

TEST REPORT

Part 15 Subpart C 15.247

Equipment under test CareSens N LINK

Model name GM505LEB

FCC ID OELGM505LEB

Applicant i-SENS Inc.

Manufacturer i-SENS Inc.

Date of test(s) 2012.06.11 ~ 2012.06.18, 2012.07.19

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Test engineer	Technical manager

Test report No.: KES-RF-120054

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Revision history

Revision	Date of issue	Test report No.	Description
-	2012.06.22	KES-RF-120041	Initial
1	2012.07.19	KES-RF-120054	Retest Band Edge Radiated Emissions and add the data and the plots



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1.0 General product description

Equipment under test	CareSense N Link
Model name	GM505LEB
Serial number	N/A
Frequency Range	2 402 MHz ~ 2 480 MHz (Bluetooth BDR & EDR)
Modulation technique	GFSK, $\pi/4$ -DQPSK, 8DPSK
Number of channels	79
Antenna type & gain	Chip antenna / -2.46 dBi
Power source	DC 3 V

1.1 Test frequency

	Low channel	Middle channel	High channel
Frequency (Mz)	2 402	2 441	2 480

1.2 Model differences

N/A

1.3 Device modifications

N/A



1.4 Test facility

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

1.5 Laboratory accreditations and listings

Country	Agency	Scope of accreditation	Certificate No.
USA	FCC	3 & 10 meter Open Area Test Sites and one conducted site to perform FCC Part 15/18 measurements.	343818
KOREA	KC	EMI (10 meter Open Area Test Site and two conducted sites) Radio (3 & 10 meter Open Area Test Sites and one conducted site)	KR0100
Canada	IC	3 & 10 meter Open Area Test Sites and one conducted site	4769B-1



2.0 Summary of tests

Section in FCC Part 15	Parameter	Status
15.247(a)(1)	Frequency separation	С
15.247(a)(1)(iii)	Number of hopping frequency	С
15.247(a)(1)	20 dB bandwidth	С
15.247(a)(1)(iii)	Time of occupancy(Dwell time)	С
15.247(b)(1)	Maximum peak output power	С
15.247(d)	Conducted spurious emission & band edge	С
15.247(d)	Radiated spurious emission & band edge	С
15.247	AC conducted emission	С
Note 1: C=Complies	NC=Not complies NT=Not tested NA=Not applicable	



2.1 Test data

2.1.1 Frequency separation

Test setup



Test procedure

- 1. The EUT must have its hopping function enabled.
- 2. Use the following spectrum analyzer setting
 - Span = 3 M_Z (wide enough to capture the peaks of two adjacent channels)

 $RBW = 30 \text{ kHz} (\geq 1\% \text{ of the span})$

 $VBW = 100 \text{ kHz} (\geq RBW)$

Sweep = auto

Detector function = peak

Trace = max hold

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

Limit

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 kz 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.

The test results in the report only apply to the tested sample.



Test results

Operation mode	Frequency (Mz)	Adjacent hopping channel separation(Mz)	Two-third of 20 dB bandwidth (組z)	Minimum bandwidth (㎞)
GFSK(1Mbps)	2 441	0.998 6	622	25
$\pi/4$ -DQPSK (2Mbps)	2 441	1.002 9	878	25
8DPSK(3Mbps)	2 441	1.007 2	839	25



GFSK



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$\pi/4$ -DQPSK





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2.1.2 Number of hopping frequency

Test setup

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

Test procedure

- 1. The EUT must have its hopping function enabled.
- 2. Use the following spectrum analyzer setting
 - Frequency range: 2 400 MHz ~ 2 441.5 MHz, 2 441.5 MHz ~ 2 483.5 MHz

Span = the frequency band of operation

RBW = 300 kHz ($\geq 1\%$ of the span)

 $VBW = 300 \text{ kHz} (\geq RBW)$

Sweep = auto

Detector function = peak

Trace = max hold

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

Limit

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

Operation mode	Number of Hopping Frequency	Limit
GFSK(1Mbps)	79	≥15
$\pi/4$ -DQPSK(2Mbps)	79	≥15
8DPSK(3Mbps)	79	≥15





2 400 MHz ~ 2 441.5 MHz(GFSK)

2 441.5 MHz ~ 2 483.5 MHz(GFSK)







2 400 MHz ~ 2 441.5 MHz(π/4-DQPSK)

2 441.5 MHz ~ 2 483.5 MHz(π /4-DQPSK)





Att	20 dB	SWT	18.9	IS S VB	W 300 kHz	Mode Au	to FFT			
TEK MIGY										
	VVV	w	VM	7774	12001	www	~~~~	AAAA	~~~~	vvvv
20 dBm			+							
30 dBm			_							
40 dBm			-			0	7			
50 dBm			_							
50 dBm			_							
70 dBm			-							
30 dBm			_							
90 dBm			-			-				
tart 2.4 GH	z				69:	1 pts			Stop 2	.4415 GHz

2 400 MHz ~ 2 441.5 MHz(8DPSK)

2 441.5 MHz ~ 2 483.5 MHz(8DPSK)





2.1.3 20 dB bandwidth

Test setup



Test procedure

- 1. Use the following spectrum analyzer setting
- Center frequency: Lowest, middle and highest channels
- Span = 5 Mz (Approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel)

 $RBW = 10 \text{ kHz} (\geq 1\% \text{ of the span})$

 $VBW = 10 \text{ kHz} (\geq RBW)$

Sweep = auto

Detector function = peak

- Trace = max hold
- 2. The EUT should be transmitting at its maximum data rate. Allow the trance to stabilize.Use the marker-topeak function to set the marker to the peak of the emission. Use the marker-delta function to measure 20 dB down on side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level.

Limit

Not applicable



Test results

Operation mode	Frequency(Mz)	20 dB bandwidth(Mz)
GFSK(1Mbps)	2 402	0.933
	2 441	0.933
	2 480	0.940

Spectrum			
Ref Level 0.93 dBm Att 20 dB	Offset 0.93 dB RBW 10 kH SWT 379.2 µs VBW 10 kH	z z Mode Auto FFT	
1Pk View			
		D1[1]	-1.48 di
-10 dBm		M1[1]	-33.25 dBn
D1 -13.88	0 dBm		2.40155140 GH
-20 dBm	- M	M M	
50 C	101		
-30 dBm	1 Min	May	
	13.880 dBm	IN IN	
-40 dBm-	ľ	N.	
-50 dBm	a P		- Alla
man and the maken	hormen white	1 1	AND W
-60-6Bm			MM M.
		1	with y
-70 dBm-			
-80 dBm			
-90 dBm			
CF 2.402 GHz	69	91 pts	Span 5.0 MHz
		Measuring	13.06.2012 11:27:55

Low channel(GFSK)



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Middle channel(GFSK)







Test results

Operation mode	Frequency(Mb)	20 dB bandwidth(Mz)
	2 402	1.316
π /4-DQPSK(2Mbps)	2 441	1.316
	2 480	1.309

				D	1[1]		1.	0.82 dB 31690 MHz
				M	1[1]		2.401	38.07 dBm 34150 GHz
1 -17.470	dBm			1.1				
		5	when	Mar Mary	4			
	7.470 dBm-	Mal			401			
, wear	manan	wayin			have	harris	AL AL	1 . No
whent						- Mrs.	. And me	WW I
				· · · · · ·				
	-D2 -37		-D2 -37,470 dBm	1 -17.470 dBm- D2 -37.470 dBm-	D2 -37,470 dBm	D2 -37,470 dBm D2 -37,470 dBm MIN MIN MIN MIN MIN MIN MIN MIN	D1[1] M1[1] M1[1] D2 -37,470 dBm M1 M1 M1 M1 M1 M1 M1 M1 M1 M1	D1[1] 1. M1[1] 2.401 2.401 D2 -37,470 dBm 01 D2 -37,470 dBm 01 D1 -17,470 dBm 01 D1

Low channel // π/4-DQPSK



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Spectrum Ref Level 1.09 dBm Offset 1.09 dB 🖷 RBW 10 kHz Att 20 dB SWT 379.2 µs 🖷 VBW 10 kHz Mode Auto FFT r 1Pk Vier D1[1] 1.07 df 1.31690 MH M1[1] -36.66 dBn 2.44034150 GH 10 dB 01 -15.960 www.wh 20 dBr 30 dB -D2 -3 960 dBr 40 dB 50 dB mumb tur A 60 dB In.N 124 phyle 70 dB 80 dB 90 d CF 2.441 GHz 691 pts Span 5.0 MHz Measuring... CONTRACTOR OF STREET, 14.06.2012 12:36:01

Middle channel // π/4-DQPSK

High channel // π/4-DQPSK



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Test results

Operation mode	Frequency(Mz)	20 dB bandwidth(Mz)
	2 402	1.259
8DPSK(3Mbps)	2 441	1.259
	2 480	1.273

Att	15 dB	SWT 3	379.2 µs 🖷 🕻	/BW 10 kHz	Mode Auto	D FFT			
1Pk View			_		D1	[1]			1 47 dF
					01	[+]		1	25900 MH
10 dBm				+	M1	[1]		2.40	-37.63 dBn 135600 GH:
20 d8m	D1 -16.070	0 dBm		1	hal				
20 UBIII				. when had	Win				
30 dBm				No. 0 .	w but	4			
		6.070 dBm	MA	<u> </u>		di l			
40 dBm						1			
-50 dBm				-					
		Ald A	Meland			1		1	h
60 dBm-	A.M.N	A n~DVA n				well	My man	Mer for	holyman
mound	Mw						- VII		
70 dBm									
80 dBm									
90 dBm						-			
PE 2 402 (2147			691	nts			Sna	n 5.0 MHz

Low channel // 8DPSK



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Middle channel // 8DPSK



High channel // 8DPSK



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2.1.4 Time of occupancy (Dwell time)

Test setup

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

Test procedure

1. Use the following spectrum analyzer setting

Center frequency: 2 441 MHz

Span = Zero span, centered on a hopping channel

RBW = 1 MHz

VBW = 1 MHz ($\geq RBW$)

Sweep = as necessary to capture the entire dwell time per hopping channel

Detector function = peak

Trace = max hold

- 2. If possible, use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g., date rate, modulation format, etc.), repeat this test for each variation.
- 3. The Bluetooth has 3 type of payload DH1, DH3, DH5. The hopping rate is 1 600 per second.

Limit

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 31.6 second period.

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

The test results in the report only apply to the tested sample.



Test results

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

Operation mode: GFSK(1Mbps)

Packet type	Frequency (Mz)	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	2 441	0.391	125.12	400
DH3	2 441	1.652	264.32	400
DH5	2 441	2.898	309.12	400

※ Remark:

DH1: Dwell time (ms) × $[(1\ 600 \div 2) \div 79] \times 31.6(s) = 125.12$ (ms) DH3: Dwell time (ms) × $[(1\ 600 \div 4) \div 79] \times 31.6(s) = 264.32$ (ms) DH5: Dwell time (ms) × $[(1\ 600 \div 6) \div 79] \times 31.6(s) = 309.12$ (ms)

> a Spectrum Ref Level 1.07 dBm Offset 1.07 dB . RBW 1 MHz Att 20 dB 🖷 SWT 5 ms 🐵 VBW 1 MHz 1Pk Clm D1[1] 0.09 d M1 D1 391.30 µs M1[1] -7.18 dBn .81159 m 10 dB 20 dB 30 dB 40 dB 50 dB 1. Multilianil WWW William Protection alight WWW. MANAMANNA aller parties O dB 30 d 90 dl 500.0 µs/ CF 2.441 GHz 691 pts 2.06.2012 18:28:51 Ready

Packet type: DH1



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Packet type: DH3





Packet type: DH5

Test report No.: KES-RF-120054



Test results

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

Operation mode: *π*/**4-DQPSK**(2Mbps)

Packet type	Frequency (Mz)	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)
2-DH1	2 441	0.391	125.12	400
2-DH3	2 441	1.645	263.20	400
2-DH5	2 441	2.891	308.37	400

※ Remark:

2-DH1: Dwell time (ms) × $[(1 600 \div 2) \div 79] \times 31.6(s) = 125.12$ (ms) 2 DH2: Dwell time (ms) × $[(1 600 \div 4) \div 70] \times 21.6(s) = 262.20$ (ms)

- 2-DH3: Dwell time (ms) × $[(1\ 600\ \div\ 4)\ \div\ 79]$ × 31.6(s) = 263.20 (ms)
- 2-DH5: Dwell time (ms) × [(1 600 \div 6) \div 79] × 31.6(s) = 308.37 (ms)



Packet type: 2-DH1



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Packet type: 2-DH3







Test report No.: KES-RF-120054



Test results

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

Operation mode: 8DPSK(3Mbps)

Packet type	Frequency (Mz)	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)
3-DH1	2 441	0.398	127.36	400
3-DH3	2 441	1.652	264.32	400
3-DH5	2 441	2.899	309.23	400

※ Remark:

3-DH1: Dwell time (ms) × [(1 600 \div 2) \div 79] × 31.6(s) = 127.36 (ms)

- 3-DH3: Dwell time (ms) × $[(1 600 \div 4) \div 79] \times 31.6(s) = 264.32(ms)$
- 3-DH5: Dwell time (ms) × $[(1 600 \div 6) \div 79] \times 31.6(s) = 309.23$ (ms)



Packet type: 3-DH1



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Packet type: 3-DH3



Packet type: 3-DH5





2.1.5 Maximum peak power output power

Test setup

EUT		Attenuator	Spectrum analyzer
	L		

Test procedure

- 1. Use the following spectrum analyzer setting
 - Center frequency: Lowest, middle and highest channels
 - Span = 5 MHz (Approximately 5 times the 20 dB bandwidth, centered on a hopping channel)
 - RBW = 1 Mz (the 20 dB bandwidth of the emission being measured)

 $VBW = 3 Mz (\geq RBW)$

Sweep = auto

Detector function = peak

Trace = max hold

2. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power.

Limit

According to 15.247(b)(3), for systems using digital modulation in the $902 \sim 928$ Mz, $2400 \sim 2483.5$ Mz, and $5725 \sim 5850$ Mz band: 1 Watt.



Test results

Operation mode	Frequency(Mz)	Output power (dBm)	Limit (dBm)
	2 402	-8.76	30
GFSK(1Mbps)	2 441	-7.18	30
	2 480	-6.30	30

Att	20 dB	SWT	1 ms 👄 🛛	W 3 MHz M	ode Auto Sweep		
1Pk Max			_				
				MI	M1[1]	a a	-8.76 dBn 2.40184080 GH
-10 dBm			/		_		
20 dBm							
-30 dBm							_
40 dBm			_				
50 dBm		-					
60 dBm							
70 dBm			-				
80 dBm						_	
90 dBm						-	
CF 2.402 G	Hz			691 p	ts		Span 5.0 MHz

Low channel // GFSK



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₫ Spectrum Ref Level 1.07 dBm Att 20 dB Mode Auto Sweep 1Pk Max 7.18 dBn M1 2.44084080 GHz 10 dB 20 dB 30 dB 40 dB 50 dBi 60 dB 70 dB -80 dB 90 dB Span 5.0 MHz CF 2.441 GHz 691 pts 2.06.2012 18:40:37 Measuring... **CONTRACTOR**

Middle channel // GFSK





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Test results

Operation mode	Frequency(Mz)	Output power (dBm)	Limit (dBm)
	2 402	-10.62	30
$\pi/4$ -DQPSK(2Mbps)	2 441	-10.05	30
	2 480	-9.40	30

1PK VIEW					10 10 10
			MILI		-10.62 dBn 2 40186250 GH
-10 dBm		M	11	\rightarrow	
-20 dBm					
20.40					~
30 dBm					
40 dBm				_	1 march
and the second se					
-50 dBm				_	
-60 dBm					
-70 dBm	-				
5 1 1 1 2 0 0 0 0 0 1 1 1 1 1					
-80 dBm					
00 dBm					
-90 UDIII					
05.0.400.011-		6	01 ptc		Span 5.0 MHz

Low channel // π/4-DQPSK



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Middle channel // π/4-DQPSK



High channel // π /4-DQPSK





Test results

Operation mode	Frequency(Mz)	Output power (dBm)	Limit (dBm)
	2 402	-10.37	30
8DPSK(3Mbps)	2 441	-8.93	30
	2 480	-8.53	30

Spectrum	97 dBm	Offcot	0 07 d0 @						
Att	20 dB	SWT	1 ms 🖷	VBW 1 MH	Z Mode A	uto Sweep			
1Pk View									
						M1[1]		2,40	-10.37 dBn 198550 GH
-10 dBm			_		MI	-	-		
			-						
-20 dBm		1	-	-					
0.0 10-0	and the second s								
-30 dBm	1							1	
-40 dBm			_				_		
No. Market									1
-50 dBm		-	-	-					-
-60 dBm									
-70 dBm			_						
-80 dBm			-	-			-		-
00.40-									
-90 dBm									
CF 2.402 GH	z				i91 pts			Spa	an 5.0 MHz
	1					teasuring	Constant of the local division of the local	440	13.06.2012

Low channel // 8DPSK



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Middle channel // 8DPSK



High channel // 8DPSK



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2.1.6 Conducted spurious emission & band edge

Test setup



Test procedure for band edge

1. Use the following spectrum analyzer setting

Center frequency: Low, middle and high channel.

Span = wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation. RBW = 100 kHz

 $VBW = 100 \text{ kHz} (\geq RBW)$

Sweep = auto

Detector function = peak

Trace = max hold

2. Allow the trace to stabilize. Set the marker on the emission at the band edge, or on the highest modulation on product outside of the band, if this level is greater than that at the band edge. Enable the marker-delta function, then use the marker-to-peak function to move the marker to the peak of the in-band emission

Test procedure for spurious emission

- 1. Use the following spectrum analyzer setting
- Center frequency: Low, middle and high channel.

Span = wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation.

RBW = 100 kHz

 $VBW = 100 \text{ kHz} (\geq RBW)$ Sweep = auto

Detector function = peak

Trace = max hold

2. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.



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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Middle channel // GFSK







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High channel // GFSK







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Hopping mode // GFSK





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Low channel // π/4-DQPSK







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Middle channel // π/4-DQPSK







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High channel // π/4-DQPSK







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Hopping mode // π /4-DQPSK





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Low channel // 8DPSK







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Middle channel // 8DPSK







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High channel // 8DPSK







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Hopping mode // 8DPSK





2.1.7 Radiated spurious emission & band edge

Test location

Testing was performed at a test distance of 3 meter Open Area Test Site

Test procedures

[9 kHz to 30 MHz]

The EUT was placed on the top of a rotating table 0.8 meter 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. 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 and perpendicular of the antenna are set to make the measurement. 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. The test-receiver system was set to Quasi-peak function and specified bandwidth with maximum hold mode.

The spectrum analyzer is set to:

- 1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer 200 Hz for Quasi-peak detection (QP) at frequency below 9 kHz~150 kHz.
- 2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer 9 kHz for Quasi-peak detection (QP) at frequency below 150 kHz~30 MHz.

[30 MHz to 1 GHz and 1 GHz to 24 GHz]

The height of the measuring antenna was varied between 1 to 4 m and the table was rotated a full revolution in order to obtain maximum values of the electric field intensity.

The measurement was made in both the vertical and horizontal polarization, and the maximum value is presented in the report.

The spectrum analyzer is set to:

- 1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer 120 kHz for Peak detection (PK) or Quasi-peak detection (QP) at frequency below 1 GHz.
- 2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection at frequency above 1 GHz.
- 3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10 Hz for Average detection (AV) at frequency above 1 GHz.



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 GHz to 24 GHz emissions.



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)
$0.009 \sim 0.490$	300	2400 / F(kliz)
0.490 ~ 1.705	30	24000 / F(kHz)
1.705 ~ 30.00	30	30
30 ~ 88	3	100
88~216	3	150
216~960	3	200
Above 960	3	500



Test results (Below 30 Mz)

The frequency spectrum from 9 kHz to 30 MHz was investigated. Emission levels are not reported much lower than the limits by over 20 dB.

Radiated e	emissions	Ant.	C	Correction factor	'S	Total	Lir	nit
Frequency (Mtz)	Reading (dBµV)	Pol.	Ant. factor (dB/m)	Cable loss (dB)	F _d (dB)	Actual (dBµN/m)	Limit (dBµV/m)	Margin (dB)
Below 30	Not detected							

※ Remark

- 1. All spurious emission at channels are almost the same below 30 Mz, so that <u>high channel</u> was chosen at representative in final test.
- 2. Actual = Reading + Ant. factor + Cable loss + F_d
- 3. $F_d = 40 \log(D_m / D_s)$
- Where:

 F_d = Distance factor in dB

- D_m = Measurement distance in meters
- D_s = Specification distance in meters

Test results (Below 1 000 Mz) – Worst case configuration: GFSK

The frequency spectrum from 30 MHz to 1 000 MHz was investigated. Emission levels are not reported much lower than the limits by over 20 dB.

Radiated e	emissions	Ant.	Correctio	on factors	Total	Liı	mit	
Frequency (MHz)	Reading (dBµN)	Pol.	Ant. factor (dB/m)	Cable loss (dB)	Actual (dBµN/m)	ActualLimitdBµN/m)(dBµN/m)		
163.400	22.46	Н	13.03	1.61	37.10	43.50	6.4	
216.700	20.43	Н	10.52	1.81	32.76	46.00	13.24	
393.800	18.23	Н	15.47	2.18	35.88	46.00	10.12	
393.800	17.03	V	15.47	2.18	34.68	46.00	11.32	
561.500	14.85	Б Н 18.96		2.74	36.55	46.00	9.45	

※ Remark

1. All spurious emission at channels are almost the same below 1 GHz, so that <u>high channel</u> was chosen at representative in final test.

2. Actual = Reading + Ant. factor + Cable loss

3. Detector mode: Quasi peak

4. To get a maximum emission level from the EUT, the EUT was moved throughout the XY, XZ and YZ planes.



Test results (Above 1 000 Mz)

Low channel // GFSK (Peak, Horizontal)

Spectru	m	Spectrum	2 🕱						
Ref Lev	el 117.0	O dBµV	•	RBW 1 MHz					
🖷 Att		20 dB SW1	F 1 ms 👄	VBW 1 MHz Mo	ode Auto Sw	еер			
●1Pk View	1								
110 dBµV-					M5[1	1		4 2.39	7 _№ 03 dBµV 90000 GHz
100 dBµV-	-				M1[1	1		10 2.4	7/70 dBµV 31800 GHz
90 dBµV—	-								\mathbb{H}
80 dBµV—	+								+
70 dBµV—									<u> </u>
60 dBµV—						M4		للمح	
50 dBµV+	12	10	at 100	M3			. Me a stra	M. AN	
40 dBµV—	Molecond	resolved by a gain	the model the	myumatharad	wyhanageller	martine i	Anne Can a	~~ v	
30 dBµV—									
20 dBµV—	_								
Start 2.3	GHz			691 pt	s			Stop	2.41 GHz
Marker									
Type R	ef Trc	Stimu	lus	Response	Function	1	Fund	tion Result	1
N1	1	2.4	4018 GHz	107.70 dBµV					
N2	1		2.31 GHz	45.15 dBµV					
N3	1		2.35 GHz	45.55 dBµV					
N4	1	2.37	5172 GHz	49.94 dBµV					
N5	1		2.39 GHz	47.03 dBµV					

Low channel // GFSK (Peak, Vertical)

Spect	rum	2	Spect	rum :	3 ()	<u>.</u>	Spectrum		×						
Ref L	evel	117.00) dBµV		•	RBW	/ 1 MHz								
🗕 Att			20 dB 🚦	SWT 1	. ms 😑	VBV	I MHz ∣	Mod	e Auto	Sweep					
😑 1Pk M	ax														
									Mé	5[1]				50 _M ilj	3 dBµV
110 aBµ	₩ <u></u>												2.3	90	00 GHz
100 dBr	N								MI	l[1]			10	18 (0)	5 dBµ∨
100 40,	·										1		2.4	018	02 GHz
90 dBµ\	/					\rightarrow								+	
															1. 1
80 dBµ\						\rightarrow		-						H -	
70 db. 4	,													V	
70 ubµv	/———														1
60 dBu\	/					\rightarrow							1	<u> </u>	
							142				IVI4	M5	M6 /		5
50 dBut	/ <u>M2</u>	a and	- of the barrents	da ashin a	auder March	ind to a	Mo	and the second second	manunt	-	A Maria	allow and	and		
service .		V.www.	100 miles - 01	NU.					No. Constants						
40 dBμ\			_			-									
30 dBus	<i>i</i>														
30 ubµs	/														
20 dBu\	<i>i</i> —					\rightarrow								<u> </u>	
Start 2	.3 GH	z				t	691	pts					Stop	2.4	1 GHz
Marker															
Type	Ref	Trc	Sti	mulus	.		Response	1	Funct	ion	1	Fun	ction Result		1
N1		1	2	.40180	J2 GHz		108.05 dBL	V							
N2		1		2.3	31 GHz	(46.74 dB	VL							
N3		1		2.3	35 GHz		47.61 dB	VL							
N4		1	2	.37633	31 GHz		52.73 dBp	VL							
N5		1	2	.38570	J2 GHz		52.07 dBp	VL							
N6		1		2.3	39 GHz		50.13 dBp	JV							



High channel // GFSK (Peak, Horizontal)

Spectro	um	SI	pectrum 2	×									
Ref Le	vel :	117.00 di	Вµ∨	- e T	RBW 1 MHz								
🖷 Att		20	dB SWT 1 r	ns 😑 '	VBW 1 MHz	Mod	le Auto	Sweep)				
⊖1Pk Vie	W												
			2.4.1				M	5[1]				5	0.60 dBµV
110 dBµ\	/+-		T			<u> </u>						2.5	06170 GHz
100 10 1			$ \cap $			l I	M	1[1]				10	6.40 dBµV
тоо авру	1								1		ī	2.4	79860 GHz
90 dBuV-						L							
50 GDJ1			1										
80 dBµV-						<u> </u>					_		
						l I							
70 dBµV-	-		M2										
		1	(l I							
60 dBhA-		1			MB	ME							
50 dput/s	45	Sur	~		M4	T							
M. Jonation	war	- Carle	· · · · · · · · · · · · · · · · · · ·	we then	munu	m	ummi	under	want	harbourne	manuskil	while	herenne
40 dBuV-	_					<u> </u>					_		
						l I							
30 dBµV-	_										_		
						l I							
20 dBµV-													
Start 2.4	46 G	Hz			691	pts						Stop	2.55 GHz
Marker]
Type	Ref	Trc	Stimulus		Response		Func	tion		Fu	inction	Result	
N1		1	2.47986	GHz	106.40 dBµ	IV							
N2		1	2.4835	GHz	64.50 dB	14							
N3		1	2.49635	GHZ	51.09 dBj	IA I							
N4 N5		1	2.5	GHZ	48.05 UBL	IA IA							
L 115			2.50017	GHZ	50.00 ubj	I V							

High channel // GFSK (Peak, Vertical)

Chaotrup		Con a atmuna	2	En a atmuna	Ø				
Defieue	1 Z	Spectrum	3 ((V
Att	117.00	20 dB 9WT	1 mc	VBW 1 MHz Mo	de Auto	Gwoor			
10k View		20 00 3441	1 1113		ue Auto	244cet	,		
UTK VIEW			1		M	5[1]			10 14 dBuV
110 dBµV—		141				0[1]		2.5	06172 GHz
		۸.			M	1[1]		10	05.98 dBµV
100 dBµV—								2.4	79863 GHz
		1.5						1	
90 аврv									
80 dBuV-									
00 0000									
70 dBµV		1 102						_	
60 dBµV		1							
-	Ju.	st has		M3 M4 M5					
120 getter the	PUN		morgin	and human human	whennestra	evener	un antendadanta	march and and	mon Musicum
40 dBuV					005-00-00-0 0 -				
10 GDp1									
30 dBµV								_	
20 dBµV									
Start 2.46	GHz			691 pt	5			Stop	2.55 GHz
Marker									
Type Re	f Trc	Stimulu	s	Response	Func	tion	Fur	iction Result	
N1	1	2.4798	63 GHz	105.98 dBµV					
N2	1	2.48	35 GHz	63.56 dBµV					
N3	1	2.4963	ISB GHZ	47.01 dBµV					
N4	1	2 5061	2.5 GHZ	47.50 dBµV					
110	1 1	2.5001		49.14 uBhA			l		



Spectr	um		Spectrum 2	×			<u> </u>		0 /			,		
Ref Le	vel	117.00)dBuV		RBW	1 MHz								(*)
Att			20 dB SWT :	18 s 👄	VBW	10 Hz	Mode	e Auto	Sweep					
●1Pk Vie	W													
								M	5[1]					40.35 dBµV
110 dBµ\	/+												2.5	506170 GHz
100 db.4								M	1[1]					92.20 dBµV
100 ubh/	Ϋ́Τ		M1						1	1		T.	2.4	179860 GHz
90 dBµV-	_		X											
			(Λ)											
80 dBµV-	-													
			1											
70 dBµV-														
60 dBuV-														
00 00 00			12											
50 dBµV-	_													
		~	$\int \cdot \cdot $		N	3	M5							
40 dBµV-	~	F		\sim	1		Ň							
20 db.47							1 -							
30 ubµv-														
20 dBµV-	_													
Start 2.	46 G	Hz				691	pts						Stop	2.55 GHz
Marker														
Туре	Ref	Trc	Stimulu	5		Response		Func	tion		F	unctio	n Result	t
N1		1	2.479	36 GHz		92.20 dB	JV							
N2		1	2.48	35 GHz		50.73 dB	JV							
N3		1	2.496:	35 GHz		37.31 dB	JV L							
N4		1	2 506	17 CH2		35.97 dBj	-0-							
		1	2,500	17 GHZ		40.35 UB	14							

High channel // GFSK (Average, Horizontal)

High channel // GFSK (Average, Vertical)





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Low channel // GFSK

Rad	liated emissions	8	Ant.	Correctio	on factors	Total	Limit		
Frequency (Mb)	Reading (dBµV)	Detector mode	Pol.	Ant. factor (dB/m)	Amp + CL (dB)	Actual (dBµV/m)	Limit (dBµN/m)	Margin (dB)	
2 390.0	47.03	Peak	Н	28.31	-38.88	36.46	74.00	37.54	
2 390.0	50.13	Peak	V	28.31	-38.88	39.56	74.00	34.44	
4 809.0	46.94	Peak	Н	33.92	-33.32	47.54	74.00	26.46	
4 089.0	46.40	Peak	V	33.92	-33.32	47.00	74.00	27.00	

Middle channel // GFSK

Rad	liated emissions	8	Ant.	Correctio	Correction factors		Limit		
Frequency (Mbz)	Reading (dBµN)	Detector mode	Pol.	Ant. factor (dB/m)	Amp + CL (dB)	Actual (dBµV/m)	Limit (dBµN/m)	Margin (dB)	
4 882.0	47.18	Peak	Н	34.16	-31.08	50.26	74.00	23.74	
4 882.0	45.22	Peak	V	34.16	-31.08	48.30	74.00	25.70	

High channel // GFSK

Rad	liated emissions	8	Ant.	Correctio	on factors	Total	Limit		
Frequency (Mz)	Reading (dBµN)	Detector mode	Pol.	Ant. factor (dB/m)	Amp + CL (dB)	Actual (dBµV/m)	Limit (dBµV/m)	Margin (dB)	
2 483.5	64.50	Peak	Н	28.50	-38.73	54.27	74.00	19.73	
2 483.5	50.73	Average	Н	28.50	-38.73	40.50	54.00	13.50	
2 483.5	63.56	Peak	V	28.50	-38.73	53.33	74.00	20.67	
2 483.5	50.61	Average	V	28.50	-38.73	40.38	54.00	13.62	
4 964.0	49.38	Peak	Н	34.43	-30.44	53.37	74.00	20.63	
4 964.0	46.00	Peak	V	34.43	-30.44	49.99	74.00	24.01	

※ Remark

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.

2. Radiated emissions measured in frequency above 1 000 MHz were made with an instrument using peak/average detector mode.

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

4. Actual = Reading + Ant. factor + Amp + CL (Cable loss)

5. To get a maximum emission level from the EUT, the EUT was moved throughout the XY, XZ and YZ planes.



Low channel // π/4-DQPSK (Peak, Horizontal)

Spectr	um	Υ	Spectrum 2	×	1								
Ref Le	vel 1	17.00) dBµV	•	RBW 1 MHz								
Att			20 dB SWT	1 ms 👄	VBW 1 MHz	Mod	le Auto	Sweep					
😑 1Pk Vie	W												
110 dBµ\	/						M	4[1]			5 2.3	52.84 di 76330	Bµ¥ GHz
100 dBµ\							M:	1[1]	,		10 2.4	01800	BµV GHz
90 dBµV-						-						+	
80 dBµV-	-					-						+	-
70 dBµV-	-					-						$ \rightarrow $	1
60 dBµV-						-			M	-	M5 m	/	+
50 dBµV-	M2 Now	undrum	munumun	untrouth	and white with	hum	united	mentor	~~~~~	Martin Marcule	and and a start of		_have
40 dBµV-													_
30 dBµV-	+					\vdash							_
20 dBµV-						-							
Start 2.	3 GH	z			691	pts					Stop	2.41 G	Hz
Marker													
Туре	Ref	Trc	Stimul	us	Response		Funct	ion		Fund	tion Result:		
N1		1	2.4	018 GHz	105.84 dB	μV L							
N2		1	2	.31 GHZ	45.14 dB	-VL							
N4		1	2 37	533 GHz	40.51 UB	uV U							
N5		1	2.31	.39 GHz	50.35 dB	JV							

Low channel // π /4-DQPSK (Peak, Vertical)

Spect	rum	2	Spectru	ım 3 🛛 🕄	Spectrum	×					
Ref L	evel	117.00) dBµV		RBW 1 MHz						
🛛 Att			20 dB SV	VT 1 ms 👄	VBW 1 MHz N	lode Aut	o Sweep	0			
😑 1Pk M	ах										
110 dBj	N-						M6[1]			2.3	i2.53 dBµV 90000 GHz
100 dBj	w+						M1[1]			10 2.4	16 46 dBµV 01802 GHz
90 dBµ\	/										\square
80 dBµ\	/						-				\uparrow
70 dBµ\	/										\vdash
60 dBµ\	/				M3			M ²	M5	M6	L
50 dBu	when	maha	unnulut	menover	manualuntalin	menul	Landor to	"Markey			
40 dBµ\	/										
30 dBµ\	/+						-				
20 dBµ\	/——						_				
Start 2	.3 GH	Iz			691 p	ots				Stop	2.41 GHz
Marker											
Туре	Ref	Trc	Stin	ulus	Response	Fur	iction		Fund	tion Result	
N1		1	2.4	01802 GHz	106.46 dBµ	V					
N2		1		2.31 GHz	47.01 dBµ	V					
N3 N4		1	23	2.35 GHZ 76331 GHz	54.12 dBuy	v V					
N5		1	2.3	85702 GHz	55.19 dBu	V					
N6		1		2.39 GHz	52.53 dBµʻ	V					



₽ Spectrum 2 X Spectrum Ref Level 117.00 dBµV RBW 1 MHz Att 20 dB SWT 1 ms 🖷 VBW 1 MHz Mode Auto Sweep ●1Pk View M5[1] 48.75 dBµ\ 2.506170 GHz 110 dBµV-M1 M1[1] 103.29 dBµ\ 2.479860 GHz 100 dBuV 90 dBµV-80 dBµV 70 dBµV 60 dBµV M4 50 dBull manua Mabiluted A band to the 40 dBµV∙ 30 dBµV 20 dBµV-Start 2.46 GHz 691 pts Stop 2.55 GHz Marker Stimulus 2.47986 GHz 2.4835 GHz 2.49635 GHz 2.5 GHz 2.50617 GHz Type Ref Trc N1 1 Response Function Function Result Response 103.29 dBµV 67.50 dBµV 48.26 dBµV 47.42 dBµV N2 N3 N4 N5 48.75 dBµ∨

High channel // π/4-DQPSK (Peak, Horizontal)

High channel // π /4-DQPSK (Peak, Vertical)

Spectrum	2	Spectrum 3	Spectrum	X			
Ref Level	117.00	dBµV (RBW 1 MHz				×
Att	}	20 dB SWT 1 ms (VBW 1 MHz Mo	de Auto	Sweep		
●1Pk View							
				MS	i[1]		48.65 dBµV
110 dBµV		M1					2.506172 GHz
		X		M1	[1]		102.57 dBµV
100 dBµV							2.479863 GHz
00 dBus/		1 3					
90 abpv							
80 dBuV							
70 dBµV		M2					
60 dBµV							
FO JD AV	N.		M3 M4 M5	8			
www.X.J. Marin	when	term	Were and the heren when	unspeech	man	damento have be season a	where he also a set of a state.
40 dBuV							L. A. Construction of the foreign
10 dbpv							
30 dBµV							
20 dBµV							
Start 2.46 G	Hz		691 pt	5			Stop 2.55 GHz
Marker							
Type Ref	Trc	Stimulus	Response	Funct	ion	Func	tion Result
N1	1	2.479863 GH	2 102.57 dBμV				
N2	1	2.4835 GH:	2 66.65 dBµV				
N3	1	2.496353 GH	2 46.44 dBµV				
N4	1	2.5 GH:	2 46.90 dBµV				
N5	1	2.506172 GH:	2 48.65 dBµV				



Spectrum		Spectr	um 2	×										
Ref Level	117.00) dBµV			RBW	1 MHz								
Att		20 dB	SWT 1	18 s 👄	VBW	10 Hz	Mod	e Auto	Sweep					
●1Pk View														
								N	15[1]					37.01 dBµV
110 dBµV-													2.5	506170 GHz
100 40-14								N	11[1]					87.47 dBµV
													2.4	179860 GHz
an deuv		M1												
20 GDD1		$-\Lambda$												
80 dBuV		-H							-					
70 dBµV														
60 dBµV			MO											
			Y											
50 dBµV														
40 deux		1	1		N	3 M4	M5							
TO ADDA	~		1				~		_					
30 dBuV														
00 00 0														
20 dBµV														
Start 2.46 (GHz					69	1 pts						Stop	2.55 GHz
Marker													i	
Type Ref	Trc	S	timulus	5		Response	.	Fund	tion	1	F	unctio	n Resul	t (
N1	1		2.4798	36 GHz		87.47 d	Вµ∨							
N2	1		2.483	35 GHz		51.89 d	BμV							
N3	1		2.4963	35 GHz		36.61 d	Вµ∨							
N4	1		2	.5 GHz		36.37 d	Вµ∨							
N5	1		2.506:	17 GHz		37.01 d	Вµ∨							

High channel // π/4-DQPSK (Average, Horizontal)

High channel // π /4-DQPSK (Average, Vertical)

Spectrur	n 2	Spe	ctrum	3 ()	0	Spectru	m	×					
Ref Leve	i 117.0	io dBµV			RBW	1 MHz							
Att		20 dB	SWT :	18 s 😑	vвw	10 Hz	Mod	e Auto	Sweep				
●1Pk View													
110 dBµV—								N	15[1]			2.3	36.91 dBµV 506172 GHz
100 dBµV–		_			_		_	N	11[1]	i.	ī	2.4	86.88 dBµV 179863 GHz
90 dBµV—		M1					_						
80 dBµV—		$- \uparrow$											
70 dBµV—							_						
60 dBµV—			M2										
50 dBµV—			<u> </u>										
40 dBµV—	~	4	L		M	3 M4	M5						
30 dBµV—					_								
20 dBµV—													
Start 2.46	GHz	I				69	1 pts					Sto	2.55 GHz
Marker													
Type Re	ef Trc	5	timulu	5		Respons	e	Fund	tion	F	unctio	n Resul	t
N1	1		2.47986	53 GHz		86.88 c	lBμV						
N2	1		2.483	35 GHz		51.28 c	IBµ∨						
N3	1		2.4963	53 GHz		36.49 c	lBμV						
N4	1		2	.5 GHz		36.25 c	Вµ∨						
N5	1		2.5061	72 GHz		36.91 c	BμV						



Low channel // π /4-DQPSK

Rad	liated emissions	5	Ant.	Correctio	on factors	Total	Limit		
Frequency (Mbz)	Reading (dBµN)	Detector mode	Pol.	Ant. factor (dB/m)	Amp + CL (dB)	Actual (dBµV/m)	Limit (dBµV/m)	Margin (dB)	
2 390.0	50.35	Peak	Н	28.31	-38.88	39.78	74.00	34.22	
2 390.0	52.53	Peak	V	28.31	-38.88	41.96	74.00	32.04	
4 809.0	47.49	Peak	Н	33.92	-31.65	49.76	74.00	24.24	
4 089.0	46.05	Peak	V	33.92	-31.65	48.32	74.00	25.68	

Middle channel // π/4-DQPSK

Rad	liated emissions	5	Ant.	Correction factors		Total	Limit		
Frequency (Mz)	Reading (dBµV)	Detector mode	Pol.	Ant. factor (dB/m)	Amp + CL (dB)	Actual (dBµN/m)	Limit (dBµN/m)	Margin (dB)	
4 882.0	48.15	Peak	Н	34.16	-31.08	51.23	74.00	22.77	
4 882.0	46.72	Peak	V	34.16	-31.08	49.80	74.00	24.20	

High channel // π/4-DQPSK

Rad	liated emissions	5	Ant.	Correctio	on factors	Total	Limit		
Frequency (MHz)	Reading (dBµN)	Detector mode	Pol.	Ant. factor (dB/m)	Amp + CL (dB)	Actual (dBµV/m)	Limit (dBµV/m)	Margin (dB)	
2 483.5	67.50	Peak	Н	28.50	-38.73	57.27	74.00	16.73	
2 483.5	51.89	Average	Н	28.50	-38.73	41.66	54.00	12.34	
2 483.5	66.65	Peak	V	28.50	-38.73	56.42	74.00	17.58	
2 483.5	51.28	Average	V	28.50	-38.73	41.05	54.00	12.95	
4 964.0	44.88	Peak	Н	34.43	-30.44	48.87	74.00	25.13	
4 964.0	51.14	Peak	V	34.43	-30.44	55.43	74.00	18.57	

※ Remark

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.

2. Radiated emissions measured in frequency above 1 000 Młz were made with an instrument using peak/average detector mode.

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

4. Actual = Reading + Ant. factor + Amp + CL (Cable loss)

5. To get a maximum emission level from the EUT, the EUT was moved throughout the XY, XZ and YZ planes.



Low channel // 8DPSK (Peak, Horizontal)

Spect	rum	Υ	Spectrum 2	X						
Ref L	evel	117.00	dBµ∨	•	RBW 1 MHz					
Att 🗧			20 dB SWT	1 ms 👄	VBW 1 MHz Mi	ode Auto Swe	зер			
🔵 1Pk Vi	ew									1
110 dBj	iv—					M6[1]			5	0.60 dBµV 90000 GHz
100 dBj	v+					M1[1]			10 2.4	15/81 dBµV 01800 GHz
90 dBµ\	/									\square
80 dBµ\	/									+
70 dBµ\	/									
60 dBµ\	/						M	4 M5		<u> </u>
50 dBµ\	1 M2		monthemarket	manautre	M3	al market	- water	- when we are all	NO AND	L.
40 dBµ\	/									
30 dBµ\	/									
20 dBµ\	/									
Start 2	.3 GH	z			691 pt	5			Stop	2.41 GHz
Marker										
Туре	Ref	Trc	Stimul	us	Response	Function		Fund	tion Result	1
N1		1	2.4	018 GHz	105.81 dBµV					
N2		1	2	.31 GHz	45.86 dBµV					
N3		1	2	.35 GHz	47.54 dBμV					
N4		1	2.37	633 GHz	51.98 dBµV					
N5 N6		1	2.3	857 GHz .39 GHz	52.74 dBµV 50.60 dBuV					
		-	-			1				

Low channel // 8DPSK (Peak, Vertical)

Spect	rum	2	Spectrum	3 (Spectrum	×				
Ref L	evel	117.00) dBµV	-	RBW 1 MHz	•				
Att	_		20 dB SWT	1 ms 👄	VBW 1 MHz Mo	de Auto Swe	ер			
●1Pk Vi	ew									
110 dBi	N					M6[1]				0.28 dBµV
110 00,	.					M1[1]			2.3	90000 GHZ
100 dBµ	JV−			-		milil			2.4	01802 GHz
00 40.4	,					1				1
an nehv	/									
80 dBµ\	/									
70 dBµ\	/									
60 dBuy	/									
00 00 0					1000		NI-	M5	M6 my	1
50 dBµ\	/ <u>M2</u>		- the set for the set of the set	و برای اصل	M3	Jacobaronan	to and the second	manaphen h	mar and a start and a start and a start	76
40 d0.4	,	04.000-1.00	0.00							
40 UBH	<u> </u>									
30 dBµ\	/									
20 dBµ\	/									
Start 2	.3 GH	Z			691 pt:	5			Stop	2.41 GHz
Marker		1 - 1			-					
Туре	Ref	Trc	Stimulu	15	Response	Function	_	Fund	ction Result	
N1 N2		1	2.4018	21 CH2	100.42 dBµV					
N2 N3		1	2	.31 GHz	46.78 dBuV					
N4		1	2,376	331 GHz	53.55 dBuV					
N5		1	2.385	702 GHz	53.16 dBµV					
N6		1	2	.39 GHz	50.28 dBµV					



High channel // 8DPSK (Peak, Horizontal)

Spectrum Spectrum 2 (8)												
Ref L	evel	117.00	dBµ∨	-	RBW 1 MHz							
🗕 Att		2	20 dB SWT 1	. ms 😑	VBW 1 MHz	Moc	le Auto	Sweep	1			
😑 1Pk Vi	e₩											
							M	5[1]				49.13 dBµV
110 dBµ	ıv+−		M1			_	_				2.5	06170 GHz
100 10			X				M	1[1]			1	03.34 dBµV
100 aBt			1						1	r	2.4	79860 GHz
on daux	/											
90 app1	<pre>' </pre>											
80 dBu\	/					_						
l '			IM2									
70 dBµ\	/		-			_						
60 dBµ\	/					_						
to Little a		pw	x L		M3 M4	M5						
ом/авру	and the			-	unt who which	when	whenhav	mun	multun	wanter	muhan	Marmana
40 dBut	,											
10 000												
30 dBu\	/					_						
20 dBµ\	/					_						
Start 2	.46 G	Hz			6	91 pts					Stop	2.55 GHz
Marker												1
Type	Ref	Trc	Stimulus		Respons	e	Func	tion		Funct	ion Result	1
N1		1	2.4798	36 GHz	103.34	dBµV						
N2		1	2.483	35 GHz	68.64	dBµV						
N3		1	2,4963	35 GHz	49.00	dBµV						
N4		1	2	.5 GHz	48.35	звµ∨						
N5		1	2,506:	L7 GHz	49.13	звµ∨ ∣]

High channel // 8DPSK (Peak, Vertical)

Spectrum	2	Spectrum	3 ()	Spectrum	X				
Ref Level	117.00	dBµV	•	RBW 1 MHz					<u> </u>
👄 Att		20 dB SWT	1 ms 👄	VBW 1 MHz	Aode Auto	Sweep	0		
●1Pk View									
					M	5[1]		47.66 0	dBμV
110 dBµV		M1						2.506172	GHz
		*			M	1[1]		102.57 0	dBμV
100 dBµV		\square						2.479863	GHz
00 dBusy		$ \rangle$							
90 ubhv									
80 dBuV									
70 dBµV		- M2							
60 dBµV									
	, pla	\downarrow		M3 M4	45				
SKIBBN YOUR	mil		William	whether the maket	mount	man	white August margine	and an artifice of a the Massive	AMANALA
40 dBuV					113551144455				
10 dbpv									
30 dBuV									
20 dBµV									
Start 2.46 C	Hz			691	pts			Stop 2.55 (GHz
Marker									
Type Ref	Trc	Stimulu	s	Response	Fund	tion	Fun	ction Result	
N1	1	2.4798	63 GHz	102.57 dBµ	V				
N2	1	2.48	35 GHz	66.96 dBµ	¥				
N3	1	2.4963	53 GHz	47.85 dBµ	V				
N4	1	2	2.5 GHz	47.37 dBµ	V				
L N5	1	2.5061	72 GHz	47.66 dBµ	V				



			- 0					<u> </u>		- 0			/		
Spect	rum		Spect	rum 2	×										
Ref L	evel	117.00	dBµ∨		•	RBW	1 MHz								
🗕 Att			20 dB	SWT 1	8 s 👄 '	VBW	10 Hz	Mod	e Auto	s Sweep					
😑 1Pk Vi	e₩														٦
									P	45[1]				36.98 dBj	ı۷
110 dBµ	-V-		_					+	_				2.	506170 GH	Iz
100 db.v/					2.506170 GHz 87.35 dbpV 2.479860 GHz										
100 aBt												r	2.	479860 GH	łz
on deux			M1												
90 UDH	·		17												
80 dBµ\	/							_						_	_
				}											
70 dBµ\	/		_							-					-
60 dBµ\				M2				-							-
50 dBu)	7			4											
50 dbp1	·		1	γ											
40 dBµ\	/	~		7		MB	M4	M5		_					_
~ ~	_	~				-1	_	^~		+				-	<u> </u>
30 dBµ\	/									-					-
20 dBh/															
Start 2	.46 G	Hz					69	1 pts					Sto	p 2.55 GH	2
Marker															_
Туре	Ref	Trc		Stimulus		R	esponse	3	Fun	ction	F	unctio	n Resu	lt	4
N1		1		2,4798	36 GHZ		87.35 d	вич							-1
N2		1		2,483	S GHZ		26 E0 d	SHV BUV							-1
N4		1		2.4903	5 GHz		36.38 d	BUV							-1
N5		1		2,5061	7 GHz		36.98 d	BUV							-1

High channel // 8DPSK (Average, Horizontal)

High channel // 8DPSK (Average, Vertical)

Spect	Spectrum 2 Spectrum 3 3 Spectrum 3													
Ref Le	evel	117.00) dBµV		RBW	1 MHz								`
🖷 Att			20 dB SWT	18 s 👄 '	vвw	10 Hz	Mod	e Auto	Sweep					
🔵 1Pk Vi	ew													
								M	15[1]					36.91 dBµV
110 dBµ	N												2.	506172 GHz
100 dB								M	11[1]					86.83 dBµV
100 000									1	T		T	2.	179863 GHz
90 dBµ∖	/		M1		_		_							
80 dBµ\	/													
Z0 dBut														
/o ubpv	1													
60 dBµ∖	/			-			_					_		
			M2											
50 dBµ\														
40 dBut	,				MB	M4	M5							
10,000.		~					-		-			_		
30 dBµ∖	/						_					_		
20 dBµ\														-
Start 2	.46 G	Hz				69	91 pts						Sto	ρ 2.55 GHz
Marker														
Туре	Ref	Trc	Stimulu	15	R	espons	e	Fund	ction		I	unctio	on Resul	t
N1		1	2.4798	BBB GHZ		86.83 0	вич							
NZ N3		1	2.46	353 GHZ		36 46 0	виV ВиV							
N4		1	2.1500	2.5 GHz		36.29 c	IBµV							
N5		1	2.506:	172 GHz		36.91 c	IBμV							



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Low channel(8DPSK)

Rad	5	Ant.	Correction factors		Total	Liı	mit	
Frequency (Mz)	Reading (dBµV)	Detector mode	Pol.	Ant. factor (dB/m)	Amp + CL (dB)	Actual (dBµN/m)	Limit (dBµN/m)	Margin (dB)
2 390.0	50.60	Peak	Н	28.31	-38.62	40.29	74.00	33.71
2 390.0	50.28	Peak	V	28.31	-38.62	39.97	74.00	34.03
4 809.0	49.67	Peak	Н	33.92	-31.65	51.94	74.00	22.06
4 089.0	36.49	Peak	V	33.92	-31.65	38.76	74.00	35.24

Middle channel(8DPSK)

Radiated emissions			Ant.	Correction factors		Total	Limit	
Frequency (Mtz)	Reading (dBµV)	Detector mode	Pol.	Ant. factor (dB/m)	Amp + CL (dB)	Actual (dBµV/m)	Limit (dBµN/m)	Margin (dB)
4 882.0	47.88	Peak	V	34.16	-31.08	50.96	74.00	23.04
4 882.0	46.17	Peak	V	34.16	-31.08	49.25	74.00	24.75

Hi	igh	channel((8DPSK)	
				_

Rad	liated emissions	5	Ant.	Correctio	Correction factors		Liı	nit
Frequency (Mz)	Reading (dBµV)	Detector mode	Pol.	Ant. factor (dB/m)	Amp + CL (dB)	Actual (dBµN/m)	Limit (dBµV/m)	Margin (dB)
2 483.5	68.64	Peak	Н	28.50	-38.73	58.41	74.00	15.59
2 483.5	51.43	Average	Н	28.50	-38.73	41.20	54.00	12.80
2 483.5	66.96	Peak	V	28.50	-38.73	56.73	74.00	17.27
2 483.5	50.86	Average	V	28.50	-38.73	40.63	54.00	13.37
4 964.0	40.36	Peak	Н	34.43	-30.44	44.35	74.00	29.65
4 964.0	37.87	Peak	V	34.43	-30.44	41.86	74.00	32.14

※ Remark

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.

2. Radiated emissions measured in frequency above 1 000 MHz were made with an instrument using peak/average detector mode.

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

4. Actual = Reading + Ant. factor + Amp + CL (Cable loss)

5. To get a maximum emission level from the EUT, the EUT was moved throughout the XY, XZ and YZ planes.



2.1.8 AC conducted emissions

Frequency range of measurement 150 kHz to 30 MHz

Instrument settings

IF Band Width: 9 kHz

Test procedures

The EUT was placed on a non-metallic table 0.8m above the metallic, grounded floor and 0.4m from the reference ground plane wall. The distance to other metallic surfaces was at least 0.8m. Amplitude measurements were performed with a quasi-peak detector and an average detector.

Limit

According to 15.207(a), for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50uH/50 ohm line impedance stabilization network (LISN). Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequencies ranges.

Encause of Emission (Mg)	Conducted limit (dBµV/m)						
Frequency of Emission (mz)	Quasi-peak	Average					
0.15 - 0.50	66 - 56*	56 - 46*					
0.50 - 5.00	56	46					
5.00 - 30.0	60	50					

※ Remark

Decreases with the logarithm of the frequency.



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Frequency	QP Level	QP Limit	QP Delta
MHz	dBuV	dBuV	dB
0.198	49.76	63.69	13.93
0.3	41.58	60.24	18.66
0.45	50.95	56.88	5.93
0.501	46.12	56.00	9.88
0.549	43.44	56.00	12.56
0.948	40.50	56.00	15.50
13.791	44.25	60.00	15.75
21.351	46.31	60.00	13.69
23.979	44.60	60.00	15.40
Frequency	AV Level	AV Limit	AV Delta
MHz	dBuV	dBuV	dB
0.198	36.06	53.69	17.63
0.3	31.67	50.24	18.57
0.45	42.15	46.88	4.73
0.501	36.94	46.00	9.06
0.549	33.05	46.00	12.95
0.948	28.31	46.00	17.69
13.791	29.18	50.00	20.82
21.351	35.50	50.00	14.50
23.979	34.71	50.00	15.29

Test report No.: KES-RF-120054

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Appendix A. Test equipment used for test

Equipment	Manufacturer	Model	Calibration due.
Spectrum Analyzer	R&S	FSV30	2013.01.10
Vector Signal Generator	R&S	SMBV2100A	2013.01.10
DC Power Supply	HP	6674A	2012.12.05
Loop Antenna	R&S	HFH2-Z2.335.4711.52	2013.03.10
Trilog-Broadband Antenna	SCHWARZBECK	VULB 9168	2013.10.25
Horn Antenna	A.H. System	SAS-571	2013.03.22
High Pass Filter	Wainwright Instrument	WHJS3000-10TT	2013.01.10
Preamplifier	A.H. System	PAM-0118	2013.05.04
EMC Analyzer	Agilent	E7405A	2012.08.22
EMI Test Receiver	LIG Nex1	ISA-80	2012.08.05
LISN	R&S	ENV216	2013.02.27

Peripheral devices

Device	Manufacturer	Model No.	Serial No.
Netbook	Lenovo	S10-2	2957N5K

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Appendix B. Test setup photo

Radiated field emissions

