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TEST REPORT

Part 15 Subpart C 15.247

Equipment under testSMART DISPLAYModel nameMC110RJAPEFCC IDBP9-MC110RJAPEApplicantMOTREX CO., LTD.ManufacturerMOTREX CO.,LTD.Date of test(s)2020.03.17 ~ 2020.03.26Date of issue2020.03.31

Issued to MOTREX CO., LTD.

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Test and report completed by :	Report approval by :
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Test engineer	Technical manager



Revision history

Revision	Date of issue	Test report No.	Description
-	2020.03.31	KES-RF-20T0049	Initial



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1. General information

Applicant:	MOTREX CO., LTD.				
Applicant address:	Seoyoung Bldg., 25, Hwangsaeul-ro 258beon-gil,				
	Bundang-gu, Seognam-si, Gyeonggi-do, Korea.				
Test site:	KES Co., Ltd.				
Test site address:	3701, 40, Simin-daero 365beon-gil, Dongan-gu, Anyang-si,				
	Gyeonggi-do, 14057, Korea				
	473-21, Gayeo-ro, Yeoju-si, Gyeonggi-do, Korea				
Test Facility	FCC Accreditation Designatio	n No.: KR0100, Registration No.	: 444148		
FCC rule part(s):	15.247				
FCC ID:	BP9-MC110RJAPE				
Test device serial No.:	Production	Pre-production	Engineering		

1.1. EUT description

Equipment under test	SMART DISPLAY
Frequency range	2 402 MHz ~ 2 480 MHz (BDR/EDR)
Model	MC110RJAPE
Modulation technique	GFSK, $\pi/4$ DQPSK, 8DPSK
Number of channels	79 ch(Non-AFH mode), 20 ch(AFH mode)
Antenna specification	Antenna type : Chip antenna, Peak gain : 0.00 dBi
Power source	DC 12 V

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

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

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



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.

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.

1.2. Test configuration

The <u>MOTREX CO., LTD. MC110RJAPE FCC ID: BP9-MC110RJAPE</u> 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

1.3. Device modifications

N/A

1.4. Frequency/channel operations

Ch.	Frequency (MLz)	Rate(Mbps)
00	2402	1,2,3
39	2441	1,2,3
78	2480	1,2,3

1.5. Accessory information

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

1.6. Software and Firmware description

The software and firmware installed in the EUT is version 200309



1.7. Measurement results explanation example

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).= 0.70 + 10 = 10.70

1.8. Measurement Uncertainty

Test Item		Uncertainty		
Uncertainty for Conduction emission test		2.62 dB		
Uncertainty for Radiation emission test (include Fundamental emission)	9kHz - 30MHz	4.54 dB		
	30MHz - 1GHz	4.36 dB		
	Above 1GHz - 30GHz	5.00 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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2. Summary of t	tests	
Reference	Test description	Test results
15.247(a)(1)	20 dB bandwidth	Pass
15.247(b)(1)	Output power	Pass
15.247(a)(1)	Channel separation	Pass
15.247(a)(1)(iii)	Number of channels	Pass
15.247(a)(1)(iii)	Time of occupancy	Pass
15.205, 15.209	Radiated restricted band and emission	Pass
15.247(d)	Conducted band edge and out of band emissions	Pass



3. Test results

3.1. 20 dB bandwidth

Test procedure

ANSI C63.10-2013 clause 6.9.2 and 6.9.3

Test setup

FUT	Attenuator	Spectrum analyzer
EUT	Attenuator	Spectrum analyzer

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 2.0 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 mode = max hold

Limit

Not applicable

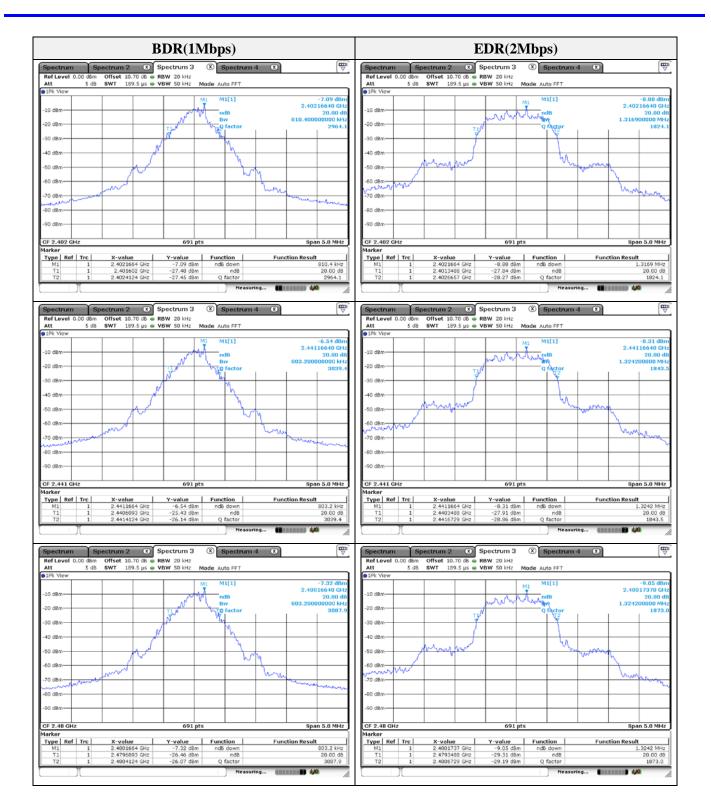


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Test results			-	-
Frequency(Mbz)	Channel no.	Data rate(Mbps)	20 dB bandwidth(Mb)	Occupied bandwidth(Mb)
2 402	00		0.810	0.832
2 441	39	1	0.803	0.832
2 480	78		0.803	0.832
2 402	00		1.317	1.179
2 441	39	2	1.324	1.179
2 480	78		1.324	1.179
2 402	00		1.266	1.179
2 441	39	3	1.266	1.179
2 480	78		1.259	1.179

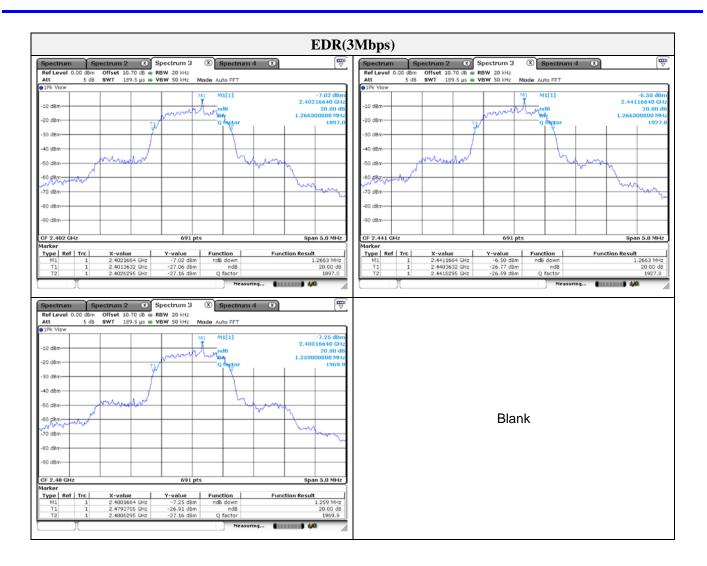


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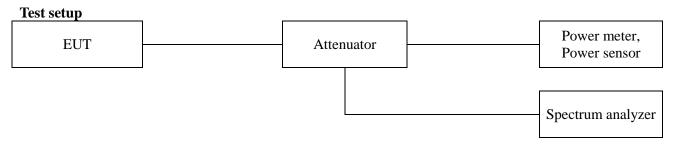




3.2. Output power

Test procedure

ANSI C63.10-2013 - Section 7.8.5



Test setting

- 1. Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
- 2. RBW > the 20 dB bandwidth of the emission being measured
- 3. VBW \geq RBW
- 4. Sweep = Auto
- 5. Detector function = Peak
- 6. Trace = Max hold

Allow trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power, after any corrections for external attenuators and cables. A plot of the test results and setup description shall be included in the test report.

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 Mz employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5 725 ~ 5 805 Mz band: 1 Watt.



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Test results					
Frequency(Mz)	Channel no.	Data rate(Mbps)	Peak Power (dBm)	Average Power (dBm) Note1	Power Limit (dBm)
2 402	00		-4.30	-4.56	20.97
2 441	39	1	-4.10	-4.43	20.97
2 480	78		-4.61	-4.83	20.97
2 402	00		-1.47	-4.20	20.97
2 441	39	2	-1.31	-4.05	20.97
2 480	78		-1.78	-4.41	20.97
2 402	00		-1.01	-4.18	20.97
2 441	39	3	-0.87	-4.01	20.97
2 480	78		-1.36	-4.36	20.97

Note.

1. The average power was tested using an average power meter.



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BDR(1Mbps)	EDR(2Mbps)
Spectrum 2 (8) Spectrum 3 (8) Spectrum 4 (8)	Spectrum 2 (Spectrum 3 (Spectrum 4 (S)
RefLevel 10.00 dBm Offset 10.70 dB	Ref Level 10.00 d8m Offset 10.70 d8 RBW 2 MHz Att 15 d6 SWT 1 ms VBW 2 MHz Mode Auto Sweep
19k View M1[1] -4.30 dBm	IPk View M1[1] -1.47 dBm
0 d8m	0 dBm
10 dBm	-10 dBm
20 dBm	-20 dBm
30 dBm-	-30 dBm
40 dBm	-40 dBm
50 dBm	-50 d8m
60 dBm	-60 dBm
70 dBm-	-70 dBm
60 dBm-	-90 dBm-
CF 2.402 GHz 691 pts Span 5.0 MHz	CF 2.402 GHz 691 pts Span 5.0 MHz
larker	Marker
Type Ref Trc X-value Y-value Function Function Result M1 1 2.4020434 GHz -4.30 dBm	Type Ref Trc X-value Y-value Function Function Result M1 1 2.4021158 GHz -1.47 dBm Function Function </td
Measuring	Measuring
Spectrum Spectrum 2 Spectrum 3 Spectrum 4 Image: Constraint of the sector of t	Spectrum Spectrum 2 Spectrum 3 Spectrum 4 Image: Constraint of the system Im
1Pk View M1[1] -4.10 d8m	1Pk View MI[1] -1.31 dBm
0 dBm	0 d8m M1 2.44092760 GH2
10 dBm	-10 dBm
20 dBm	-20 dBm
30 dBm-	-30 dBm
40 dBm-	-40 dBm
50 dBm	-50 dBm
60 dBm	-60 dBm
70 dBm	-70 dbm
60 dBm-	-80 dBm
2F 2.441 GHz 691 pts Span 5.0 MHz Jarker	CF 2.441 CHz 691 pts Span 5.0 MHz Marker
Type Ref Trc X-value Y-value Function Function Result M1 1 2.4410289 GHz -4.10 dBm	Type Ref Trc X-value Y-value Function Function Result M1 1 2.4409276 GHz -1.31 dBm
Measuring	Measuring
Spectrum 2 3 Spectrum 3 3 Spectrum 4 3	Spectrum Spectrum 2 (S) Spectrum 3 (Spectrum 4 (S)
RefLevel 10.00 d8m Offset 10.70 d8 ⊕ RBW 2 MHz Att 15 dB SWT 1 ms VBW 2 MHz Mode Auto Sweep]PK View	RefLevel 10.00 dBm Offset 10.70 dB ⊕ RBW 2 MHz Att 15 dB SWT 1 ms VBW 2 MHz Mode Auto Sweep © IPk view 0 P View Mode Auto Sweep ●
M1[1] -4.61 d8m 2.48007950 GHz	M1[1] -1.78 dBn
dBm Mi	0 dBm
10 dBm	-10 dBm
20 dBm	-20 dBm
30 dBm-	-30 dBm
40 dBm	-40 dBm
50 dBm	-50 dBm
60 dBm	-60 dBm
70 dBm	-70 dBm
80 dBm	-B0 dBm
CF 2.48 GHz 691 pts Span 5.0 MHz Jarker	CF 2.48 GHz 691 pts Span 5.0 MHz Marker
Type Ref Trc X-value Y-value Function Function Result M1 1 2.4800796 GHz -4.61 dBm -4.61 dBm	Type Ref Trc X-value Y-value Function Function Result M1 1 2.4799132 GHz -1.78 dBm



of Level 10.00 dbm Offset 10.70 db eRBW 2 MHz 15 db SWT 1 ms VBW 2 MHz Note 15 db SWT 1 ms VBW 2 MHz Mode Auto Sweep 0 IPR View	pectrum	Spe	ctrum 2	× s	Spectrum 3		Spectrum 4	4 🗵		Ē	Spectrun	Sp	ectrum 2	× 5	Spectrum 3	× :	Spectrum 4	×		Ē
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den de	1Pk View	12 UD	3971	1 105	YOW 2 MHz	Mode A	uto sweep					15 UB	941	1 005	YOW 2 MH2	MODE A	uto sweep			
dm d						N	41[1]		2.405								1[1]		2 44	-0.87 dB
0 00m 0 <td>dBm</td> <td></td> <td></td> <td></td> <td><u>+</u></td> <td>·</td> <td></td> <td></td> <td>21101</td> <td></td> <td>0 dBm</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>++</td> <td>_</td> <td></td> <td></td>	dBm				<u>+</u>	·			21101		0 dBm						++	_		
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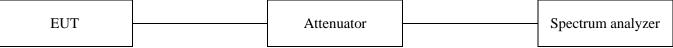


3.3. Carrier frequency separation

Test procedure

ANSI C63.10-2013 - Section 7.8.2

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

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 Mz. 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.



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Test results				
Frequency(Mz)	Channel no.	Data rate(Mbps)	Channel Separation (MHz)	Minimum limit (Mz)
2 441	39	1	0.999	0.535
2 441	39	3	1.001	0.844

	Hopping mo	ode_BD	R(1Mbps))		Hoppin	g mode_	EDR(3N	(Mbps)	
Spectrum Sp	ectrum 2 🔊 Spect	rum 3 💌	Spectrum 4 🔹		Spectrum	Spectrum 2 X	Spectrum 3	Spectrun	14 🕷	Ē
Ref Level 10.70 dBm	Offset 10.70 dB . RBW			(*	Ref Level 10.70	dBm Offset 10.70 dB	BW 30 kHz			(*
Att 20 dB		30 kHz Mode	Auto FFT			0 dB SWT 63.1 µs		Mode Auto FFT		
1Pk View					1Pk View					
			02[1]	-0.11 dB				D2[1]		-0.04 dB
				998.60 kHz						1.00140 MH
0 dBm	Mi	N	41[1]	-5.55 dBm	0 dBm-	M1		M1[1]		-5.39 dBn
-10 dBm			1 ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	2.44116710 GHz	-10 dBm			1		2.44116710 GH
-10 0Bm					-10 08m		mont	mm		- m
-20 dBm	1 m		\sim	m	-20 dBm			~		
-20 0011		$\gamma = - \gamma$	1	\sim	-20 0bin					
-30 dBm		~~~~		\sim	-30 dBm					
									1 1	
-40 dBm					-40 dBm					
									1 1	
-50 dBm					-50 dBm					
									1 1	
-60 dBm					-60 dBm				+	
									1 1	
-70 dBm					-70 dBm-				+ +	
-80 dBm					-80 dBm-					
CF 2.4415 GHz		691 pts		Span 2.0 MHz	CF 2.4415 GHz		691 pt	s		Span 2.0 MHz
Marker					Marker					
Type Ref Trc			ction Fun	ction Result	Type Ref Trc		Y-value	Function	Funct	ion Result
M1 1 D2 M1 1		-0.11 dB			M1 1 D2 M1 1					
	33010 KHS	-0.11.00	-		De MI I	1.0014 MHz	-0.04 08			
			Measuring	· · · · · · · · · · · · · · · · · · ·	L JL			Mease	aring 📲	4,0



3.4. Number of hopping frequency

Test procedure

ANSI C63.10-2013 - Section 7.8.3

Test setup

FUT	Attenuator	Spectrum analyzer
EUT	Attenuator	Speed uni anaryzei

Test setting

- 1. The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:
- 2. Frequency range: 2 400 MHz ~ 2 441.5 MHz, 2 441.5 MHz ~ 2 483.5 MHz
- 3. Span = the frequency band of operation $\frac{1}{2}$
- 4. 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.
- 5. VBW \ge RBW
- 6. Sweep = auto
- 7. Detector function = peak
- 8. Trace = max hold

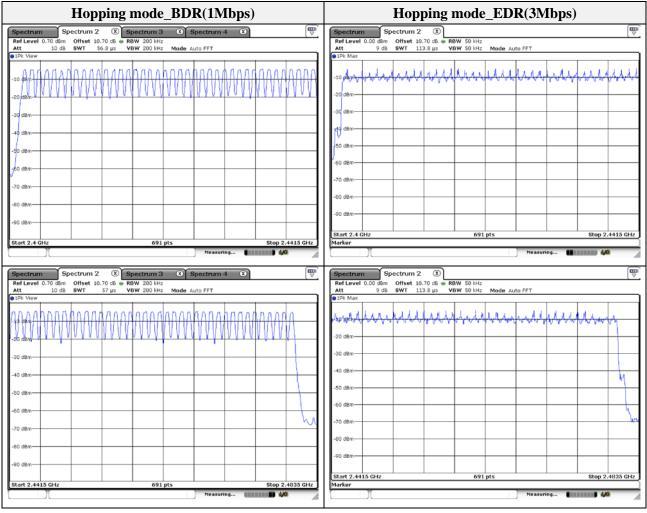
Allow the trace to stabilize. It might prove necessary to break the span up into subranges to show clearly all of the hopping frequencies. Compliance of an EUT with the appropriate regulatory limit shall be determined for the number of hopping channels. A plot of the data shall be included in the test report.

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.



Test results





3.5. Time of occupancy

Test procedure

ANSI C63.10-2013 - Section 7.8.4

Test setup

FUT	Attonuator	Spectrum analyzer
EUT	Attenuator	Spectrum analyzer

Test setting

- 1. The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:
- 2. Span = zero span, centered on a hopping channel
- 4. RBW = shall be \leq channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel.
- 5. VBW = 1 Mz (\geq RBW)
- 6. Sweep = as necessary to capture the entire dwell time per hopping channel
- 7. Detector function = peak
- 8. Trace = max hold

Use the marker-delta function to determine the transmit time per hop. If this value varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation in transmit time.

Limit

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

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

*Adaptive Frequency Hopping

A period time = $0.4(s) \times 20 = 8(s)$

Time of occupancy on the TX channel in 8 sec = time domain slot length \times (hop rate \div number of hop per channel) \times 8



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Test resul	ts					
Pack	et type	Frequency (MHz)	Dwell time (ms)	A period time (s)	Time of occupancy on the Tx channel	Limit for time of occupancy on the Tx channel
DH1	Non-AFH	2441	0.384	31.6	122.88	400
DHI	AFH	2441	0.384	8	61.44	400
DH3	Non-AFH	2441	1.645	31.6	263.20	400
DH3	AFH	2441	1.641	8	131.28	400
DH5	Non-AFH	2441	2.886	31.6	307.84	400
DH3	AFH	2441	2.893	8	154.29	400
2-DH1	Non-AFH	2441	0.390	31.6	124.80	400
2-DH1	AFH	2441	0.390	8	62.40	400
2-DH3	Non-AFH	2441	1.648	31.6	263.68	400
2-DH3	AFH	2441	1.643	8	131.44	400
2-DH5	Non-AFH	2441	2.896	31.6	308.91	400
2-DH3	AFH	2441	2.890	8	154.13	400
3-DH1	Non-AFH	2441	0.390	31.6	124.80	400
3-DH1	AFH	2441	0.390	8	62.40	400
3-DH3	Non-AFH	2441	1.642	31.6	262.72	400
3-003	AFH	2441	1.638	8	131.04	400
3-DH5	Non-AFH	2441	2.900	31.6	309.33	400
3-DU2	AFH	2441	2.890	8	154.13	400

Note:

1.Non-AFH

DH1: Dwell time (ms) × $[(1\ 600 \div 2) \div 79] \times 31.6(s) = 122.88$ (ms) DH3: Dwell time (ms) × $[(1\ 600 \div 4) \div 79] \times 31.6(s) = 263.20$ (ms) DH5: Dwell time (ms) × $[(1\ 600 \div 6) \div 79] \times 31.6(s) = 307.84$ (ms) 2-DH1: Dwell time (ms) × $[(1\ 600 \div 2) \div 79] \times 31.6(s) = 124.80$ (ms) 2-DH3: Dwell time (ms) × $[(1\ 600 \div 4) \div 79] \times 31.6(s) = 263.68$ (ms) 2-DH5: Dwell time (ms) × $[(1\ 600 \div 6) \div 79] \times 31.6(s) = 308.91$ (ms) 3-DH1: Dwell time (ms) × $[(1\ 600 \div 2) \div 79] \times 31.6(s) = 124.80$ (ms) 3-DH1: Dwell time (ms) × $[(1\ 600 \div 2) \div 79] \times 31.6(s) = 124.80$ (ms) 3-DH3: Dwell time (ms) × $[(1\ 600 \div 4) \div 79] \times 31.6(s) = 124.80$ (ms) 3-DH3: Dwell time (ms) × $[(1\ 600 \div 4) \div 79] \times 31.6(s) = 262.72$ (ms) 3-DH5: Dwell time (ms) × $[(1\ 600 \div 6) \div 79] \times 31.6(s) = 309.33$ (ms)

2.AFH

DH1: Dwell time (ms) × $[(800 \div 2) \div 20] \times 8(s) = 61.44$ (ms) DH3: Dwell time (ms) × $[(800 \div 4) \div 20] \times 8(s) = 131.28$ (ms) DH5: Dwell time (ms) × $[(800 \div 6) \div 20] \times 8(s) = 154.29$ (ms) 2-DH1: Dwell time (ms) × $[(800 \div 2) \div 20] \times 8(s) = 62.40$ (ms) 2-DH3: Dwell time (ms) × $[(800 \div 4) \div 20] \times 8(s) = 131.44$ (ms) 2-DH5: Dwell time (ms) × $[(800 \div 6) \div 20] \times 8(s) = 154.13$ (ms) 3-DH1: Dwell time (ms) × $[(800 \div 2) \div 20] \times 8(s) = 62.40$ (ms) 3-DH3: Dwell time (ms) × $[(800 \div 4) \div 20] \times 8(s) = 62.40$ (ms) 3-DH3: Dwell time (ms) × $[(800 \div 4) \div 20] \times 8(s) = 62.40$ (ms) 3-DH3: Dwell time (ms) × $[(800 \div 4) \div 20] \times 8(s) = 131.04$ (ms) 3-DH5: Dwell time (ms) × $[(800 \div 2) \div 20] \times 8(s) = 154.13$ (ms)



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Packet	BDR(1	(Mbps)
type	Non-AFH	AFH
	Spectrum Spectrum 4 Spectrum 2 Image: Constraint of the sector of th	Spectrum Spectrum 3 Spectrum 4 Spectrum 2 Image: Control of the sector of the s
DH1	-10 d8m	-10 dBm -20 dBm -30 dBm -40 dBm -40 dBm -40 dBm -70
	GF 2.41 GHz 691 pts 100.0 µs/ Marker Type Ref Trc X-value Function Function Result M1 1 300.7 µs -6.45 dBm Function Function Result 02 M1 1 300.7 µs -1.09 dB Ready Function Result Spectrum Spectrum 4 Spectrum 2 Spectrum 2 Spectrum	CF 2.441 GHz 691 pts 100.0 µs/ Marker Y-value Function Function Result M1 1 317.39 µs -4.64 dBm -2.40 dB Function Result 02 M1 1 384.06 µs -2.40 dB Ready Function Result Spectrum Spectrum 3 Spectrum 4 Spectrum 2 TTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTT
DH3	Operation Operation <t< td=""><td>Art Operation Oper</td></t<>	Art Operation Oper
DH5	Spectrum Spectrum 3 Spectrum 4 Spectrum 2 Image: Construct a construct	Spectrum Spectrum 3 O Spectrum 4 E Spectrum 2 Image: Control of the second secon

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Packet	EDR(2	2Mbps)
type	Non-AFH	AFH
	Spectrum Spectrum 3 Spectrum 4 Spectrum 2 Tmm Ref Level 20.00 dbm Offset 10.70 db e RBW 1 MHz Spectrum 2 Tmm Tmm Att 25 db e SWT 1 ms VBW 1 MHz Spectrum Tmm	Spectrum Spectrum 3 Spectrum 4 Spectrum 2 Image: Constraint of the sector of t
	10 dBm 02[1] 3.63 dB 10 dBm 389.06 µs 389.06 µs 0 dBm 7.63 dBm 7.63 dBm -10 dBm 1.549.92 Ms/delWeithkohl/2 276.01 µs -10 dBm -1.549.92 Ms/delWeithkohl/2 0	02[1] 0.13 dB 10 dBm 309.06 µs 0 dBm M1[1] -4.69 dBm 320.29 µs -10 dBm - -20 dBm -
DH1	-30 den. -40 den. -40 den. -40 den. -40 den. - 0 den.	-30 den-
	-70 d8m	-70 dBm CF 2.441 GHz 691 pts 100.0 µs/ Marker Type Kef Trc X-value Y-value Function Function Result M 1 320.29 µs -4.69 dBm Function Function
	D2 M1 1 389.86 µs 3.63 d8 Ready	02 M1 1 389.86 µs 0.13 db Ready
	Spectrum Spectrum 4 Spectrum 2 Tmm Ref Level 20.00 dem Offset 10.70 de e RBW 1 MHz Spectrum 2 Tmm Tmm Att 25 dB e SWT 3 ms VBW 1 MHz SGL Tmm Tmm SGL 0.00 dem	Spectrum Spectrum 3 ③ Spectrum 4 ③ Spectrum 2 ○ □ Ref Level 20.00 dem Offset 10.70 dB ← RBW 1 MHz ● Spectrum 2 ③ □ <
	D2[1] 6.74 dB 10 dBm	D2[1] 0.38 dB 10 dBm D2[1] 0.38 dB 10 dBm M1[1] -4.10 dBm 0 dBm M1 - 4.10 dBm 0 dBm M1 - 4.10 dBm
	-10 d8m M1 -20 d8m V	-10 dBm
DH3	-40 dem W W W W W W W W W W W W W W W W W W W	40 dem // // // // ///////////////////////
	-70 dBm	-70 d8m- -70 d8m- CF 2.411 GHz 691 pts 300.0 µs/ Marker
	Type Ref Trc X-value Y-value Function Function M1 1 623.19 µs -16.31 dbm -16	Type Peri Trc X-volue Y-volue Function Function Result M1 1 657.97 µz -4.0 dbm 1
	Spectrum Spectrum 4 Spectrum 2 Image: Constraint of the sector of th	Spectrum Spectrum 3 Spectrum 4 Spectrum 2 Image: Constraint of the sector of th
		IDE Chw D2[1] 1.28 dB 10 dBm 2.00906 ms 2.00906 ms 10 dBm M1[1] -4.08 dBm 0 dBm 10 dBm 431.80 µs
DUE	-10 dem	-10 den
DH5	-40 d8m -50 d8m -60 d8m	-40 dBm
	-70 d8m	-70 dBm
	Type Ref Trc X-value Y-value Function Function Result M1 1 501.45 µs -15.72 dbm 02 M1 2.09565 ms 11.72 db M1 1 2.09565 ms 11.72 db Ready ####################################	Type Ref Trc X-volue Y-volue Function Function Result M1 1 491.69 µs -4.00 dBm 0.00 mm 0.00



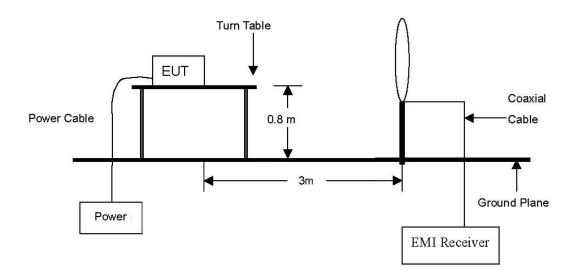
Packet	EDR(3	BMbps)
type	Non-AFH	AFH
	Spectrum Spectrum 4 Spectrum 2 Tmm Ref Level 20.00 d/m Offset 10.70 d/b # RBW 1 MHz Att 25 d/b # SWT 1 ms VBW 1 MHz SGL # BW 1 MHz # BW 1 MHz SGL # BW 1 MHz # BW # BW	Spectrum Spectrum 3 O Spectrum 4 Spectrum 2 Image: Comparison of the sector
	0 dBm 02[1] 10.61 dB 0 dBm M1[1] -14.10 dBm -10 dBm 334.70 µs 334.70 µs -10 dBm -10 dBm -10 dBm -10 dBm	02[1] -1.05 dB 10 dBm 309.06 μs 0 dBm M1[3] -4.22 dBm 324.64 μs -10 dBm -1.95 db -20 dBm -1.95 db
DH1	-30 dBm	-30 dem
	Open CF 2.441 GHz 691 pts 100.0 μs/ Marker Type Ref Trc X-value Function Function Result M1 1 324.70 μs -14.10 dbm Function Function Result M1 1 329.66 μs 10.61 dB Ready Marker	Type Ref Trc X-value Function Function Result M1 1 324,64 μs -4.22 dbm Function Function Result 02 M1 1 369,06 μt -1.05 db Ready W
	Spectrum Spectrum 4 Spectrum 2 T Ref Level 20.00 drm Offset 10.70 dt # RBW 1 MHz Att 25 dB # SWT 3 ms VBW 1 MHz SGL # SK	Spectrum Spectrum 3 Spectrum 4 Spectrum 2 Image: Comparison of the second secon
	۱0 dBm M1(1) -4.38 dBm 10 dBm 739.13 μs 739.13 μs 0 dBm 02[1] 0.66 dB 0 dBm 1.64203 ms 1.64203 ms	D2[1] 0.71 dB 10 dBm 1.62760 ms 10 dBm M1[1] -4.34 dBm 656.52 µs 0 dBm M1
DH3	-10 dBm	-10 dbm
DIIS	-40 c8m	-00 cem
	-70 dBm GF 2.441 GHz 691 pts 300.0 µs/ Marker Type Ref Trc X-value Function Result M1 739.13 µs -4.30 dBm Function Function Result	-70 dBm GF 2.141 GHz Marker Type Ref Trc X-value Function Function Result 1 656.52 µ5 -4.34 dBm Function Function Result 1 656.52 µ5 -4.34 dBm Function Function Result 1 656.52 µ5 -4.34 dBm Function F
	D2 M1 1 1.64203 ms 0.66 dB Ready Ready Ready Ready Spectrum Spectrum 3 O Spectrum 4 Spectrum 2 Image: Comparison of the second sec	D2 M1 1 1.63768 ms 0.71 dB Ref Level Spectrum Spectrum Spectrum Spectrum W Ref Level 20.00 dbm Offset 10.70 db € RBW 1 MHz Spectrum Spectrum W Att 25 db SWT 4 ms VBW 1 MHz Spectrum Spectru
	SGL @1Pk Clav 10 dBm 10 dBm 11 dBm 12 4.05 dBm 13 6dm 14 .05 dBm 14 .05 dBm 15 6dm 16 7.0 m 17 6dm 17 6dm 18 7.0 m 19 7.0 m 19 7.0 m 10 7.0 m 1	SGL © IPk Clrw D2[1] 0.67 dB 2.00906 ms 4.02 dbm M1[1] 4.02 dbm 4.02 d
	0 dBm	0 dem
DH5	-30 dBm	-30 dBm
	-70 dBm CF 2.441 CHz 691 pts 400.0 μs/ Marker Type [Ref Trc X-value Y-value Function Function Result	-70 d8m CF 2.441 GHz 691 pts 400.0 μs/ Marker Type Ref Trc X-value Y-value Function Function Result
	Uppe Inc A-Value F-Value F-value M1 1 6.46-39 µs -4.35 dbm F-value D2 M1 2.9 ms -1.73 db Ready Mathematical Action (Mathematical Actio	Type Res Transmission M1 1 471.01 µs -4.32 dBm D2 M1 1 2.86986 ms 0.67 dB Ready Ready



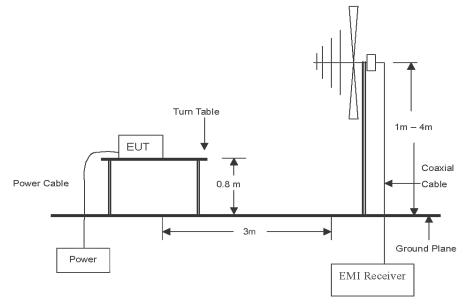
3.6. Radiated restricted band and emissions

Test setup

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

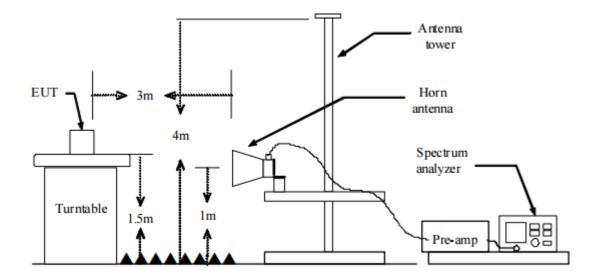


The diagram below shows the test setup that is utilized to make the measurements for emission from 30 Mz to 1 Gz emissions.





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

- 1. The EUT is placed on a turntable, which is 0.8 m (below 1 GHz) and 1.5 m (above 1 GHz) ground plane.
- 2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
- 3. EUT is set 3 m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
- 4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
- 6. Repeat above procedures until the measurements for all frequencies are complete.
- 7. Spectrum analyzer settings for f < 1 GHz:
 - Span = wide enough to fully capture the emission being measured

RBW = 100 kHz $VBW \ge RBW$ Sweep = auto Detector function = quasi peakTrace = max hold

- 8. Spectrum analyzer settings for $f \ge 1$ GHz: Peak
 - Span = wide enough to fully capture the emission being measured

RBW = 1 MHz

 $VBW \ge RBW$

Sweep = auto Detector function = peak

```
Trace = max hold
```

9. Spectrum analyzer settings for $f \ge 1$ GHz: Average

Average value of pulsed emissions.

Unless otherwise specified, when the radiated emission limits are expressed in terms of the average value of the emission and pulsed operation is employed, the average measurement shall determined from the peak field strength after correcting for the worst-case duty cycle as described in 7.5 in ANSI 63.10-2013 & Procedure 9(b) in the KDB 558074 v05r02.

10. Duty Cycle Correction Factor (20 channel hopping in AFH mode)

- a. Time to cycle through all channels = $\Delta t = \tau [ms] \times 20$ channels = 58.00 ms, where $\tau =$ pulse width
- b. 100 ms/ Δt [ms] = H \rightarrow Round up to next highest integer, H =2, where H = number of hops

c. Worst Case Dwell Time = τ [ms] × H = 5.80 ms

- d. Duty Cycle Correction = 20log (Worst Case Dwell Time/ 100ms) dB = -24.73 dB
- 11. Both 2Mbps & 3Mbps data rate were investigated. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.



Note:

- 1. The spectrum is measured from 9 kHz to the 10th harmonic of the fundamental frequency of the transmitter using CISPR quasi peak detector below 1 GHz. Above 1 GHz, average and peak measurements were taken using linearly polarized horn antennas. The worst-case emissions are reported however emissions whose levels were not within 20 dB of the respective limits were not reported.
- 2. The loop antenna was investigated with three polarizations, and horizontal and vertical polarizations were reported as the worst case.
- 3. According to 15.35 (c), as a "duty cycle correction factor", pulse averaging with 20 log(duty cycle) has to be used.

Duty cycle correction factor = $20\log(\text{dwell time}/100 \text{ ms})$

- 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. Average test would be performed if the peak result were greater than the average limit.
- 6. Field strength($dB\mu N/m$) = Level($dB\mu N$) + Correction factors(dB/m) + Cable loss(dB) + or F_d(dB)
- 7. Correction factors(dB/m) = Antenna factor(dB/m) + Cable loss(dB) + or Amp. gain(dB)
- 8. Margin(dB) = Limit(dB μ N/m) Field strength(dB μ N/m)
- 9. The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z, it was determined that \underline{X} orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in \underline{X} orientation.
- 10. The worst-case emissions are reported however emissions whose levels were not within 20 dB of respective limits were not reported.
- 11. 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 test site, adequate comparison measurements were confirmed against 30 m open field test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.
- 12. f < 30 MHz, extrapolation factor of 40 dB/decade of distance. $F_d = 40\log(D_m / D_s)$

 $f \ge 30$ 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



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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 (Mz)	Distance (Meters)	Radiated (µN/m)
0.009 ~ 0.490	300	2 400 / F(kHz)
0.490 ~ 1.705	30	24 000 / F(klz)
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.

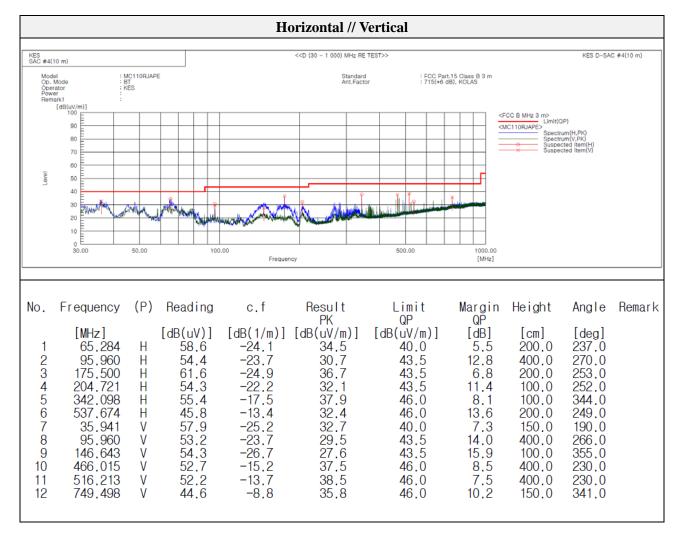


)	
EDR	
3 Mbps	
3 meter	
39(Worst case)	

	Horizontal			Vertical	
KES SAC #4(10 m)	<0 (0.009 - 30) MHz LOOP ANT RE TEST>>	KES D-SAC #4(10 m)	KES SAC #4(10 m)	<0 (0.009 - 30) MHz LOOP ANT RE TEST>>	KES D-SAC #4(10 m)
Model INCTIGNACE Quelos ISS Pores ISS Paral I ISS ISS ISS ISS ISS ISS ISS ISS ISS I		GOC 8 N/C + 30 M/C (1,280) GOC, 8 N/C + 30 M/C + 30 M/C (1,280) GOC, 8 N/C + 30 M/C + 30 M	Nodel ::NC1/RUAPE Co.Note ::ET Coverso ::ES Rest: Rest: [65(0)(0)] 100 000 000 000 000 000 000 000 000 00		df0C \$ kVt - 30 Mtc_15,266 Coci Lim(02) Sapected lim(V) Sapected lim(V) S10.00 [Mtc]
2 0.763 H 2	ading c.f Result Limit PK 0P (uV)] [dB(1/m)] [dB(u/m)] 43.7 19.9 63.6 112.9 77.2 21.2 48.4 70.0 26.4 20.2 46.6 69.5	Margin Height Angle Remark [dB] [dB] [cm] [deg] 49.3 100.0 333.0 21.6 100.0 253.0 22.9 100.0 318.0	[MHz] [dB	ading c.f Pecult Limit M PK OP (uV)] [d8(1/m)] [d8(uV/m)] 42.8 19.8 62.6 117.6 27.9 20.9 48.8 72.1 25.0 20.5 45.5 69.5	argin Height Angle Remark OP [d8] [cm] [deg] 55.0 100.0 50.0 23.3 100.0 325.0 24.0 100.0 27.0



Test results (Below 1 000 版) – Worst case			
Mode:	EDR		
Transfer rate:	3 Mbps		
Distance of measurement:	3 meter		
Channel:	39(Worst case)		





Test results (Above 1 000	MEz)
Mode:	BDR
Transfer rate:	1 Mbps
Distance of measurement:	3 meter
Channel:	00

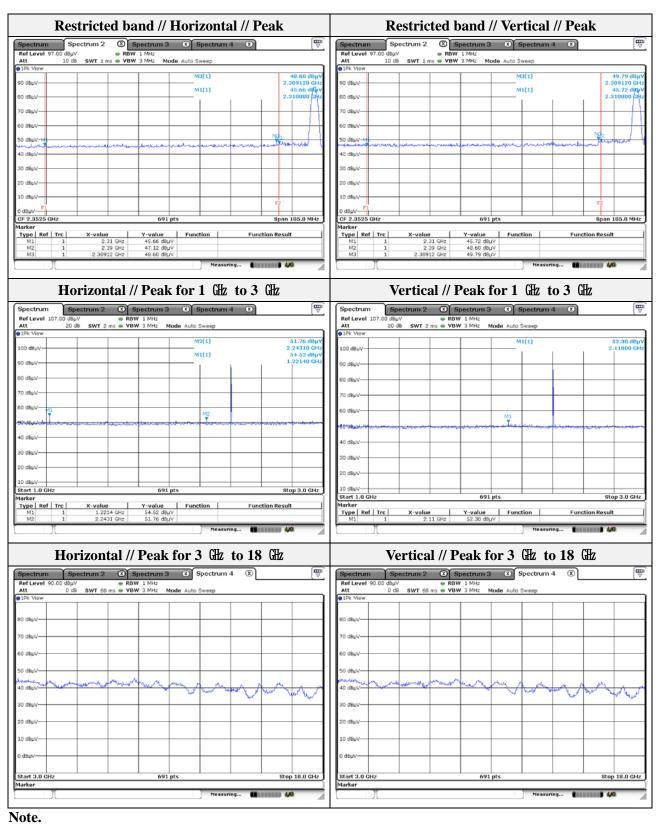
- Spurious

Frequency (Mbz)	Level (dBµN)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBµV/m)	Limit (dBµN/m)	Margin (dB)
1 221.40	54.52	Peak	Н	-5.84	-	48.68	74.00	25.32
2 243.10	51.76	Peak	Н	0.82	-	52.58	74.00	21.42
2 110.00	52.30	Peak	V	1.20	-	53.50	74.00	20.50

Band edge

Frequency (MLz)	Level (dBµN)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBµV/m)	Limit (dBµN/m)	Margin (dB)
2 389.12	48.60	Peak	Н	0.46	-	49.06	74.00	24.94
2 389.12	49.79	Peak	V	0.46	-	50.25	74.00	23.75





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

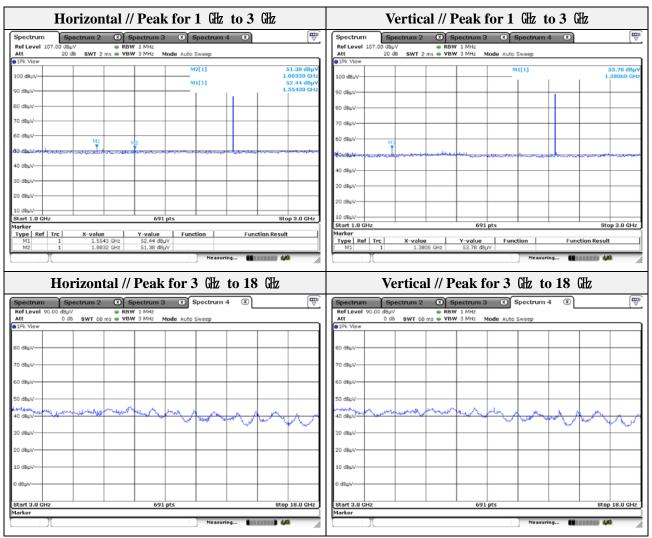
2. No spurious emission were detected above 3 GHz.



Mode:	BDR
Transfer rate:	1 Mbps
Distance of measurement:	3 meter
Channel:	39

Frequency (Mz)	Level (dBµN)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBµV/m)	Limit (dBµN/m)	Margin (dB)
1 554.30	52.44	Peak	Н	-2.16	-	50.28	74.00	23.72
1 803.20	51.38	Peak	Н	2.05	-	53.43	74.00	20.57
1 380.60	53.78	Peak	V	-5.41	-	48.37	74.00	25.63





Note.

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

2. No spurious emission were detected above 3 GHz.



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

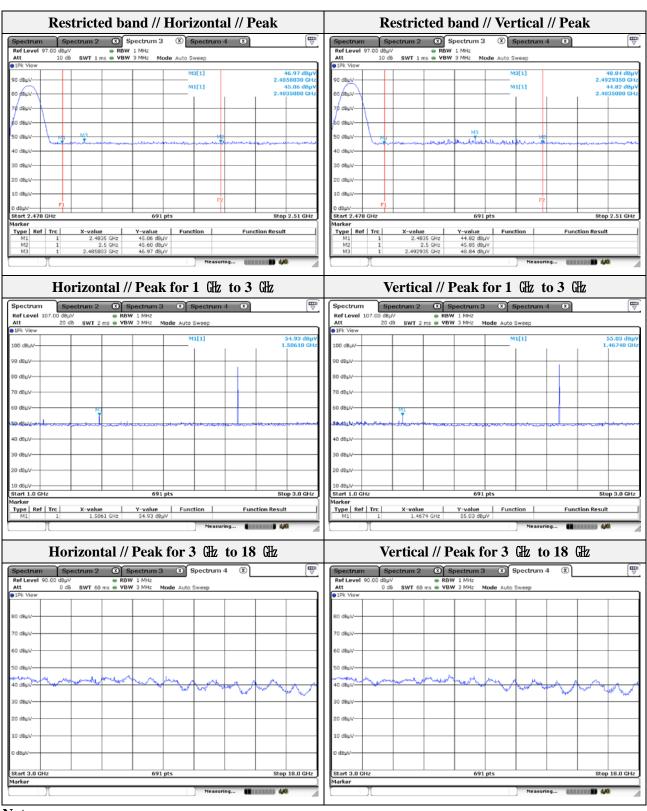
- Spurious

Frequency (Mb)	Level (dBµN)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBµV/m)	Limit (dBµN/m)	Margin (dB)
1 586.10	54.93	Peak	Н	-1.63	-	53.30	74.00	20.70
1 467.40	55.03	Peak	V	-5.22	-	49.81	74.00	24.19

- Band edge

Frequency (Mbz)	Level (dBµN)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBµV/m)	Limit (dBµN/m)	Margin (dB)
2 485.80	46.97	Peak	Н	0.17	-	47.14	74.00	26.86
2 492.94	48.84	Peak	V	0.15	-	48.99	74.00	25.01





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

2. No spurious emission were detected above 3 GHz.



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

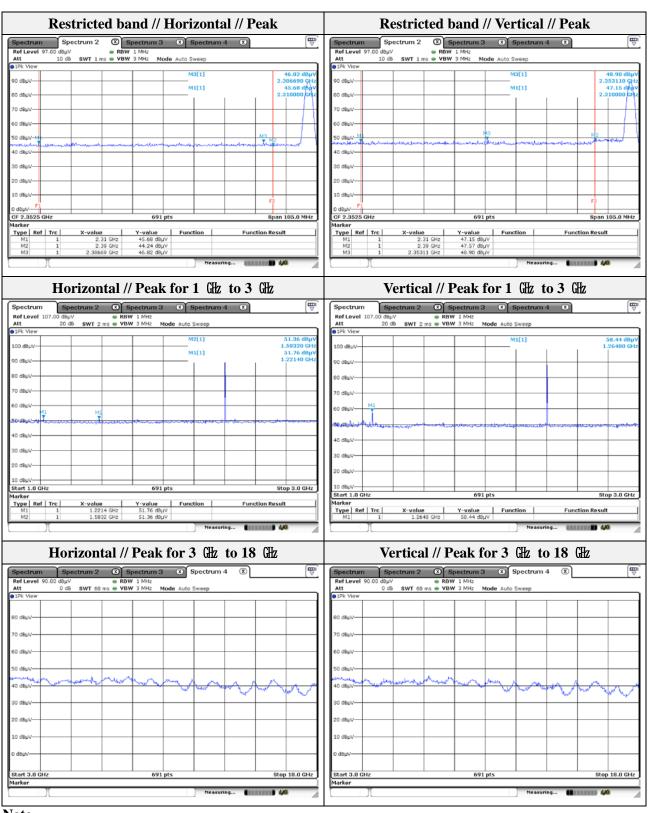
- Spurious

Frequency (MLz)	Level (dBµN)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBµV/m)	Limit (dBµN/m)	Margin (dB)
1 221.40	51.76	Peak	Н	-5.84	-	45.92	74.00	28.08
1 583.20	51.36	Peak	Н	-1.68	-	49.68	74.00	24.32
1 264.80	58.44	Peak	V	-5.73	-	52.71	74.00	21.29

- Band edge

Frequency (Mbz)	Level (dBµN)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBµV/m)	Limit (dBµN/m)	Margin (dB)
2 386.69	46.82	Peak	Н	0.46	-	47.28	74.00	26.72
2 353.11	48.90	Peak	V	0.55	-	49.45	74.00	24.55





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

2. No spurious emission were detected above 3 GHz.



Mode:	EDR
Transfer rate:	3 Mbps(Worst case)
Distance of measurement:	3 meter
Channel:	39

- Spurious

Frequency (MLz)	Level (dBµN)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1 586.10	55.16	Peak	Н	-1.63	-	53.53	74.00	20.47
1 206.90	55.22	Peak	V	-5.88	-	49.34	74.00	24.66



Horizonta	al // Peak for 1 🕀	z to 3 GHz	Ver	tical // Peak for	r 1 GHz to 3	GHz
Spectrum Spectrum 2	Spectrum 3 🛞 Spectrum	n 4 🗶	Spectrum Spectr	rum 2 🛞 Spectrum 3	Spectrum 4 (*	
Ref Level 107.00 dBµV	RBW 1 MHz	•	Ref Level 107.00 dBµV	RBW 1 MHz		
Att 20 dB SWT 2 ms	VBW 3 MHz Mode Auto Sweep		Att 20 dB	SWT 2 ms VBW 3 MHz Mode	Auto Sweep	
	M1[1]	55.16 dBµV			M1[1]	55.22 dBµV
100 dBµV		1.58610 GHz	100 dBµV			1.20690 GHz
90 dBµV			90 dBµV-			
80 dBµV			80 dBµV-			
70 dBµV-			70 dBµV-			
60 dBµV			60 dBµV M1			
SQ dBullot have a start and a start a start a start a start a st			BOLISE MALE AND	And and and a state of the stat		
	prese of the second s					
40 dBµV			40 dBµV			
30 dBµV			30 dBµV			
20 dBµV			20 dBµV			
10 dBµV Start 1.0 GHz	691 pts	Stop 3.0 GHz	10 dBµV Start 1.0 GHz	691 pts		Stop 3.0 GHz
	barbes	SCOP 3.0 GHZ		691 pts		Stop 3.0 GHz
			Marker			
tarker Type Ref Trc X-value	Y-value Function	Function Result	Type Ref Trc X	Value Y-value Sc 22 dBuly	Function F	unction Result
Marker	Hz 55.16 dBµV			Y-value 1.2069 GHz 55.22 dBµV		
Marker Type Ref Trc X-value	Hz 55.16 dBµV		Type Ref Trc X	X-value Y-value 1.2069 GHz 55.22 d8µV		unction Result
tarker Type Ref Trc X-value M1 1 1.58610 Horizonta	I // Peak for 3 GHz	to 18 GHz	Type Ref Trc X M1 1 1 1 1	tical // Peak for	Measuring 1	GHz
Marker Type Ref Trc X-value M1 1 1.5861 C Horizonta Spectrum Spectrum 2 Ref Level 90.00 dByV	Hz 55.16 d8μV Меази	to 18 GHz	Type Ref Trc × M1 1 1 1 1 Vert Spectrum Spectr Ref Level 90.00 dbµV	tical // Peak for	Messuring	GHz
tarker Type Trc X-value M1 1 1.5061 0 HOrizonta Spectrum Spectrum Spectrum 2 Ref Level 90.00 dBµV Att 0 dB SWT 60 ms	S5.16 dBµV Neess Neess Neess Spectrum 3 Spectrum RBW 1 MHz	to 18 GHz	Type Ref Trc × M1 1 1 1 1 Vert Spectrum Spectr Ref Level 90.00 dbµV	1.2009 GHz 55.22 dByv tical // Peak for um 2	Messuring	GHz
Iorkar X-value M1 1 1.5861 0 Horizonta Spectrum 2 Ref Level 90.00 d8µV Att 0 d8 SWT 60 ms IPK View	S5.16 dBµV Neess Neess Neess Spectrum 3 Spectrum RBW 1 MHz	to 18 GHz	Type Ref Trc × M1 1 1 1 Vert Spectrum Spectr Ref Level 90.00 dbµ' Att 0 db s @1Pk View 0 db s 1	1.2009 GHz 55.22 dByv tical // Peak for um 2	Messuring	GHz
offset Trc x-value M1 1 1.5861 0 HOrizonta Spectrum Spectrum 2 Ref Level 90.00 dBµV 0 dB swT 60 ms IPR View IPR View	S5.16 dBµV Neess Neess Neess Spectrum 3 Spectrum RBW 1 MHz	to 18 GHz	Type Ref Trc X M1 1 1 1 Vert1 Spectrum Spectrum Spectrum Ref Level 90.00 d5µ ^V O d5 µ ^S Spectrum	1.2009 GHz 55.22 dByv tical // Peak for um 2	Messuring	GHz
orker INTE x-volue INTE x-volue MIL 1.5061 0 HORIZONTA Spectrum 2 Ref Level 90.00 dBµ ^A D dB swr 60 ms IPk View 0 dBµ ^A 0 0 swr 60 ms	S5.16 dBµV Neess Neess Neess Spectrum 3 Spectrum RBW 1 MHz	to 18 GHz	Type Ref Trc × M1 1 1 1 Vert Spectrum Spectr Ref Level 90.00 dbµ' Att 0 db s @1Pk View 0 db s 1	1.2009 GHz 55.22 dByv tical // Peak for um 2	Messuring	GHz
orker Trc X-volue M1 1 2.5861 0 M1 1 2.5861 0 Horizonta Spectrum Spectrum 2 Ref Lavel 90.00 dbµV 0 db sWT 60 ms 10k View 0 0 dbµV	S5.16 dBµV Neess Neess Neess Spectrum 3 Spectrum RBW 1 MHz	to 18 GHz	Type Ref Trc x M1 1 1 1 Vert Spectr Spectr Ref Level 90.00 dBµV Att 0 dB s 0 dB s 0 91Pk View 0 dB µV 0 0 80 dBµV 70 dBµV 0 0	1.2009 GHz 55.22 dByv tical // Peak for um 2	Messuring	GHz
orker Trc X-volue M1 1 2.5861 0 M1 1 2.5861 0 Horizonta Spectrum Spectrum 2 Ref Lavel 90.00 dbµV 0 db sWT 60 ms 10k View 0 0 dbµV	S5.16 dBµV Neess Neess Neess Spectrum 3 Spectrum RBW 1 MHz	to 18 GHz	Type Ref Trc × M1 1 1 1 Vert1 Spectra Spectra Spectra Ref Level 90.00 dBµV 0 dB s 0 dB s 0 dB s Plk View 0 dB gV 0 dB s 0 dB s 0 dB s	1.2009 GHz 55.22 dByv tical // Peak for um 2	Messuring	GHz
Jarker Trc X-value M1 1 1.5861 0 Horizonta Image: Constraint of the second	S5.16 dBµV Neess Neess Neess Spectrum 3 Spectrum RBW 1 MHz	to 18 GHz	Type Ref Trc x M1 1 1 1 Vert Spectr Spectr Ref Level 90.00 dBµV Att 0 dB s 0 dB s 0 91Pk View 0 dB µV 0 0 80 dBµV 70 dBµV 0 0	1.2009 GHz 55.22 dByv tical // Peak for um 2	Messuring	GHz
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terker Yype Ref Trc X-value M1 1 1.5061 0 Morizonta Boectrum 2 Spectrum 2 Ref Level 90.00 dbµV Att 0 dB SWT 60 ms 91Pk View 0 0 SWT 60 ms 90 dbµV 0 0 SWT 60 ms 910k View 0 0 SWT 60 ms 90 dbµV 0 SWT 60 ms 0 910k View 0 0 SWT 60 ms	S5.16 dBµV Neasi N	to 18 GHz	Type Ref Trc xx M1 1 1 1 Vert Spectrum Spectr Ref Level 90.00 dbµV Att 0 db s 6 91Pk View 0 60 dbµV 60 dbµV 60 dbµV 50 dbµV <td>1.2009 GH2 55.22 dBµV tical // Peak for Um 2 O Spectrum 3 © RBW 1 M42 WT 50 ms © VBW 3 MH2 Mode</td> <td>A GHz to 18 Spectrum 4 Auto Sweep</td> <td>GHz</td>	1.2009 GH2 55.22 dBµV tical // Peak for Um 2 O Spectrum 3 © RBW 1 M42 WT 50 ms © VBW 3 MH2 Mode	A GHz to 18 Spectrum 4 Auto Sweep	GHz
Spectrum	S5.16 dBµV Neasi N	to 18 GHz	Type Ref Trc x M1 1 1 1 Vert Spectrum Spectr Ref Level 90.00 dbµ' Att 0 db s 0 IPk View 0 db s 0 80 dbµ/ 0 s 70 dbµ/ 0 s 50 dbµ/ 50 dbµ/ s	1.2009 GH2 55.22 dBµV tical // Peak for Um 2 O Spectrum 3 © RBW 1 M42 WT 50 ms © VBW 3 MH2 Mode	A GHz to 18 Spectrum 4 Auto Sweep	GHz
Spectrum Spectrum Ref Level 90.00 dbµV db SWT 60 ms PIPL View 0 db SWT 60 ms 0 dbµV db SWT 60 ms 10 dbµV db SWT 60 ms	S5.16 dBµV Neasi N	to 18 GHz	Type Ref Trc xx M1 1 1 1 Vert Spectrum Spectr Ref Level 90.00 dbµV 0 db s 6 1Pk View 0 db s 6 60 dbµV 60 dbµV 60 dbµV 50 dbµV 50 dbµV 10 40 dbµV 30 dbµV 10	1.2009 GH2 55.22 dBµV tical // Peak for Um 2 O Spectrum 3 © RBW 1 M42 WT 50 ms © VBW 3 MH2 Mode	A GHz to 18 Spectrum 4 Auto Sweep	GHz
Spectrum Spectrum Ref Level 90.00 dbµV db SWT 60 ms PIPL View 0 db SWT 60 ms 0 dbµV db SWT 60 ms 10 dbµV db SWT 60 ms	S5.16 dBµV Neasi N	to 18 GHz	Type Ref Trc × M1 1 1 1 Vert1 No Spectrum Spectrum Ref Level 90.00 dBµ ^V Att 0 db s 0 0 5 IPk View 0 db s 0 0 5 5 IPk View 0 0 5 5 5 0 0 0 5 5 5 5 50 dBµ ^V 40 5	1.2009 GH2 55.22 dBµV tical // Peak for Um 2 O Spectrum 3 © RBW 1 M42 WT 50 ms © VBW 3 MH2 Mode	A GHz to 18 Spectrum 4 Auto Sweep	CHz
Spectrum	S5.16 dBµV Neasi N	to 18 GHz	Type Ref Trc xx M1 1 1 1 Vert Spectrum Spectr Ref Level 90.00 dbµV 0 db s 6 1Pk View 0 db s 6 60 dbµV 60 dbµV 60 dbµV 50 dbµV 50 dbµV 10 40 dbµV 30 dbµV 10	1.2009 GH2 55.22 dBµV tical // Peak for Um 2 O Spectrum 3 © RBW 1 M42 WT 50 ms © VBW 3 MH2 Mode	A GHz to 18 Spectrum 4 Auto Sweep	GHz
Varker X-value Trc X-value M1 1 1.5061 0 Horizonta Spectrum Spectrum 2 Ref Level 90.00 dBµV 0 dB SWT 60 ms 1Pk View 0 dB SWT 60 ms 1Pk View 0 dB uV 0 dB uV 20 dBµV 0 dB uV 0 dB uV	S5.16 dBµV Neasi N	to 18 GHz	Type Ref Trc x M1 1 1 1 Vert Spectrum Spectr Ref Level 90.00 dbµ' Att 0 db s #1Pk View 0 db s 9 #0 dbµ' 4 0 db s #0 dbµ' 4 0 db s 50 dbµ' 50 dbµ' 1 #0 dbµ' 4 4 #0 dbµ' 4 4	1.2009 GH2 55.22 dBµV tical // Peak for Um 2 O Spectrum 3 © RBW 1 M42 WT 50 ms © VBW 3 MH2 Mode	A GHz to 18 Spectrum 4 Auto Sweep	GHz
Varker X-value Trc X-value M1 1 1.5061 0 Horizonta Spectrum Spectrum 2 Ref Level 90.00 dBµV 0 dB SWT 60 ms 1Pk View 0 dB SWT 60 ms 1Pk View 0 dB uV 0 dB uV 20 dBµV 0 dB uV 0 dB uV	S5.16 dBµV Neasi N	to 18 GHz	Type Ref Trc xx M1 1 1 1 Vert Spectrum Spectr Ref Level 90.00 dbµV Att 0 db s Ø 1Pk View 0 db s 6 Ø 0 dbµV 60 dbµV 1 Ø 0 dbµV 60 dbµV 1 Ø 0 dbµV 1 1 Ø 0 dbµV 2 0	1.2009 GH2 55.22 dBµV tical // Peak for Um 2 O Spectrum 3 © RBW 1 M42 WT 50 ms © VBW 3 MH2 Mode	A GHz to 18 Spectrum 4 Auto Sweep	GHz
Spectrum Spectrum Ref Level 90.00 dBµV 0 dB SWT 60 ms 1 dBµV 0 dB SWT 60 ms 20 dBµV 0 dB SWT 60 ms 30 dBµV 0 dB SWT 60 ms	S5.16 dBµV Neasi N	to 18 GHz	Type Ref Trc x M1 1 1 1 Vert Spectrum Spectr Ref Level 90.00 dbµ' Att 0 db s #1Pk View 0 db s 9 #0 dbµ' 4 0 db s #0 dbµ' 4 0 db s 50 dbµ' 50 dbµ' 1 #0 dbµ' 4 4 #0 dbµ' 4 4	1.2009 GH2 55.22 dBµV tical // Peak for Um 2 O Spectrum 3 © RBW 1 M42 WT 50 ms © VBW 3 MH2 Mode	A GHz to 18 Spectrum 4 Auto Sweep	GHz
Spectrum Spectrum Ref Level 90.00 dbµV db SWT 60 ms D1Pk View db SWT 60 ms 0 dbµV db SWT 60 ms 10 dbµV dbµV 10 dbµV dbµV 10 dbµV dbµV	SS.16 dBµV Neasi N/Peak for 3 GHz Spectrum RBW 1 MH2 Node Auto Sweep	uring to 18 GHz	Type Ref Trc M1 1 Vert1 Spectrum Spectr Ref Level 90.00 dBµ/ Att 0 dB s PIR View 80 dBµ/ 60 dBµ/ 50 dBµ/ 60 dBµ/ 50 dBµ/ 30 dBµ/ 20 dBµ/ 10 dBµ/ 0 dBµ/ 0 dBµ/	1.2009 GHz 55.22 dBµV tical // Peak for um 2 ① Spectrum 3	Auto Sweep	

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

2. No spurious emission were detected above 3 GHz.



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

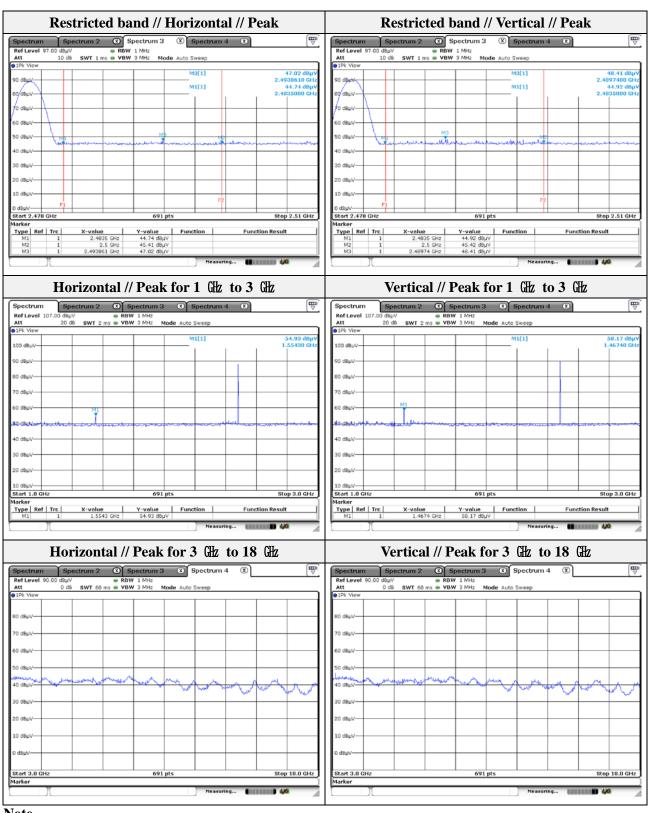
- Spurious

Frequency (MHz)	Level (dBµN)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBµV/m)	Limit (dBµN/m)	Margin (dB)
1 554.30	54.93	Peak	Н	-2.16	-	52.77	74.00	21.23
1 467.40	58.17	Peak	V	-5.22	-	52.95	74.00	21.05

- Band edge

Frequency (Mb)	Level (dBµN)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBµV/m)	Limit (dBµN/m)	Margin (dB)
2 493.86	47.02	Peak	Н	0.14	-	47.16	74.00	26.84
2 489.74	48.41	Peak	V	0.16	-	48.57	74.00	25.43





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

2. No spurious emission were detected above 3 GHz.



Test results (18 Hz to 30 Hz) – Worst case			
Mode:	EDR		
Transfer rate:	3 Mbps		
Distance of measurement:	3 meter		
Channel:	39(Worst case)		

Horizontal	Vertical
Spectrum Spectrum 2 Spectrum 3 Spectrum 4 C C Ref Level 100.00 d8µV ■ RBW 1 MHz ■ RBW 1 MHz ■ Q	Spectrum Spectrum 2 Spectrum 3 Spectrum 4 Image: Comparison of the system of t
90 dkµV 90 dkµV 80 dkµV 90 dkµV 80 dkµV 90 dkµV 70 dkµV 90 dkµV 60 dkµV 90 dkµV 50 dkµV 90 dkµV 30 dkµV 90 dkµV 10 dkµV 90 dkµV	00 dbu/v
Start 18.0 GHz 691 pts Stop 30.0 GHz Marker	Start 18.0 GHz 691 pts Stop 30.0 GHz Marker
Measuring	Measuring

1. No spurious emission were detected above 18 GHz.



3.7. Conducted band edge and out of band emissions

Test procedure

ANSI C63.10-2013 - Section 7.8.6 and 7.8.8

Test setup

EUT			Spectrum analyzer
-----	--	--	-------------------

Test setting

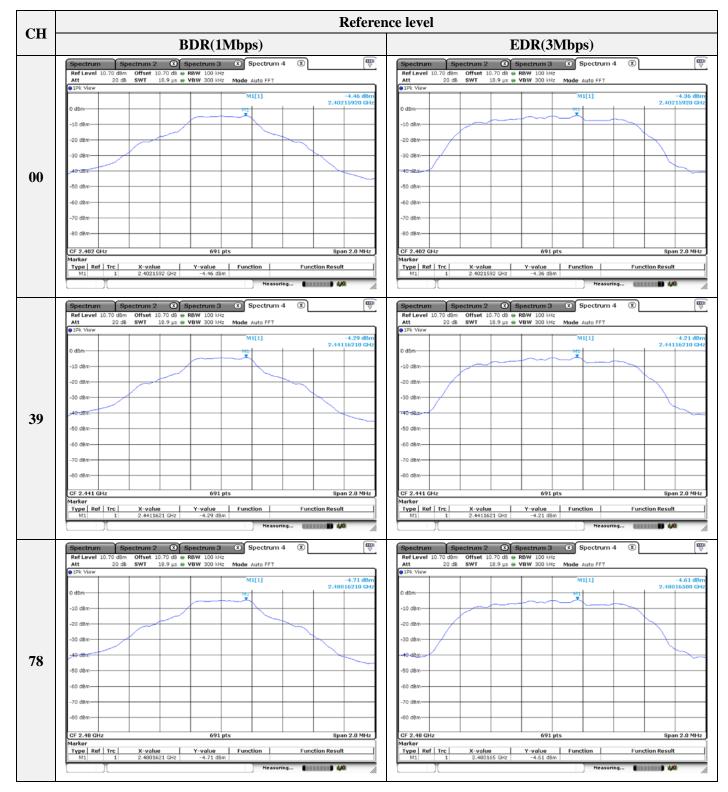
- 1. Span = wide enough to capture the peak level of the in-band emission and all spurious emissions(e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic.
- 2. RBW = 100 kHz
- $3. \text{VBW} \geq 300 \text{ kHz}$
- 4. Detector = Peak
- 5. Number of sweep points $\geq 2 \times \text{Span/RBW}$
- 6. Trace mode = max hold
- 7. Sweep time = auto couple
- 8. 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))

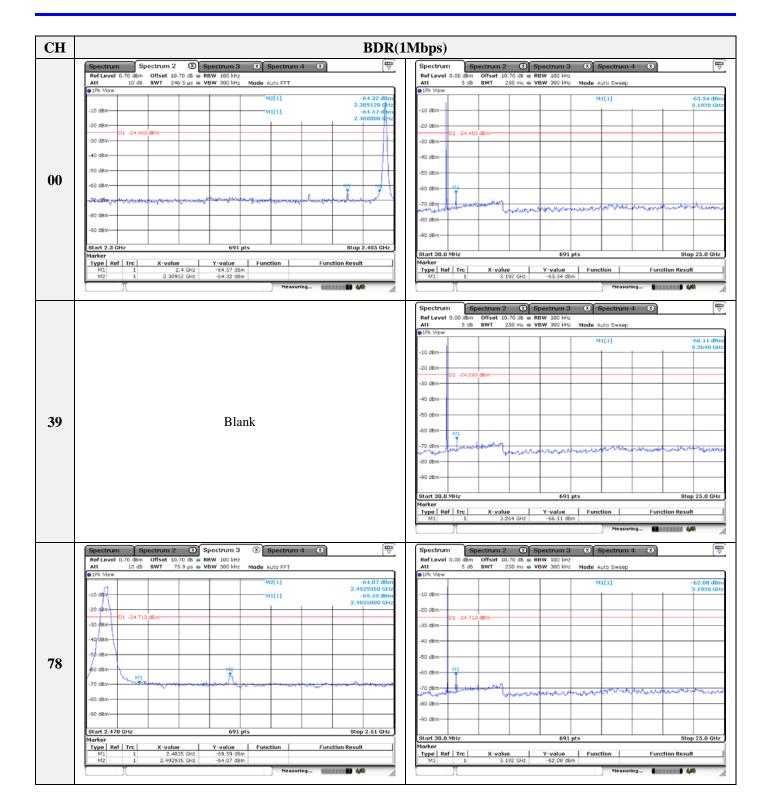


Test results



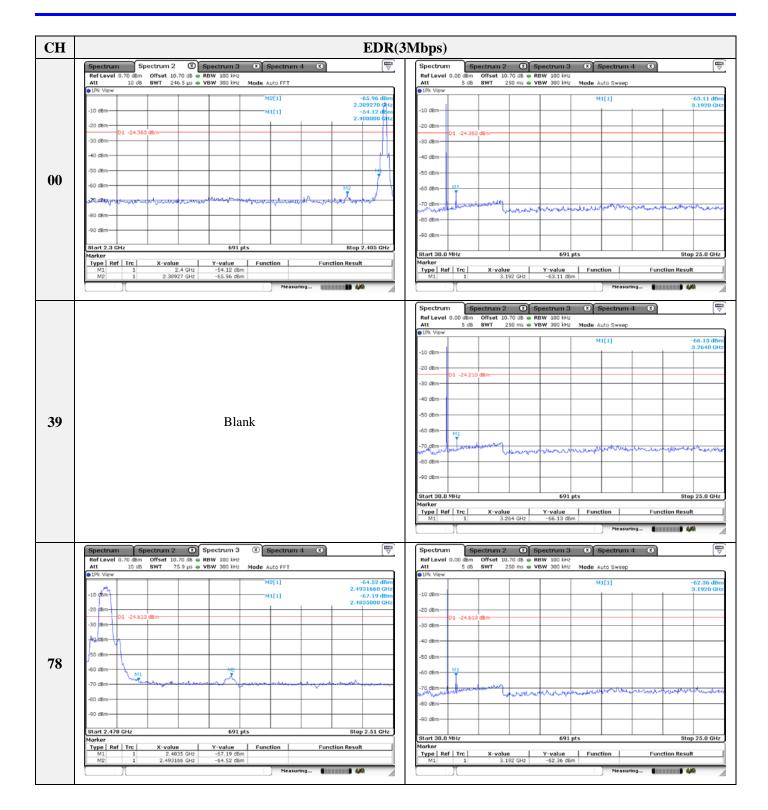


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Hopping mode_BDR(1Mbps)						
Spectrum Spectrum 2 (Spectrum 3 (Spectrum 4 🗴	Spectrum Spectrum 2	Spectrum 3 (Spectrum	n 4 🛞	E
Ref Level 0.70 dBm Offset 10.70 dB - RBW 100 kHz		Ref Level 0.70 dBm Offset 10.70 dB	🖷 RBW 100 kHz			
Att 10 dB SWT 265.5 µs VBW 300 kHz Me	de Auto FFT	Att 10 dB SWT 75.9 µ	5 👄 VBW 300 kHz 🛛 M	ode Auto FFT		
1Pk View		1Pk View				
	M3[1] -64.31 dBm			M3[1]		-65.27 dBm
-10 dBm	1+1#\# #################################	1-18-06- A M			2.	4861110 GHz
-10 0Bm	M1[1] -4/28/498/M	-10,08,07		M1[1]		-4.64 dBm
-20 dBm	United subset in the state of t	-20 dBm			2.	4791740 GHz
-20 Ubin 01 -24,280 dBm		01 -24,640 dBm				
-30 dBm		-30 dBm				
55 50m		So dani				
-40 dBm		-40 dBm				
-50 dBm		-50 dBm				
-60 dBm	MO	-60 dBm				
		A MER A MAR	~^^^			
132.58 mar mar mar gal with the and a state of a state	man a suber with the suber and the suber and the suber and the suber a	-70 dBm	Λ_{a}	montan	mary mary	Annon
-80 dBm		-80 dBm				
-90 dBm		-90 dBm				
Start 2.3 GHz 691 pts	Stop 2.42 GHz	Start 2.476 GHz	691 pts		St	op 2.51 GHz
Marker		Marker				
	Function Function Result	Type Ref Trc X-value	Y-value	Function	Function Res	ult
M1 1 2.4081 GHz -4.28 dBm		M1 1 2.479174 GH	iz -4.64 dBm			
M2 1 2.4 GHz -67.19 dBm		M2 1 2.4835 GF				
M3 1 2.39907 GHz -64.31 dBm		M3 1 2.486111 GF	iz -65.27 dBm			
	Measuring			Measu	uring	100
						1

Spectrum	Spectrum 2 🛛 🕲	Spectrum 3	Spectrum -	4 🙁		Spectrum	S	pectrum 2 🛛 🛞	Spectrum 3	Spectrum	14 🛛	9
Att 10 d			Mode Auto FET			Ref Level (Att).70 dBm 10 dB	Offset 10.70 dB = SWT 75.9 us =	RBW 100 kHz VBW 300 kHz	Mode Auto EET		
1Pk View		10H 300 KH2	Houe Auto PPT			1Pk View	10 00	3411 73.5 µ5 🥌	10H 300 KH2	HOUE AUTOFFT		
			M3[1]		-65.08 dBm	LAN DEMON	м.			M3[1]		-64.80 dB 2.4871450 G
10 dBm-			M1[1]		-4.16 IBm 2.406190 GHz					M1[1]		-4.63 dt 2.4761720 G
20 dBm 01 -24.:	60 dBm						1 -24.63	0 dem			+ +	
0 dBm						-30 dBm					+ +	
10 dBm					1	-40 dBm	М					
50 dBm				h	2	-50 dBm-					+ +	
i0 dBm				A see Tak		-60 dBm	1	Mer much			<u> </u>	
	and and the second s		ىيە ئەلە <mark>رىك</mark> اما قىرىمىيە م ۇرىيە يەمەر.	ududalish		-70 dBm-		And the second of	man cander	*****		~ ***
0 dBm						-80 dBm					+ +	
0 dBm-						-90 dBm					+ + +	
tart 2.3 GHz		691 pts			Stop 2.42 GHz	Start 2.476	GHz		691 pt:	,	· · ·	Stop 2.51 GH
arker						Marker						
ype Ref Trc M1 1 M2 1 M3 1	2.40619 GHz 2.4 GHz 2.39508 GHz	-4.16 dBm -57.70 dBm -65.08 dBm	Function	Functio	n Result	Type Ref M1 M2 M3 M3	1 1	X-value 2.476172 GHz 2.4835 GHz 2.487145 GHz	Y-value -4.63 dBm -69.72 dBm -64.80 dBm	Function	Functio	an Result



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Appendix A. Measurement equipment							
Equipment	Manufacturer	Model	Serial No.	Calibration interval	Calibration due.		
Spectrum Analyzer	R&S	FSV40	101002	1 year	2020.06.24		
8360B Series Swept Signal Generator	HP	83630B	3844A00786	1 year	2021.01.15		
DC Power Supply	Agilent	6632B	US36351824	1 year	2021.01.14		
Power Meter	Anritsu	ML2495A	1438001	1 year	2021.01.14		
Pulse Power Sensor	Anritsu	MA2411B	1339205	1 year	2021.01.14		
Attenuator	KEYSIGHT	8493C	82506	1 year	2021.01.14		
Loop Antenna	Schwarzbeck	FMZB1513	225	2 years	2021.02.15		
Trilog-broadband antenna	SCHWARZBECK	VULB 9163	715	2 years	2020.09.20		
Horn Antenna	A.H	SAS-571	414	2 years	2021.02.11		
Horn Antenna	SCHWARZBECK	BBHA9170	BBHA 9170550	2 years	2021.02.19		
High Pass Filter	Wainwright Instrument Gmbh	WHJS3000- 10TT	1	1 year	2020.06.25		
Preamplifier	R&S	SCU01	100603	1 year	2020.11.25		
Preamplifier	AGILENT	8449B	3008A01742	1 year	2021.01.02		
EMI Test Receiver	R&S	ESU26	100551	1 year	2020.04.09		
EMI TEST RECEIVER	R & S	ESR3	101781	1 year	2020.04.22		
PULSE LIMITER	R & S	ESH3-Z2	101915	1 year	2021.01.02		

Peripheral devices

Device	Manufacturer	Model No.	Serial No.	
Notebook computer	LG Electronics Inc.,	LGS53	306QCZP560949	