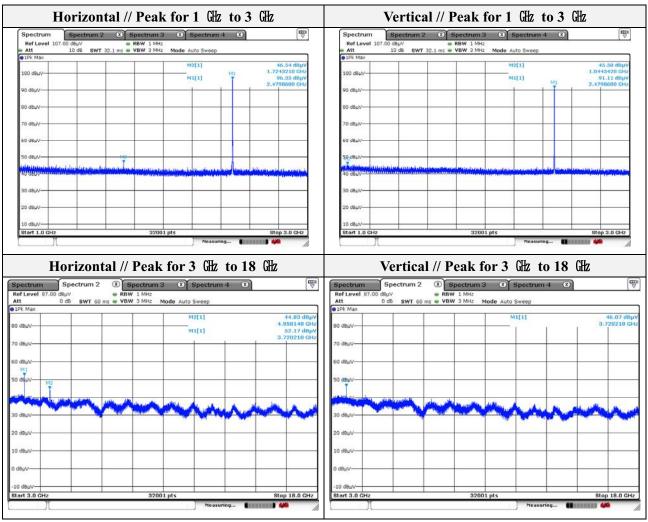
Frequency (Mb)	Level (dBµV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBµV/m)	Limit (dBµN/m)	Margin (dB)
2 483.50	48.98	Peak	Н	-1.66	-	47.32	74.00	26.68
2 483.50	45.24	Peak	V	-1.66	-	43.58	74.00	30.42

Spectrum	Spectrum 2 X Spectrum 3 X Spectrum 4 X								Spectrur	n Sp	ectrum 2	× S	ectrum :	3 🗷 5	pectrum	4 🛞		u ⊂
Ref Level 87.0 Att	0 d8µ∨ 0 d8 SWT 3.	B US B VBW		lode Auto	FFT				Ref Level Att	87.00 dBµV 0 dB		B RBW		Mode Auto	FT			
1Pk Max					1000				• 1Pk Max									
80 dBµV				M	11[1]	ī ī		48.98 dBµV 00260 GHz	80 dBµV					м	1[1]			45.24 dBµ 500260 GH
70 dBµV	_	-							70 dBµV									-
i0 dBµV									60 d8µV									
50 dBuV	_	-						-	50 dBuV-	-	-		-		1			-
HO dBuV			~		~				40 dBµV-	~			~					
80 dBµV									30 dBµV		-							-
20 dBhA			-						20 dBµV							-	<u> </u>	-
10 dBµV									10 dBµV									+
0 dBµV									0 dBµV								-	
-10 dBuy-									-10 dBuV-									

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Note.

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Mode:	BDR (Left)
Distance of measurement:	3 meter
Channel:	00

- Spurious	
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Frequency (Mbz)	Level (dBµV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBµN/m)	Limit (dBµN/m)	Margin (dB)
1 126.34	46.28	Peak	Н	-9.13	-	37.15	74.00	36.85
1 177.84	47.06	Peak	V	-8.79	-	38.27	74.00	35.73
3 603.03	53.98	Peak	Н	0.70	-	54.68	74.00	19.32
3 603.03	46.62	Average	Н	0.70	1.15	48.47	54.00	5.53
3 603.50	47.39	Peak	V	0.71	-	48.10	74.00	25.90
4 802.05	44.81	Peak	Н	5.15	-	49.96	74.00	24.04
4 803.93	38.83	Average	Н	5.16	1.15	45.14	54.00	8.86

Band edge

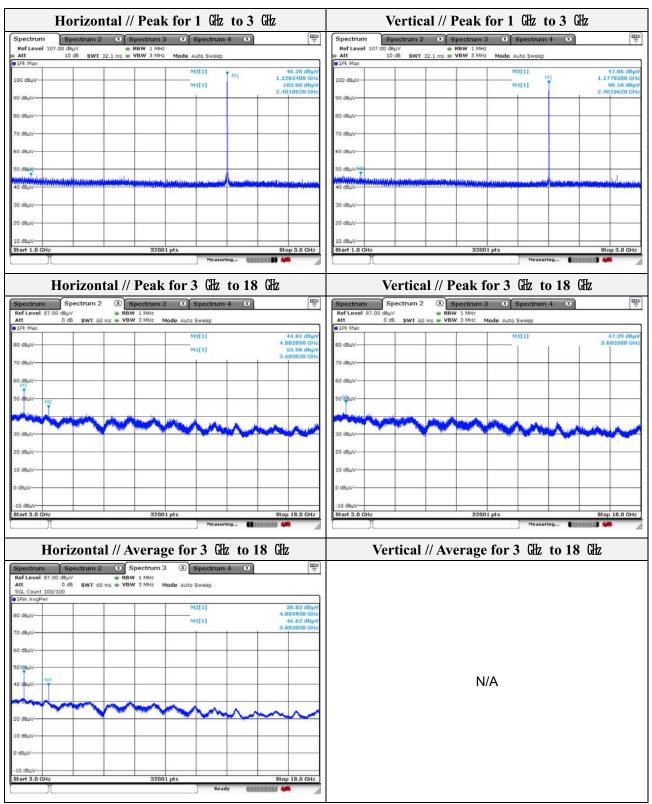
Frequency (Mb)	Level (dBµV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBµN/m)	Limit (dBµN/m)	Margin (dB)
2 388.71	41.66	Peak	V	-1.86	-	39.80	74.00	34.20
2 389.53	42.70	Peak	Н	-1.86	-	40.84	74.00	33.16

Spectrum	Spectrum 2	Spectrum	3 🛞 Spectrum	4 🛞		Spectrum	Spectrum 2	X Spect	rum 3 🛛 🗵	Spectrum 4	8	
Ref Level 87.0 Att		RBW 1 MHz µs WBW 3 MHz	Mode Auto FFT			Ref Level 87. Att	0 dB SWT 11.	RBW 1 4 µs • VBW 3		FFT		
• 1Pk Max						1Pk Max						
80 dBµV			M1[1]		42.70 dBpV 352888 GHz	80 dBµV			N	1(1)		41.66 dBµ\ 871130 GH;
70 dBµV						70 dBµV	_				_	-
60 dBµV	_					60 dBµV			-		_	-
50 dBµV					M	50 dBµV	-				_	
TR. dBulloo	Annual .	www.	mon	man	Turner	49,0844-1		voor		mvm		X
30 dBµV						30 dBµV						
20 dBµV						20 dBµV		-				-
10 dBµV				· · · · ·		10 dBµV	_				_	
0 dBµV						0 dBµV						-
-10 d8µV-						-10 dBµV						<u> </u>

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Note.

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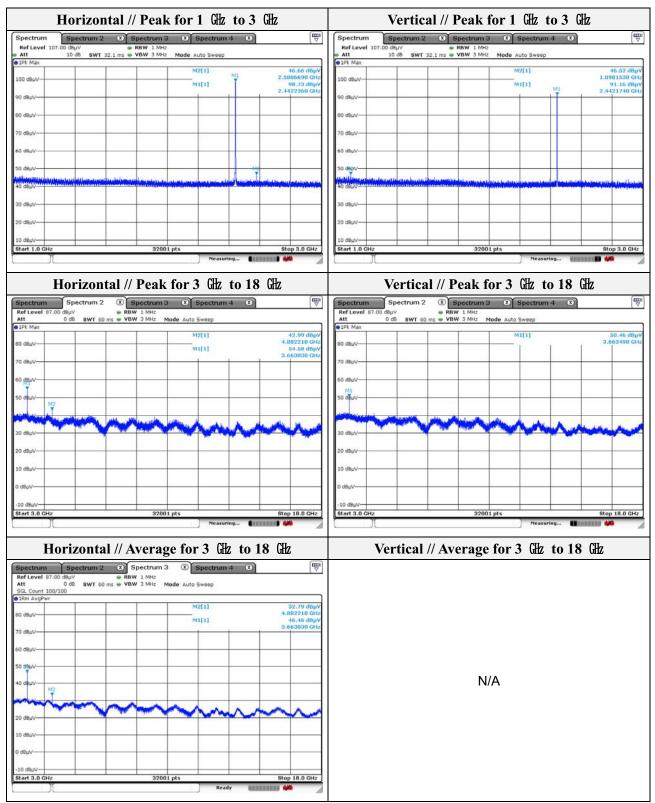
Mode:	BDR (Left)
Distance of measurement:	3 meter
Channel:	40

Frequency (歴2)	Level (dBµN)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBµN/m)	Limit (dBµN/m)	Margin (dB)
1 098.15	46.52	Peak	V	-9.32	-	37.20	74.00	36.80
2 580.67	46.66	Peak	Н	-1.19	-	45.47	74.00	28.53
3 663.03	46.46	Average	Н	1.16	1.15	48.77	54.00	5.23
3 663.03	54.58	Peak	Н	1.16	-	55.74	74.00	18.26
3 663.49	50.46	Peak	V	1.17	-	51.63	74.00	22.37
4 882.21	42.99	Peak	Н	5.70	-	48.69	74.00	25.31
4 882.21	32.79	Average	Н	5.70	1.15	39.64	54.00	14.36

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Note.

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

- Spurious

Frequency (Mz)	Level (dBµV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBµN/m)	Limit (dBµV/m)	Margin (dB)
1 195.28	45.67	Peak	Н	-8.68	-	36.99	74.00	37.01
1 730.51	47.23	Peak	V	-4.39	-	42.84	74.00	31.16
3 719.27	44.86	Peak	V	1.60	-	46.46	74.00	27.54
3 719.74	53.26	Peak	Н	1.60	-	54.86	74.00	19.14
3 720.21	47.46	Average	Н	1.61	1.15	49.07	54.00	4.93
4 958.14	46.26	Peak	Н	6.22	-	52.48	74.00	21.52
4 960.02	35.22	Average	Н	6.23	1.15	41.45	54.00	12.55

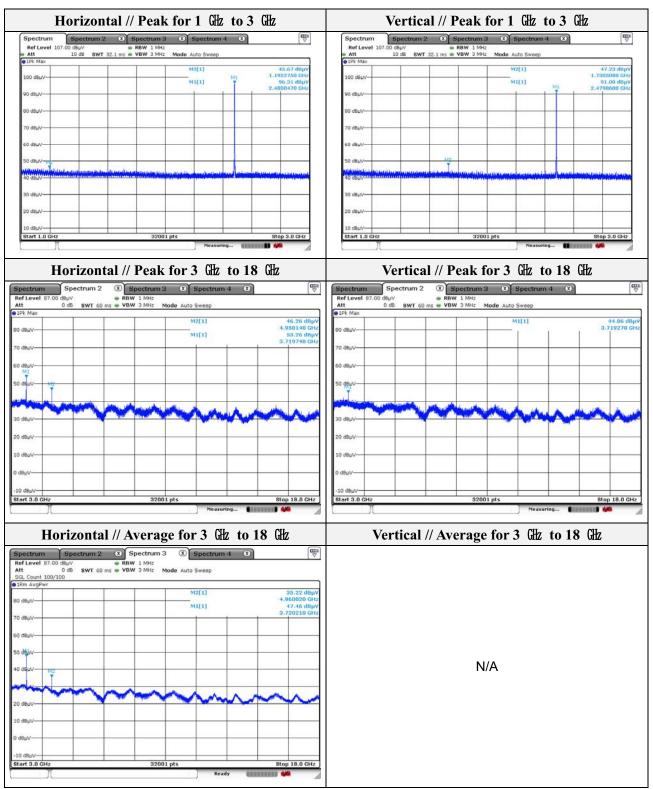
- Band e	edge							
Frequency	Level	Detect mode	Ant. Pol.	CF	DCF	Field strength	Limit	Margin
(MHz)	(dBµV)		(H/V)	(dB)	(dB)	(dBµN/m)	(dBµN/m)	(dB)
2 483.50	49.17	Peak	Н	-1.66	-	47.51	74.00	26.49
2 483.50	45.20	Peak	V	-1.66	-	43.54	74.00	30.46

Spectrum	Spectrum 2	Spectrum	13 🗶 S	pectrum	4 🕱			Spectrum	Spe	ctrum 2	X Sp	ectrum	3 🗶	Spectrum	4 🛞		
Ref Level 87.0		RBW 1 MHz µs WBW 3 MHz	Mode Auto F	FT	_			Ref Level 8 Att		SWT 3.8	RBW		Mode Auto	FFT	_		
• 1Pk Max								1Pk Max						Ch II			
80 dBµV			MI	[1]	ĩ ĩ		49.17 dBµV 00260 GHz	80 dBµV					M	1[1]			45.20 dBµ 00260 GH
70 dBµV	_				-			70 dBµV					-		-		
i0 dBµV								60 dBµV									
50 dBuV	-		-	-				50 dBµV-						-	-		-
10 dBµV	~~		-					40 dBuV									
30 dBµV				-		_		30 dBµV								_	
20 dBµV			-				-	20 dBµV									
10 dBµV								10 dBµV									
0 dBuV								0 dBµV									
-10 dBuV			_					-10 dBuV-									<u> </u>

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Note.

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Mode:	EDR (Right)
Transfer rate:	3 Mbps(Worst case)
Distance of measurement:	3 meter
Channel:	00

- Spurious

Frequency (Mbz)	Level (dBµV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBµN/m)	Limit (dBµN/m)	Margin (dB)
1 682.76	50.53	Peak	Н	-4.99	-	45.54	74.00	28.46
2 222.49	41.00	Peak	V	-1.89	-	39.11	74.00	34.89
3 602.56	51.78	Peak	Н	0.70	-	52.48	74.00	21.52
3 603.50	44.27	Peak	V	0.71		44.98	74.00	29.02
3 797.08	47.18	Peak	Н	2.20	-	49.38	74.00	24.62
4 803.93	43.54	Peak	Н	5.16	-	48.70	74.00	25.30

- Band edge

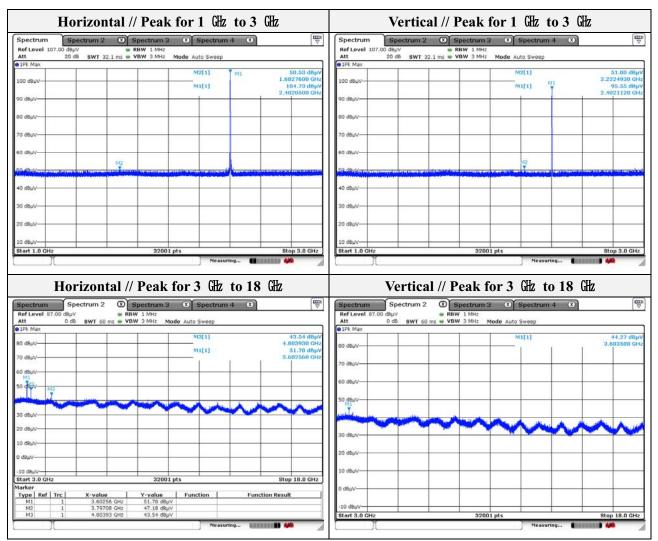
- Dallu e	euge							
Frequency (Mz)	Level (dBµV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2 376.04	48.46	Peak	Н	-1.87	-	46.59	74.00	27.41
2 374.23	42.83	Peak	V	-1.87	-	40.96	74.00	33.04

Restrie	cted band //	Horizontal //	Peak		Restric	ted band /	// Vertical	// Peak	
Spectrum Spectrum Ref Level 87.00 dBµV Att	m 2 Spectrum 3 • RBW 1 MH2 T 11.4 µs • VBW 3 MH2			Spectrum Ref Level 87.		Spectrum 3 BW 1 MHz WS 9 VBW 3 MHz		1 ®	
1Pk Max	1 11.1 10 0 1011 0 1010			• 1Pk Max	0.00 000111		Houe Auto PPT		
80 dBµV		M1[1]	48.46 dBµV 2.37603678 GHz	80 dBµV			M1[1]	42.83 di 2,37423420 di	
70 dBµV				70 dΒµV	_			· · · · · · · · · · · · · · · · · · ·	_
60 d8µV				60 dBµV					-
50 dBµV	0.000		hann	50 dBµV				M1	
40-080v		many		30 dBµV	- Andrew of	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	m n n n n		
20 dBµV				20 dBµV					_
10 d8µV				10 dBµV	_				_
0 dBuV				0 dBuV					_
-10 d8µV-	32001	ots	Stop 2.39 CHz	-10 d8µV	_	3200	Lots	Stop 2.39 G	Hz
<u> </u>	01001		In the second se			5200	Neasurin		1

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Note.

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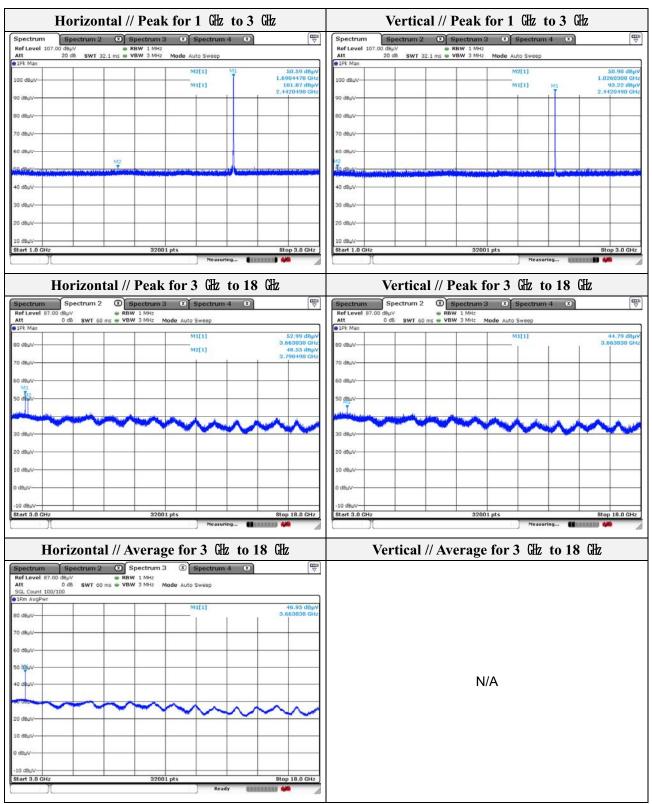
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Mode:		EDR (R	light)					
Transfer ra	ite:	3 Mbps	(Worst case)					
Distance o	f measurem	ent: 3 meter						
Channel:		40						
- Spurio	us							
Frequency (Mbz)	Level (dBµV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB μ V/m)	Limit (dBµV/m)	Margin (dB)
1 026.03	50.98	Peak	V	-9.80	-	41.18	74.00	32.82
1 690.45	50.59	Peak	Н	-4.90	-	45.69	74.00	28.31
3 663.03	52.99	Peak	Н	1.16	-	54.15	74.00	19.85
3 663.03	46.95	Average	Н	1.16	1.15	49.26	54.00	4.74
3 663.03	44.79	Peak	V	1.16		45.95	74.00	28.05
3 798.49	48.55	Peak	Н	2.21	-	50.76	74.00	23.24

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Note.

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

- Spurious

Frequency (Mbz)	Level (dBµV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBµN/m)	Limit (dBµN/m)	Margin (dB)
1 753.07	51.01	Peak	Н	-4.11	-	46.90	74.00	27.10
2 123.31	50.97	Peak	V	-2.00	-	48.97	74.00	25.03
3 719.74	45.95	Peak	V	1.60	-	47.55	74.00	26.45
3 720.21	52.64	Peak	Н	1.61	-	54.25	74.00	19.75
3 720.21	48.19	Average	Н	1.61	1.15	49.80	54.00	4.20

- Band edge

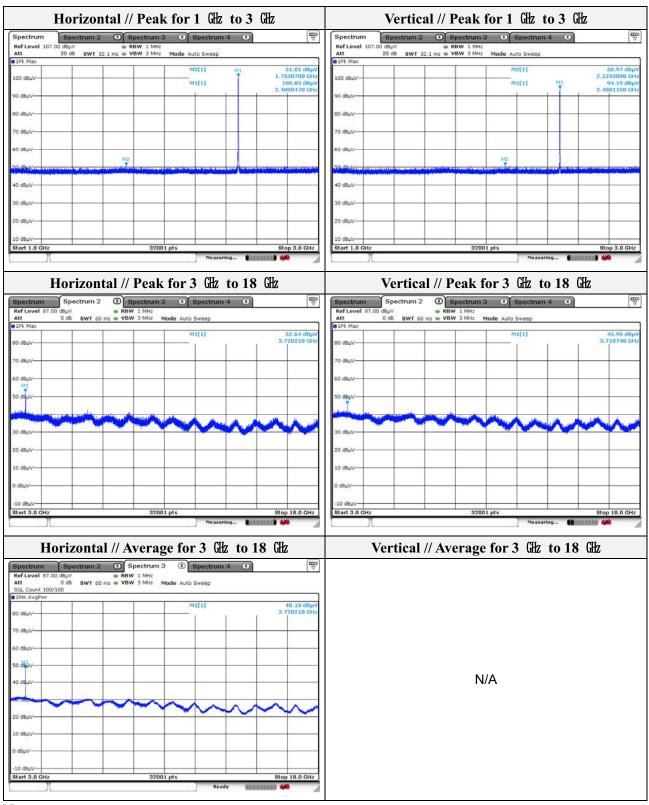
Frequency (Mz)	Level (dBµV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBµV/m)	Limit (dBµN/m)	Margin (dB)
2 483.50	53.84	Peak	Н	-1.66	-	52.18	74.00	21.82
2 484.24	45.27	Peak	V	-1.66	-	43.61	74.00	30.39

	Y				eak	6		ted band			(m
Spectrum Ref Level 87.0		Spectrum RBW 1 MHz		n4 ⊛		Ref Level 87.0		Spectrum RBW 1 MHz		4 ເ⊗	
Att 1Pk Max	0 dB SWT 3.8	us 🖶 VBW 3 MHz	Mode Auto FFT			Att	0 dB SWT 3.8	us 🖶 VBW 3 MHz	Mode Auto FFT		
80 dBµV			M1[1]	7 7	53.84 dBµV 2.483500260 GHz	80 dBµV			M1[1]	r 1	45.27 dBµ 2.404237580 GH
70 dBµV	_					70 dBµV	_				
60 dBµV						60 dBµV					
50 dBuv						50 dBuV					
40 dBµV						40 dBµV					
30 dBµV						30 dBµV					
20 dBµV						20 dBµV					
10 d8µV				+ +		10 dBµV					
0 dBµV						0 dBµV					
-10 dBµV-						-10 d8µV					
Start 2.4835 G	Hz	320	01 pts	aring Eine	Stop 2.5 GHz	Start 2.4835 G	Hz	320	01 pts Neasuri	ing Bitter	Stop 2.5 GHz

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Note.

1. Average test would be performed if the peak result were greater than the average limit. Mode: EDR (Left)

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Distance of measurement:

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Transfer rate:

3 Mbps(Worst case) 3 meter

Channel:

00

-	Spurious	5

Frequency (畑)	Level (dBµN)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBµV/m)	Limit (dBµN/m)	Margin (dB)
1 042.03	50.17	Peak	V	-9.69	-	40.48	74.00	33.52
1 761.76	51.04	Peak	Н	-4.00	-	47.04	74.00	26.96
3 603.97	45.91	Peak	V	0.71	-	46.62	74.00	27.38
3 603.50	50.64	Peak	Н	0.71	-	51.35	74.00	22.65
4 803.46	41.81	Peak	V	5.16	-	46.97	74.00	27.03
4 804.40	45.35	Peak	Н	5.17	-	50.52	74.00	23.48
- Band e	edge			•	•			
Frequency	Level		Ant. Pol.	CF	DCF	Field strength	Limit	Margin

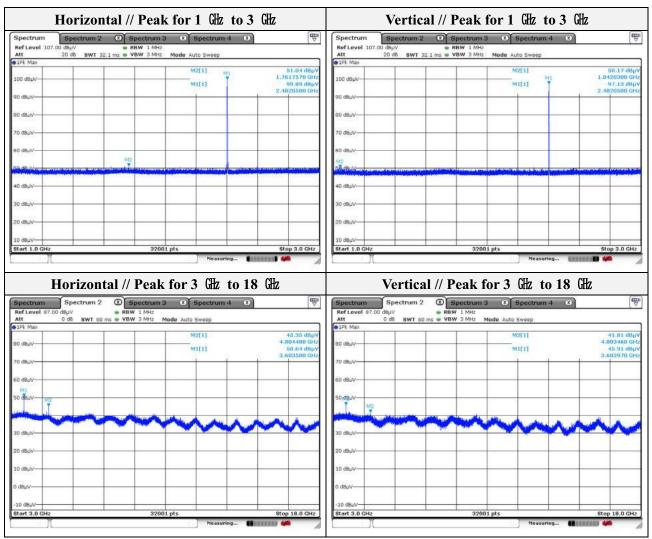
Frequency (畑z)	Level (dBµV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2 348.94	42.52	Peak	V	-1.87	-	40.65	74.00	33.35
2 370.13	42.73	Peak	Н	-1.87	-	40.86	74.00	33.14

Restricted band // Horizontal // Peak									R	estrio	ted l	band	// Ve	rtical	// Pe	ak		
									Spectrum	and a second sec	pectrum 2		Spectrum	з х	Spectrun	n4 🛞		E U
Ref Level 87.0	0 dBµV 0 dB SWT 11	e RBW		Inde Auto	FFT				Ref Level 87.00 dBµV									
IPk Max									IPk Max	1								
80 dBµV	_			MI	[1]	1		42.73 dBµV 12940 GHz	80 dBµV				-		01[1]	1		42.52 dBp 894000 GH
70 dBµV								-	70 dвµV				-	-		-		-
60 dBµV									60 dBµV			-	-		-		+	
50 d8µV						MI	_		50 d8µV	-			M	1				-
10-ditter	Armen	man.	~~~~	man	m	m	m		*+0*08# \ *~~~	~~~~~		-	and well	1	hun	m	m	
3D dBLIV				-			_		зр авул			-					-	-
20 dBµV									20 dBµV		-		-	-		-	-	-
10 dBµV									10 dBµV		-	-	-	-		-	-	-
0 dBuV								-	0 dBuV			-	-			-		
-10 dBµV	_					_	2000		-10 dBµV—	Sau	-	-		- Cast			-	i - Contra - Secondario
Start 2.31 GHz			32001	pts				2.39 GHz	Start 2.31	GHz			3204	01 pts	-			p 2.39 GHz
1				18	Measurii	1g		- Mi		л					Measu	ring 📲		

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Note.

1. Average test would be performed if the peak result were greater than the average limit.

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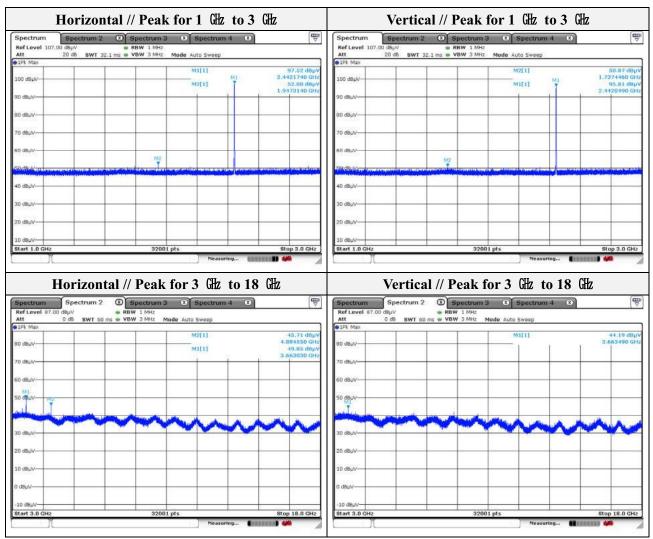
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Mode:		EDR (L	eft)					
Transfer ra	te:	3 Mbps	(Worst case)					
Distance o	f measurem	ent: 3 meter						
Channel:		40						
- Spurio	us							
Frequency (Mbz)	Level (dBµV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBµN/m)	Limit (dBµV/m)	Margin (dB)
1 737.45	50.87	Peak	V	-4.31	-	46.56	74.00	27.44
1 947.31	52.00	Peak	Н	-2.52	-	49.48	74.00	24.52
3 663.03	49.85	Peak	Н	1.16	-	51.01	74.00	22.99
3 663.49	44.19	Peak	V	1.17	-	45.36	74.00	28.64
4 884.55	45.71	Peak	Н	5.72	-	51.43	74.00	22.57

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Note.

1. Average test would be performed if the peak result were greater than the average limit.

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

- Spurious

Frequency (Mbz)	Level (dBµV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBµN/m)	Limit (dBµN/m)	Margin (dB)
1 657.64	50.61	Peak	V	-5.31	-	45.30	74.00	28.70
1 745.45	51.12	Peak	Н	-4.21	-	46.91	74.00	27.09
3 719.74	49.10	Peak	Н	1.60	-	50.70	74.00	23.30
3 720.21	44.54	Peak	V	1.61	-	46.15	74.00	27.85

- Band edge

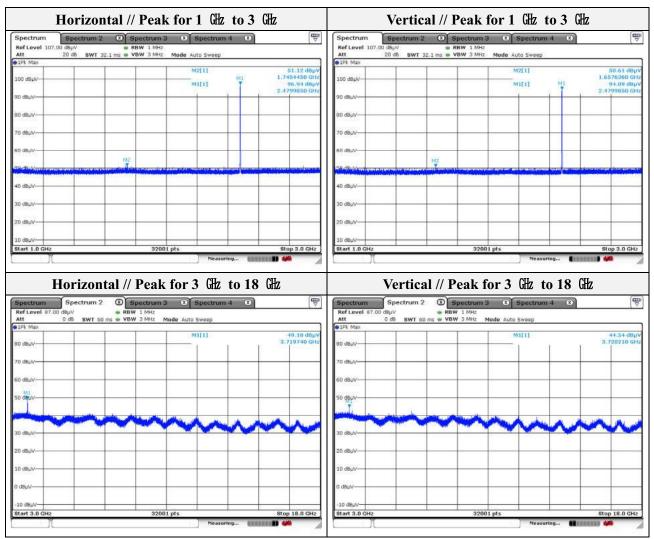
Frequency (Mb)	Level (dBµN)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBµN/m)	Limit (dBµN/m)	Margin (dB)
2 483.50	47.81	Peak	Н	-1.66	-	46.15	74.00	27.85
2 483.50	47.68	Peak	V	-1.66	-	46.02	74.00	27.98

Restricted band // Horizontal // Peak						Restric	ted band	// Vertical	// Peak
Spectrum	Spectrum 2	Spectrum 3	(X) Spectrum 4 (x) 🗒	Spectrum	Spectrum 2	(X) Spectrum	3 (x) Spectrum	4 3
Ref Level 87.0 Att	0 d8µV 0 d8 swr 3.8 µs =	RBW 1 MH2 VBW 3 MH2 Mo	de Auto FFT		Ref Level 87.0 Att		RBW 1 MHz µs WBW 3 MHz	Mode Auto FFT	
IPk Max	- 10 - 10 - 10 - 10 - 10 - 10 - 10 - 10				IPk Max		· · · · ·		
80 dBµV	_	_	M3[1]	47.81 dBµV 2.483500260 GHz	80 dBµV	_		M1[1]	47.68 d 2.483500260
70 dBµV					70 dBµV-	_			
60 d8µV					60 dBµV	_	-		
50 dBµV					50 dBµV				
40 dBuV		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~			40 dBuV				
зр авџу	_				3D dBµV	_			
20 dBµV		_			20 dBµV				
10 dBuV					10 dBµV				
0 dBuV					0 dBuV	_			
-10 d8µV					-10 dBµV				
Start 2.4835 G	Hz	32001	pts Measuring	Stop 2.5 GHz	Start 2.4835 G	Hz	320	01 pts Measurin	Stop 2.5 G

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Note.

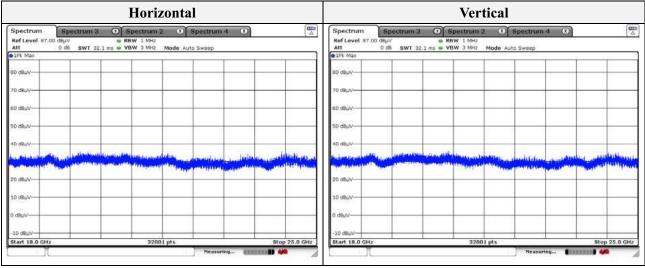
1. Average test would be performed if the peak result were greater than the average limit.

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Test results (18 GHz to 25	(Hz) – Worst case
Mode:	BDR (Right)
Distance of measurement:	3 meter
Channel:	78 (Worst case)



Note.

1. No spurious emission were detected above 18 GHz.

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Mode:	BDR (Left)
Distance of measurement:	3 meter
Channel:	78 (Worst case)

Horizontal										Ver	tical					
Spectrum Spectrum 2 Spectrum 3 Spectrum 4 🛞 🕎																
Ref Level 87.0		• RBW 1	MHZ Mode Aut	o Sween			Ref Level Att		8WT 32	1 ms . VBV	V 1 MHz	Mode Aut	o Sween			
• IPk Max	July Strive		House House Ha	o oneep	15		e IPk Max			1112 - 101		HIDDE AST	o oneep		12 C	
80 dBµV			_				80 dahA									
70 dBµV			-				70 dBµV					-			-	
60 dBµV			_				60 dBµV									
50 d8µV							50 d8µV									
	State State Log	Contraction and	the set of the set				an anna llas	diagonal and	int along	-	and the second	her staller	Nipersola I	Augent		
3D dBUV-			-	(4			зр двул									<u> </u>
20 dBµV			_				20 dBµV									
10 dBµV							10 dBµV								-	
0 dBuV			-				0 dBuV									
-10 dBuV			-		-		-10 dBµV-	2 - C							-	
Start 18.0 GHz			32001 pts	. J.	1	Stop 25.0 GHz	Start 18.0	GHz			3200	1 pts			Stop	25.0 GHz
n			1	Measuring) CANER			π					Measur	ing (M		• _/

Note.

1. No spurious emission were detected above 18 GHz.

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3.7. Conducted band edge and out of band emissions

Test procedure

KDB 558074 v05r02 & ANSI 63.10-2013

Test setup



Test setting

- 1. 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 10th harmonic.
- 2. RBW = 100 kHz
- $3. \text{VBW} \geq 300 \text{ kHz}$
- 4. Detector = Peak
- 5. Number of sweep points $\geq 2 \times \text{Span/RBW}$
- 7. Trace mode = max hold
- 8. Sweep time = auto couple
- 9. The trace was allowed to stabilize

Limit

According to 15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph(b)(3) of this section , the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in section 15.209(a) is not required. In addition, radiated emission which in the restricted band, as define in section 15.205(a), must also comply the radiated emission limits specified in section 15.209(a) (see section 15.205(c))

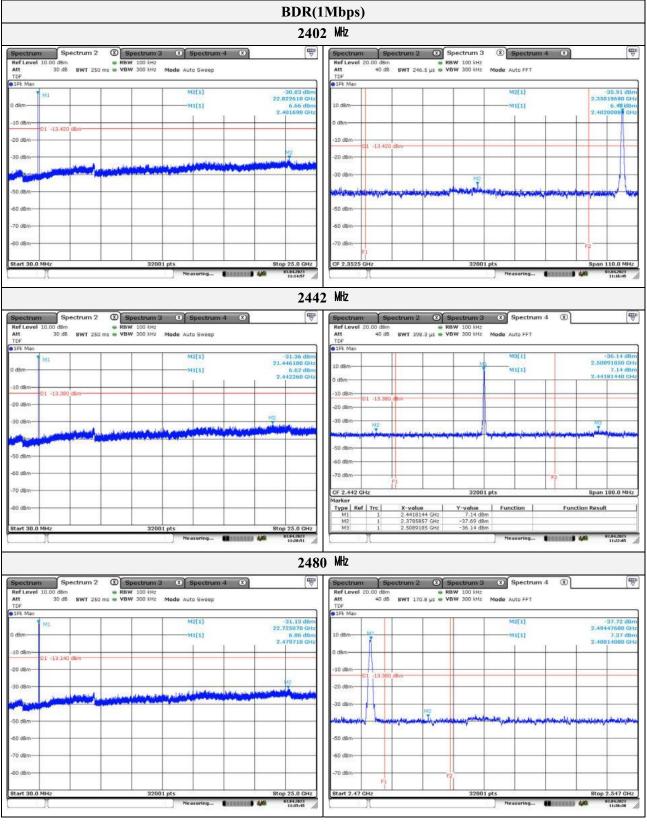
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Test result





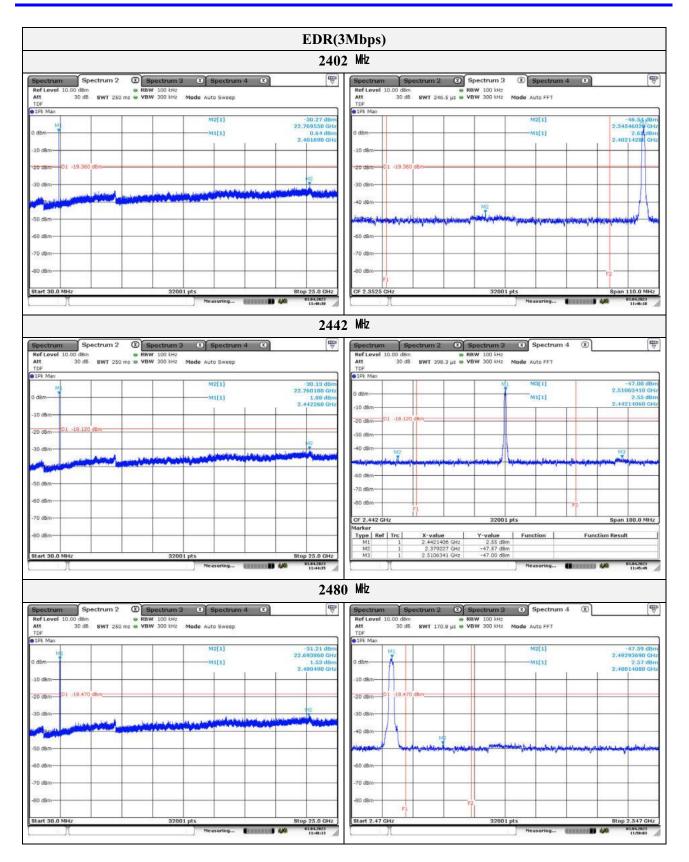
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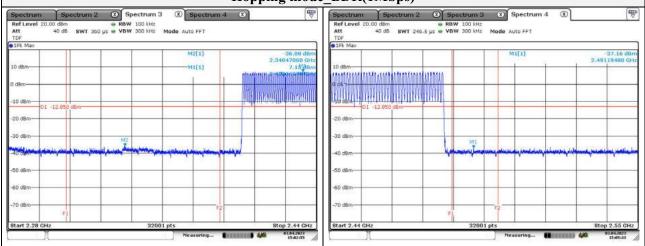
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Hopping mode_BDR(1Mbps)



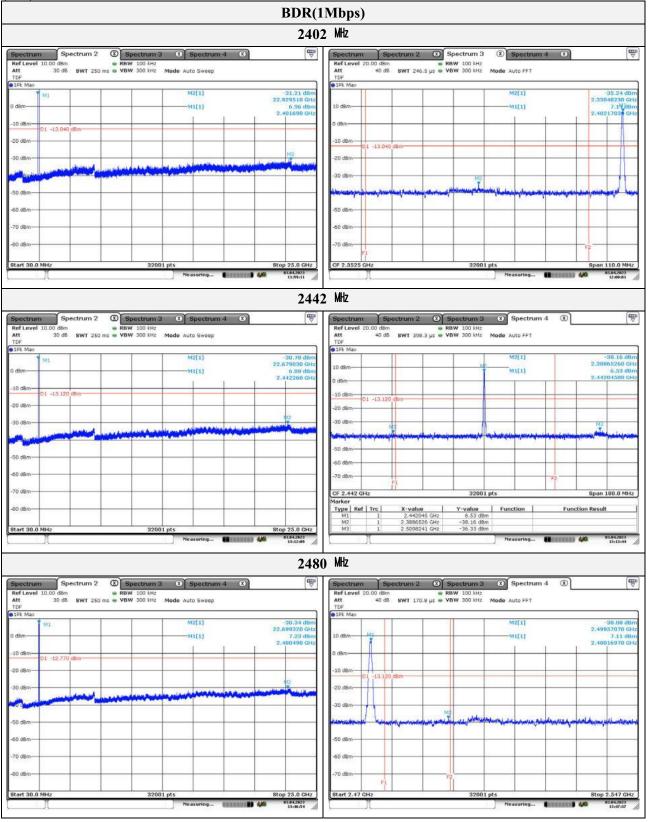
				Hopping	mode	_EDR	k(3Mbps	5)					
TDF		Spectrum 3 BW 100 kHz WBW 300 kHz	Spectrum	4 8	⊴∎	Att TDF	20.00 d8m		Spectrum 3 RBW 100 kHz VBW 300 kHz		Ľ		I I I I I
9 1Pk Max 10 dBm			M2[1] 	2.351 2.432	36.55 dBm 11530 GHz 2.61 dBm 14274LGHz	10 dBm-	ANNA MARANA	Million		M1[1]		-36.7 2.485519)	
-10 dBm	17,390 dBm					-10 dBm	-D1 -17,390 dbm-						
-50 d8m	updus quotu queux	nghurung ^{man} tang ^{ha} ndan pir d	uyunan dalamada ana ana ana ana ana ana ana ana ana			-40 dBm			han the state of the		nanyihiti tangan		V. Selecc
-60 dBm -70 dBm Start 2.28 GHz	FI	32001	pts F2	Stop	2.44 GHz	-60 dBm	GH2		F1 3200	F2		Stop 2.55	5 GHz
			Neasuring	62.000 E 4/4 *	15:09:14	[_)[Neasuring		4/4 63.44.2 15:15	923 3:17 /

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(Left)



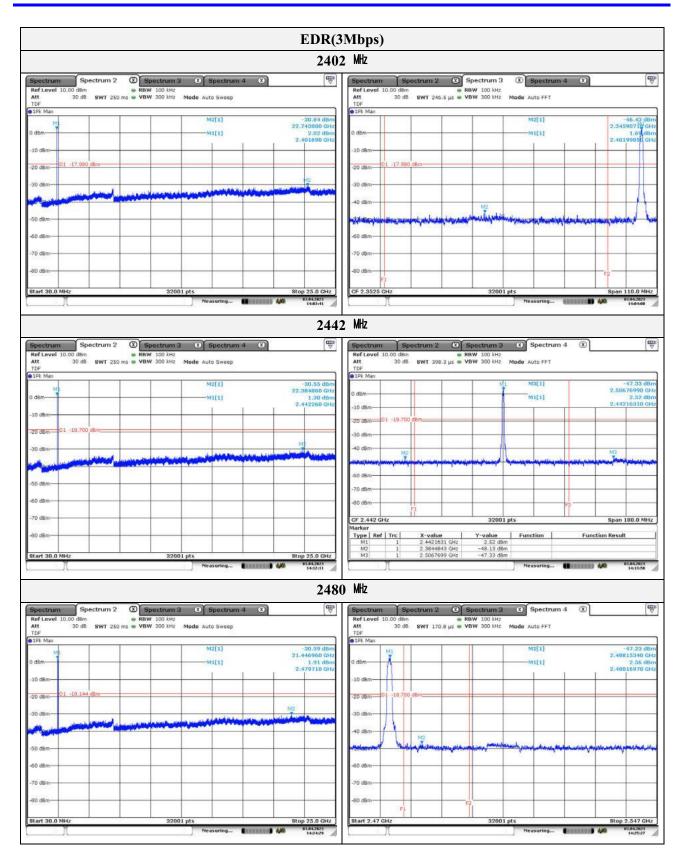
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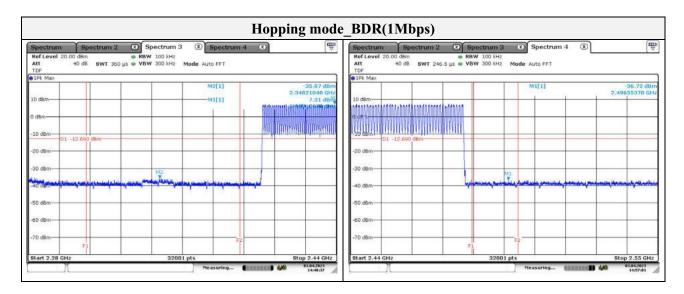


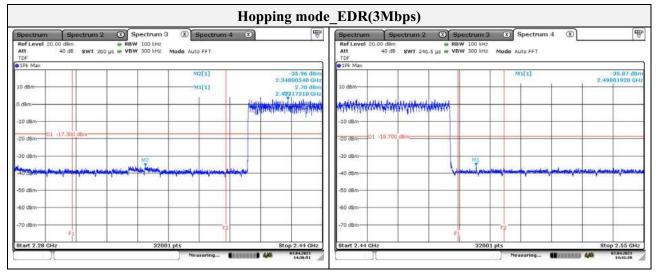
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Equipment	Manufacturer	Model	Serial No.	Calibration interval	Calibration due.
EMI Test Receiver	R&S	ESU26	100552	1 year	2023.08.01
Spectrum Analyzer	R&S	FSV40	101002	1 year	2023.06.17
Spectrum Analyzer	R&S	FSV40	101725	1 year	2023.06.16
ATTENUATOR	KEYSIGHT	8493C	82506	1 year	2024.01.17
Power Meter	Anritsu	ML2495A	1438001	1 year	2024.01.13
Pulse Power Sensor	Anritsu	MA2411B	1339205	1 year	2024.01.13
SIGNAL GENERATOR	KEYSIGHT	N5182B	MY59100115	1 year	2023.04.27
SIGNAL GENERATOR	Anritsu	68369B	002118	1 year	2024.01.14
BAND REJECT FILTER	MICRO-TRONICS	BRM50702	G272	1 year	2024.01.12
Attenuator	KEYSIGHT	-	-	1 year	2024.03.21
Loop Antenna	Schwarzbeck	FMZB1513	1513-257	2 years	2023.03.18
Horn Antenna	A.H	SAS-571	414	1 year	2024.01.16
Horn Antenna	SCHWARZBECK	BBHA9170	BBHA 9170550	1 year	2024.01.16
TRILOG- BROADBAND ANTENNA	VULB9163	Schwarzbeck	714	2 years	2024.04.19
Amplifier	SONOMA INSTRUMENT	310N	186549	1 year	2023.04.21
PREAMPLIFIER	HP	8449B	3008A00538	1 year	2023.06.02
BROADBAND AMPLIFIER	SCHWARZBECK	BBV9721	PS9721-003	1 year	2024.01.16
DC POWER SUPPLY	AGILENT	6632B	MY43004130	1 year	2023.06.17

Appendix A. Measurement equipment

Peripheral devices

Device	Manufacturer	Model No.	Serial No.
Notebook computer	LG Electronics Inc.,	LG15N54	504NZJV027828
Jig board	-	-	-

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