

Test Report



INTENTIONAL RADIATOR TESTS ACCORDING TO FCC PART 15 C and INDUSTRY CANADA REQUIREMENTS

Bluegiga Technologies Oy

RSS-210, Issue 8, 2010 RSS-GEN Issue 3, 2010

Equipment Under Test: Bluetooth Low Energy Module

Model: BLE121LR-A-M256K

Type:

Manufacturer:

Customer:

Bluegiga Technologies Oy PO. BOX 120 FI-02631 ESPOO **FINLAND** 15.247: 2013

PO. BOX 120 FI-02631 ESPOO

FINLAND

FCC Rule Part: IC Rule Part:

Date:

Issued by:

26.5.2014

Niko Kotsalo **Test Engineer**

Checked by:

Date:

26.5.2014

Jari Merikari **Technical Manager**

These test results are valid for the tested unit only. This report shall not be reproduced, except in full, without a written permission of SGS Fimko.



PRODUCT DESCRIPTION	3
Equipment Under Test (EUT)	3
Description of the EUT	3
Ratings and declarations	3
Power Supply	3
Mechanical Size of the EUT	3
Samples	4
GENERAL REMARKS	5
Disclaimer	5
SUMMARY OF TESTING	6
EUT Test Conditions During Testing	6
TEST RESULTS	7
Maximum Peak Conducted Output Power	7
Transmitter Radiated Spurious Emissions 30 – 1000 MHz	10
Transmitter Radiated Spurious Emissions 1 000 – 26 500 MHz	14
Transmitter Band Edge Measurement and Conducted Spurious Emissions	25
6 dB Bandwidth of the Channel	33
Power Spectral Density	36
99% Occupied Bandwidth	39
LIST OF TEST EQUIPMENTS	42



Equipment Under Test (EUT)

Bluetooth Low Energy ModuleModel:BLE121LR-A-M256KType:-Serial no:-HW version:-SW version:-FCC ID:QOQBLE121LRIC:5123A-BGTBLE121LR

Description of the EUT

The EUT is a Bluetooth Low Energy single mode module targeted for low power accessories. Device can be used with batteries or from DC power supply.

Classification of the device

Fixed device	
Mobile Device (Human body distance > 20cm)	\boxtimes
Portable Device (Human body distance < 20cm)	

Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing

Ratings and declarations

Operating Frequency Range (OFR):	2402 – 2480 MHz
Channels:	40
Channel separation:	2 MHz
Channel bandwidth:	1.099855282 MHz
Effective conducted power:	8.32 dBm
Transmission technique:	Digital Transmission
Modulation:	GFSK
Integral Antenna gain:	0 dBi

Power Supply

Operating voltage range 2.0 – 3.6 VDC

Mechanical Size of the EUT

Height: 1.8 mm Width: 13.0 mm	Depth: 14.7 mm
-------------------------------	----------------



Samples

Two samples were used in the tests. One normal sample with integral antenna for radiated emissions and one sample with antenna removed and replaced with coaxial cable with SMA-connector for conducted RF tests. During the tests the EUT was set into continuous transmit and hopping was stopped into the channel under test. Normal test modulation and maximum transmit power was used in all tests. No modifications were done during the tests.



Disclaimer

This document is issued by the Company under its General Conditions of service accessible at <u>http://www.sgs.com/terms and conditions.htm.</u> attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein.

Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only. This document cannot be reproduced except in full, without prior approval of the Company.

SUMMARY OF TESTING

Test Specification	Description of Test	Result
§15.247(b)(3) / RSS-210 A8.4	Maximum Peak Conducted Output Power	PASS
§15.247(a)(2) / RSS-210 A8.2	6 dB Bandwidth	PASS
§15.247(e) / RSS-210 A8.2	Power Spectral Density	PASS
RSS-GEN 4.6.1	99% Occupied Bandwidth	PASS
§15.247(d) / RSS-210 A8.5	100 kHz Bandwidth of Frequency Band Edges and Conducted Spurious Emissions	PASS
§15.209(a), §15.247(d) / RSS-210 A8.5	Radiated Emissions Within The Restricted Bands	PASS
§15.109 / RSS-GEN 7.2.3.2	Unintentional Radiated Emissions	PASS

EUT Test Conditions During Testing

The EUT was in continuous transmit mode during all the tests. The hopping was stopped and the EUT was configured into the wanted channel. Normal modulation and duty cycle was applied in all the tests. Duty cycle of the EUT was measured and it was 63.6% which is the highest possible duty cycle that the EUT is capable of.

Following channels were used during the tests when the hopping was stopped:

Channel Low (Ch 0) = 2402 MHz Channel Mid (Ch 20) = 2442 MHz

Channel High (Ch 39) = 2480 MHz

Test Facility

Testing Location / address: FCC registration number: 90598	SGS Fimko Ltd Särkiniementie 3 FI-00210, HELSINKI FINI AND
Testing Location / address: FCC registration number: 178986 Industry Canada registration number: 8708A-2	SGS Fimko Ltd Karakaarenkuja 4 FI-02610, ESPOO FINLAND



Maximum Peak Conducted Output Power

Standard:	ANSI C63.10	(2009)
Tested by:	NKO	
Date:	14.5.2014	
Humidity:	22 %	
Temperature:	21.5 °C	
Measurement uncertainty	± 2,87dB	Level of confidence 95 % (k = 2)

FCC Rule: 15.247(b)(3)

For systems using digital modulation in the 2400-2483.5 MHz bands the limit is 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power.

Results:

Channel	Conducted Power [dBm]	Limit [dBm]	Margin [dBm]	Result
Low	8.32	30	21.68	PASS
Mid	7.82	30	22.18	PASS
High	7.11	30	22.89	PASS

Conducted Output Power Test

SGS	

Spectr	rum							
Ref Lev Att TDF	vel 1	4.00 dBm 30 dB	SWT 1.9 µs	RBW 1 MHz VBW 3 MHz	Mode	Auto FFT		12
😑 1Pk Ma	зх							
10 dBm-				M1	2	M1[1]		7.11 dB 2.47973520 GF
0 dBm—								
-10 dBm	i <u></u>		2 2		8			
-20 dBm	i		5		2	0		
-30 dBm					2		2	30 30
-40 dBm	-		\$S		ź		10	
-50 dBm	r		6		÷	6		- E
-60 dBm	i				~			
-70 dBm	i		5 5		12			
-80 dBm	ı—		×		2			2
CF 2.48	3 GHz		k la	i	591 pts	×.	3	Span 3.0 MHz
Marker		17 W2						
Type M1	Ref	Trc 1	Stimulus 2.4797352 GI	Respon	se	Function	Fu	nction Result
)[Measuring.	······	14.05.2014 16:16:46

Date: 14.MAY.2014 16:16:46





Date: 14.MAY.2014 16:17:43

Figure 2. Channel Mid.

Conducted Output Power Test



Spectrum					
Ref Level 3 Att TDF	14.00 dBm 30 dB	RB SWT 1.9 µs 👄 VB	W 1 MHz W 3 MHz Mode	auto FFT	
∋1Pk Max		32 35	205 - 125		
10 dBm		the second se		M1[1]	8.32 d 2.40225180 (
0 dBm			- 14 - 14 - 14 - 14 - 14 - 14 - 14 - 14		
-10 dBm					
-20 dBm		3			2 2 2
-30 dBm		*			20 79 NY
-40 dBm			- K		
-50 dBm					
-60 dBm			0		
-70 dBm		35	- e - e -		
-80 dBm			- 12 - 12 - 12 - 12 - 12 - 12 - 12 - 12		
CF 2.402 GI	-lz	1. 1.	691 pts	-	Span 3.0 Mi
Marker	67 92	97	101000000000000000000000000000000000000		
Type Ref M1	Trc 1	Stimulus 2.4022518 GHz	Response 8.32 dBm	Function	Function Result
	X) Measuring	14.05.2014 16:18:38

Date: 14.MAY.2014 16:18:38

Figure 3. Channel High.



Transmitter Radiated Spurious Emissions 30 – 1000 MHz

Standard:	ANSI C63.10	(2009)
Tested by:	NKO	
Date:	7.5. – 13.5.2014	
Humidity:	20 – 38 %	
Temperature:	23.2 – 25 °C	
Measurement uncertainty	± 4.51 dB	Level of confidence 95 $\%$ (k = 2)

FCC Rule: 15.247(d), 15.209(a)

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 emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.205(a).

The correction factor in the final result table contains the sum of the transducers (antenna + amplifier + cables). The QuasiPeak value is the measured value corrected with the correction factor.

Measured Peak Values In The Frequency Range 30 MHz - 1000 MHz.



FCC Part 15 Class B Spurious Emission 30-1000MHz 3m

٠

Figure 4. Measured curve with peak-detector. Channel Low.

Final measurements from the worst frequencies

Table 1. Final results.

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
144.015000	19.2	1000.0	120.000	122.0	V	264.0	14.5	24.3	43.5	
956.985000	27.1	1000.0	120.000	151.0	V	191.0	28.2	18.9	46.0	
974.505000	27.1	1000.0	120.000	179.0	V	236.0	28.2	26.8	53.9	

FCC Part 15 Class B Spurious Emission 30-1000MHz 3m



Figure 5. Measured curve with peak-detector. Channel Mid.

Final measurements from the worst frequencies

Table 2. Final results.

S

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
47.995000	17.6	1000.0	120.000	100.0	V	211.0	15.2	22.4	40.0	
143.995000	20.0	1000.0	120.000	110.0	V	235.0	14.5	23.5	43.5	
956.075000	27.1	1000.0	120.000	100.0	Н	228.0	28.2	18.9	46.0	



FCC Part 15 Class B Spurious Emission 30-1000MHz 3m



٠

Preview Result 1V-PK+ Final Result 1-QPK

Figure 6. Measured curve with peak-detector. Channel High.

Final measurements from the worst frequencies

Table 3. Final results.

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
47.995000	18.1	1000.0	120.000	100.0	V	29.0	15.2	21.9	40.0	
144.015000	18.6	1000.0	120.000	110.0	V	39.0	14.5	24.9	43.5	
937.725000	26.7	1000.0	120.000	292.0	V	279.0	27.9	19.3	46.0	

Transmitter Radiated Spurious Emissions 1 000 – 26 500 MHz

Measured Peak and Average Values In The Frequency Range 1 000 MHz – 4 000 MHz.

The correction factor in the final result tables contains the sum of the transducers (antenna + amplifier + cables). The Max Peak and Average values are measured values corrected with the correction factor.



FCC Part 15 Class B Spurious Emission 1-4GHz 3m (optimized 2.4 GHz TX)

Figure 7. Measured curve with peak- and average detector. Channel Low.

Final measurements from the worst frequencies

 Table 4. Final Max Peak results.

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
2337.725000	54.2	1000.0	1000.000	227.0	Н	12.0	3.9	19.7	73.9	
2369.775000	59.1	1000.0	1000.000	227.0	Н	-5.0	4.2	14.8	73.9	
2389.200000	51.0	1000.0	1000.000	221.0	H	-5.0	4.4	22.9	73.9	
2402.200000	100.5	1000.0	1000.000	101.0	Н	21.0	4.5	-26.6	73.9	Carrier

Table 5. Final Average results.

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
2337.925000	47.0	1000.0	1000.000	226.0	Н	-4.0	3.9	6.9	53.9	
2370.025000	50.8	1000.0	1000.000	222.0	Н	19.0	4.2	3.1	53.9	
2389.800000	36.7	1000.0	1000.000	220.0	Н	13.0	4.4	17.2	53.9	
2402.000000	95.2	1000.0	1000.000	220.0	Н	20.0	4.5	-41.3	53.9	Carrier





FCC Part 15 Class B Spurious Emission 1-4GHz 3m (optimized 2.4 GHz TX)

FCC Part 15 Class B Electric Field Strength 3 m AV.LimitLine Preview Result 2-AVG Final Result 2-AVG

٠

Final measurements from the worst frequencies

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
2377.725000	52.3	1000.0	1000.000	219.0	Н	18.0	4.3	21.6	73.9	
2410.250000	58.0	1000.0	1000.000	221.0	Н	15.0	4.5	15.9	73.9	
2441.750000	102.1	1000.0	1000.000	211.0	Н	21.0	4.4	-28.2	73.9	Carrier
2474.250000	62.9	1000.0	1000.000	211.0	Н	17.0	4.7	11.0	73.9	
2506.225000	57.4	1000.0	1000.000	205.0	Н	21.0	4.9	16.5	73.9	

Table 6. Final Max Peak results.

Table 7. Final Average results.

Frequency (MHz)	MaxPeak-ClearWrite (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
2378.125000	50.1	105.0	Н	0.0	4.3	23.8	73.9	
2410.250000	55.1	105.0	Н	0.0	4.5	18.8	73.9	
2441.750000	100.8	105.0	Н	0.0	4.4	-26.9	73.9	Carrier
2474.250000	62.2	105.0	Н	0.0	4.7	11.7	73.9	
2506.625000	56.7	105.0	Н	0.0	4.9	17.2	73.9	

۵

Figure 8. Measured curve with peak- and average detector. Channel Mid.





FCC Part 15 Class B Spurious Emission 1-4GHz 3m (optimized 2.4 GHz TX)

FCC Part 15 Class B Electric Field Strength 3 m AV.LimitLine Preview Result 2-AVG Final Result 2-AVG

٠

Final measurements from the worst frequencies

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
2448.250000	59.9	1000.0	1000.000	211.0	Н	15.0	4.4	14.0	73.9	
2479.750000	102.3	1000.0	1000.000	203.0	Н	18.0	4.7	-28.4	73.9	Carrier
2485.100000	59.7	1000.0	1000.000	100.0	Н	21.0	4.8	14.2	73.9	
2512.275000	59.6	1000.0	1000.000	100.0	Н	21.0	4.9	14.3	73.9	
2544.125000	54.2	1000.0	1000.000	198.0	Н	-5.0	4.9	19.7	73.9	

Table 8. Final Max Peak results.

Table 9. Final Average results.

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
2448.000000	49.6	1000.0	1000.000	211.0	H	-4.0	4.4	4.3	53.9	
2480.000000	97.6	1000.0	1000.000	208.0	H	21.0	4.7	-43.7	53.9	Carrier
2483.700000	44.8	1000.0	1000.000	207.0	H	21.0	4.8	9.1	53.9	
2512.025000	51.8	1000.0	1000.000	205.0	Н	21.0	4.9	2.1	53.9	
2543.925000	47.1	1000.0	1000.000	243.0	Н	-4.0	4.9	6.8	53.9	

Figure 9. Measured curve with peak- and average detector. Channel HIGH.

Measured Peak and Average Values In The Frequency Range 4 000 MHz – 18 000 MHz.

FCC Part 15 Class B Spurious Emission 4-18GHz 3m



Figure 10. Measured curve with peak- and average detector. Channel Low.

Final measurements from the worst frequencies

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
4706.200000	48.8	1000.0	1000.000	130.0	V	105.0	14.3	25.1	73.9	
17630.600000	56.5	1000.0	1000.000	247.0	V	315.0	28.3	17.4	73.9	

Table 10. Final Max Peak results.

Table 11. Final Average results.

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
4697.800000	35.0	1000.0	1000.000	100.0	V	181.0	14.3	18.9	53.9	
17447.800000	42.5	1000.0	1000.000	105.0	Н	334.0	28.2	11.4	53.9	





FCC Part 15 Class B Spurious Emission 4-18GHz 3m



FCC Part 15 Class B Electric Field Strength 3 m PK.LimitLine
 Preview Result 1-PK+
 Final Result 2-AVG

Figure 11. Measured curve with peak- and average detector. Channel Mid.

Final measurements from the worst frequencies



FCC Part 15 Class B Spurious Emission 4-18GHz 3m



FCC Part 15 Class B Electric Field Strength 3 m PK.LimitLine
 Preview Result 1-PK+
 Final Result 2-AVG

Figure 12. Measured curve with peak- and average detector. Channel High.

Final measurements from the worst frequencies

Measured Peak and Average Values In The Frequency Range 18 000 MHz – 26 500 MHz.



FCC Part 15 Class B Spurious Emission 18-26.5GHz 3m

Figure 13. Measured curve with peak- and average detector. Channel Low.

Final measurements from the worst frequencies



FCC Part 15 Class B Spurious Emission 18-26.5GHz 3m



FCC Part 15 Class B Electric Field Strength 3 m PK.LimitLine
 Preview Result 1-PK+
 Final Result 2-AVG

Figure 14. Measured curve with peak- and average detector. Channel Mid.

Final measurements from the worst frequencies

FCC Part 15 Class B Spurious Emission 18-26.5GHz 3m



Figure 15. Measured curve with peak- and average detector. Channel High.

Final measurements from the worst frequencies



Radiated band edge measurement results



FCC Part 15 Class B Spurious Emission 1-4GHz 3m (optimized 2.4 GHz TX)

Figure 16. Measured curve with peak- and average detector. Lower band edge.

Final measurements from the worst frequencies

Table 12. Final Max Peak results.

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
2369.775000	59.1	1000.0	1000.000	227.0	Н	-5.0	4.2	14.8	73.9	
2389.200000	51.0	1000.0	1000.000	221.0	H	-5.0	4.4	22.9	73.9	
2402.200000	100.5	1000.0	1000.000	101.0	Н	21.0	4.5	-26.6	73.9	

 Table 13. Final Average results.

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
2370.025000	50.8	1000.0	1000.000	222.0	Н	19.0	4.2	3.1	53.9	
2389.800000	36.7	1000.0	1000.000	220.0	Н	13.0	4.4	17.2	53.9	
2402.000000	95.2	1000.0	1000.000	220.0	Н	20.0	4.5	-41.3	53.9	





FCC Part 15 Class B Spurious Emission 1-4GHz 3m (optimized 2.4 GHz TX)



Final measurements from the worst frequencies

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
2479.750000	102.3	1000.0	1000.000	203.0	Н	18.0	4.7	-28.4	73.9	
2485.100000	59.7	1000.0	1000.000	100.0	Н	21.0	4.8	14.2	73.9	
2512.275000	59.6	1000.0	1000.000	100.0	Н	21.0	4.9	14.3	73.9	
2544.125000	54.2	1000.0	1000.000	198.0	Н	-5.0	4.9	19.7	73.9	

Table 14. Final Max Peak results.

Table 15. Final Average results.

Frequency	Average	Meas.	Bandwidth	Height	Polarization	Azimuth	Corr.	Margin	Limit	Comment
(MHz)	(dBµV/m)	Time	(kHz)	(cm)		(deg)	(dB)	(dB)	(dBµV/m)	
		(ms)								
2480.000000	97.6	1000.0	1000.000	208.0	Н	21.0	4.7	-43.7	53.9	
2483.700000	44.8	1000.0	1000.000	207.0	Н	21.0	4.8	9.1	53.9	
2512.025000	51.8	1000.0	1000.000	205.0	Н	21.0	4.9	2.1	53.9	
2543.925000	47.1	1000.0	1000.000	243.0	Н	-4.0	4.9	6.8	53.9	

Standard:	ANSI C63.10	(2009)
Tested by:	NKO	
Date:	14.5.2014	
Humidity:	22 %	
Temperature:	21.5 °C	
Measurement uncertainty	\pm 2.87 dB	Level of confidence 95 $\%$ (k = 2)

FCC Rule: 15.247(d), 15.209(a)

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 emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.205(c)).

Table 16. Band edge attenuation.

Band Edge	Attenuation
Lower Band Edge	Upper Band Edge
-53.36 dBc	-48.05 dBc
Limit:	-20dBc

 Table 17. Conducted spurious emissions.

	Condu	cted Spurious Em	issions	
Channel	Measured Attenuation [dB]	Limit [dBc]	Margin [dB]	Result
Low	-	-20.0	-	-
Mid	-	-20.0	-	-
High	-	-20.0	-	-

No significant emissions were detected close to the limit.



Spect	rum						
Ref Le Att TDF	vel 1	4.00 dBm 30 dB	SWT 1	🥌 RB 9 μs 🥌 VB	₩ 100 kHz ₩ 300 kHz Mod	e Auto FFT	Y
∎1Pk M	ах		a 14	35	10: UL		
10 dBm				-	× 2	M2[1]	-45.79/dBm
0 dBm—			-		0	M1[1]	2.3900040 GHz 7.57 dBm 2.4022250 GHz
-10 dBn	i d	1 -11.680	dBm	-		16 	
-20 dBn	n		-				
-30 dBn	1			2		2	
-40 dBn	n		M2	-		(m)	
-50 dBn	m	m	mfm	mun	honora	with	
-60 dBn	<u> </u>			3	-		
-70 dBn	ñ		* *				
-80 dBn	1-+		F1	5		2	
CF 2.3	945 G	iHz		÷	691 pts		Span 17.0 MHz
Marker		[may]	network	area T	name i		
M1	Ker	1	2,40	2225 GHz	7,57 dBm	Function	Function Result
M2	ļ	ī	5215	2.39 GHz	-45.79 dBm		
)() Measuring	. 16.05.2014

Date: 16.MAY.2014 12:26:17





Date: 16.MAY.2014 12:33:30

Figure 19. Upper Band Edge.



Spectrur Ref Level	n 14.00 dBm		👄 RB	W 100 kHz					(🗸
Att TDF	30 dB	SWT 30 r	ns 👄 VB	W 300 kHz Mo	de Auto Swi	зер			
1Pk Max			<i>w</i>	72. Uz					
10 dBm		6	n <u>e</u>		M1[1]	1		M1 7 2.4	6.12 dBn 799700 GH
) dBm		?	3			2			
10 dBm—	D1 -11.680	dBm							
20 dBm—		5	4					2	
30 dBm—		s	2	-				2	
40 dBm—	25 Y	ç			2				2
50 dBm	en her and a start web	a part of the second	arter to day	terre balance of a spirit billing allow	tra del contratto	and the second	Malder, Laksholmer		also lite at a stand strength
60 dBm—						100			
70 dBm		5	4		n	4			e c
80 dBm—		63	-	-	2	2			X
Start 30.0	MHz	5	02	30000 p	ts	2.		l S	top 3.0 GHz
larker	e		. 1			1	10 00 0000000		
M1 M1		2,479	97 GHz	кезропзе 6.12 dBm	Function		Fun	ction Resu	llt.
	Y				Measuri	ng 📔	📕 ent ant int um ont the kr	1/0	14.05.2014







Date: 14.MAY.2014 17:32:59

Figure 21. Conducted Spurious Emissions 3 000 – 6 000 MHz. Channel Low.



Spectr	um											
Ref Lev Att TDF	vel 1	4.00 dBm 30 dB	SWT 100 ms	■ RBW ■ VBW	100 kHz 300 kHz	Mod	le Aut	o Sweep				in the second
🔵 1 Pk Ma	зx	,	3 1-			110						
10 dBm-			5			2	M	1[1]			15.	-37.46 dBm 842500 GHz
0 dBm—			2			ë.			X			
-10 dBm		1 -11.680	dBm			8						
-20 dBm	_		5 90			<i>.</i>	1		-			
-30 dBm			6 12			4						641
-40 dBm	_			1.000		de.	4.10	taliat, av Allel at	Lat uther	Li ulikier.	والمعالية والمعالية والمعالية	The second second
والمعالمة والمناوية والمراج	and the sea	م الط طب الم الم الم الم الم	ويفع العالم وبالرواب الرواب	All Barris	ditte and a state of the state	and the state	R. B. D. J. L. B. B.	Contraction of the second			stablest entremolitie	
-50 dBm	01•						2					-
-60 dBm	-		s		-	4	2			8		96
-70 dBm	_		5 92	e		92						11
-80 dBm			6 12	-		4						*
Start 6.	.0 GH	z	i Is		3000	0 pts	li i		21		Sto	p 16.0 GHz
Marker		vi 10		-97		- Dr		97				
Type M1	Ref	Trc 1	Stimulus 15.8425 GH	- Iz	Response -37.46 dE	3m	Func	tion		Fund	ction Resu	lt
)()	Mea	suring			4/0	14.05.2014 17:39:27

Date: 14.MAY.2014 17:39:27





Date: 14.MAY.2014 17:48:32





Spectrun	а С								
Ref Level Att TDF	14.00 dBm 30 dB	SWT 30 m	e RBV	✔ 100 kHz ✔ 300 kHz Mo	de Auto S	6weep			12
1Pk Max	· · · ·	2 a		D: D:					
10 dBm	-				M1	[1]		2.4	-49.19 dBn 799700 GHa
) dBm		-		N	÷		×		95. 95.
•10 dBm	D1 -11.680	dBm			3				2
-20 dBm		3		¢	12		-	20	R
-30 dBm					2			20	
-40 dBm—	,	¢		- K K.			- 2		
-50 dBm	فاخاطنها ممرورهم		र्गलन् २ वित्र प्रथम् २२ व	मानित्य सम्प्रदेव जोत्त्र केली हेल्स मिल्लून	Netley della la solt		A LEVEL IN CONTRACTOR	UM	wide is not blighter a strange
-60 dBm			_				200 100 y 200 1	20W	~
-70 dBm		5			2			2	et.
-80 dBm							8	že	
Start 30.0	MHz	L I		30000 p	its		2	St	op 3.0 GHz
larker	-1	Name and a state of the state of			T same second		to a contract of	-	- 401
Type Ref Trc Stimulus M1 1 2.47997 GHz			-49.19 dBm	se Function Function Result					
)[Meas	uring	in the second second second second	144	14.05.2014 17:28:25

Date: 14.MAY.2014 17:28:25





Date: 14.MAY.2014 17:32:05





Spectrun	12 N										
Ref Level Att TDF	14.00 dBm 30 dB	SWT 100 n	e RBW	100 kHz 300 kHz	Mode	e Auti	o Sweej	ρ			
1Pk Max		17. N.			115						
10 dBm	<i>.</i>	6	-		ġ.	M	1[1]			15.	-37.58 dBr 473830 GH
) dBm		* ÷		-	ei.	-		- k		2.	2
•10 dBm—	D1 -11.680	dBm			<u> </u>			-		-	
-20 dBm		5 90			¢.	2		3			
-30 dBm		8 82			<u>9</u>	2				2	NAT
-40 dBm			CORCUMPTON CO.	La china a	1.6	. 1.1.			industry and a state	المر الماليس العلى ال	Elimetell' Truch
العفليكن معمر إعالان لل	مأذادة إوأ المسقاني بالعريان ا	all which is a state of the state	Lange to a start of the	teles and a second second	All Lands		All and the	No.		The purchase of the second second	in the set of the
50 dBm	Internet and the second				2	100		1.30 1.		22	
60 dBm—		2 2			2			_			*
-70 dBm		8 92			2	5				\$1.	8
-80 dBm		s2			62					8	8
Start 6.0 C	Hz	L L		3000	0 pts			2.		Sto	p 16.0 GHz
larker	94 - HA		27		14						
Type Re M1	f Trc 1	Stimulus 15.47383	GHz	-37.58 dB	3m	Func	tion		Fui	nction Resu	lt
	Y		oana an indina k			Mea	surina	. 1	ten hat just ing som der har	1 100	14.05.2014

Date: 14.MAY.2014 17:40:18





Date: 14.MAY.2014 17:44:42

Figure 27. Conducted Spurious Emissions 16 000 – 26 500 MHz. Channel Mid.



Spectrun	n									
Ref Level Att TDF	14.00 dBm 30 dB	SWT 30 ms	■ RBW ■ VBW	100 kHz 300 kHz M(ode Auto	Sweep				
1Pk Max	R 9	0 93	,							
10 dBm	-				M	1[1]		M	2.4	6.26 dBn 799700 GH
) dBm		*		8 8 .	2			-		8
-10 dBm	D1 -11.680	dBm					_			2
-20 dBm	1,72,700,544	5 4			71				8) 8	1
-30 dBm		· · · · ·						2	7	2
-40 dBm—		<u> </u>					3		tr	×
-50,dBm-	AN, et a 19 de jui de statil	A participation of the second		-	a parta a finala	and the state of	- a hutbert by at starts		a coult be	مال الدو العلمان بي من الدار المسلم العلم العلم المراجع الم
-60 dBm—			a sed finn			Carling and an i				*
-70 dBm		5						9		8
-80 dBm				× 4			8	70		2
Start 30.0	MHz	ti Ui		30000	ots		2.	2	St	op 3.0 GHz
1arker	el 1		1.		1 -		10 00 000		20 -1 -2003	14
M1 M1	1 1 1 1 1	2.47997	GHz	6.26 dBm	Func	cion	Fu	nctio	n kesul	
1)[1	Mea	suring		1 44	1	14.05.2014 17:29:32

Date: 14.MAY.2014 17:29:32





Date: 14.MAY.2014 17:31:04

Figure 29. Conducted Spurious Emissions 3 000 – 6 000 MHz. Channel High.



opectrum	invite		122						
Att TDF	14.00 dBm 30 dB	SWT 10	oms 🖷 VI	3W 100 kHz BW 300 kHz	Mode Aut	o Sweep			
1Pk Max			100		15				
10 dBm	2 5	6 9		-	<u>M</u>	1[1]		15.4	-38.41 dBn (80170 GH)
) dBm		÷		100	s			-11	
•10 dBm—	D1 -11.680	dBm	-	-			_		
-20 dBm		5							
-30 dBm		s							
-40 dBm						Inda Unite .	LUMA WALL UNDERSTAN		MIT.
الما فالمستنظرة خلدي إلى	a de la stalle sentilit	and a set of the set o	الدورية المروح المحاليات	a de la paleta de la paleta de para pl	Manager and the second s	- Alexandra	and a state of the	The second s	A STREET STREET
50 dBm—					100000-00	<i>a</i> .		12	-
-60 dBm		2		÷					×-
-70 dBm		5		é	a A				*
-80 dBm—				-	4		8	<u>.</u>	
Start 6.0 C	Hz	5	30.	30000) pts		a.	Stop	16.0 GHz
larker	21 10.				14	57			
Type Re M1	f Trc	Stimul: 15.48	IS	Response -38.41 dB	Func m	tion	Fun	ction Result	<u>i</u>
18.873	70			2014/02/22			and have been been some some some	1.000	14.05.2014

Date: 14.MAY.2014 17:41:21





Date: 14.MAY.2014 17:43:36

Figure 31. Conducted Spurious Emissions 16 000 – 26 500 MHz. Channel High.



6 dB Bandwidth of the Channel

Standard:	ANSI C63.10	(2009)
Tested by:	NKO	
Date:	14.5.2014	
Humidity:	22 %	
Temperature:	21.5 °C	

FCC Rule: 15.247(a)(2) RSS-210 A8.2

<u>Results:</u>

 Table 18. 6 dB bandwidth test results.

Channel	6 dB BW [kHz]	Minimum limit [kHz]
Low	730.800	
Mid	730.800	500
High	730.800	

6 dB Bandwidth of the Channel





Date: 14.MAY.2014 16:10:52

Figure 32. 6 dB bandwidth of the channel Low.



Date: 14.MAY.2014 16:12:29

Figure 33. 6 dB bandwidth of the channel Mid.

6 dB Bandwidth of the Channel





Date: 14.MAY.2014 16:13:28

Figure 34. 6 dB bandwidth of the channel High.



Power Spectral Density

Power Spectral Density

Standard:	ANSI C63.10	(2009)
Tested by:	NKO	
Date:	14.5.2014	
Humidity:	22 %	
Temperature:	21.5 °C	

FCC Rule: 15.247(e) RSS-210 A8.2

<u>Results:</u>

 Table 19. Power Spectral Density test results.

Channel	PSD dBm/3 kHz	Maximum limit [dBm/3kHz]
Low	-6.89	
Mid	-7.35	+8.00
High	-8.22	

Power Spectral Density





Date: 14.MAY.2014 16:30:48





Figure 36. Power Spectral Density of the channel Mid.

Power Spectral Density





Date: 14.MAY.2014 16:32:46

Figure 37. Power Spectral Density of the channel High.



99% Occupied Bandwidth

Standard:	RSS-GEN	(2010)
Tested by:	NKO	· · · ·
Date:	16.5.2014	
Humidity:	25 %	
Temperature:	22.1 °C	

RSS-GEN 4.7

Table 20. 99 % OBW test results.

Channel	Limit	99 % BW [MHz]	Result
Low	-	1.099855282	PASS
Mid	-	1.099855282	PASS
High	-	1.099855282	PASS

99 % Occupied Bandwidth





Date: 16.MAY.2014 14:30:07

Figure 38. 99 % OBW. Channel Low.



Figure 39. 99 % OBW. Channel Mid.

99 % Occupied Bandwidth





Date: 16.MAY.2014 14:32:29

Figure 40. 99 % OBW. Channel High.



Manufacturer	Туре	Serial no	Inv. no
ROHDE & SCHWARZ			
Spectrum Analyzer EMI Test receiver Test software	FSV 40 ESU 26 EMC32	101068 100185 -	9093 8453 -
DAVIS			
Weather station	Vantage Pro	-	5297
ETS-LINDGREN			
Antenna (18 GHz – 26 GHz)	3160-09	28535	7294
ЕМСО			
Antenna (1 - 18 GHz)	3117	29617	7293
SCHWARZBECK			
Antenna (30 MHz - 1 GHz)	VULB 9168	9168-503	8911
HEWLETT- PACKARD			
Microwave amplifier	83017A	-	5226
HUBER-+ SUHNER			
Attenuator 10dB	6810.17B	-	-
DEISEL			
Antenna mast Turntable	MA 240 DS 430	240/455 -	7896 -
WAINWRIGHT			
High Pass Filter	WHKX	10	8267

All used measurement equipment was calibrated (if required).