

FCC Part 15C Compliance Test Report

Test Report no.:	EMC_BO_001677	Date of Report:	06-Oct-2011
Number of pages:	36	Project support engineer:	Robert Müller

Customer:	novero International GmbH, Parsevalstr. 7A, 40468 Düsseldorf, Germany		
Customers contact:	Bernhard Bläcker		
Manufacturer	Novero International GmbH		
EUT ident.:	Bluetooth Headset Module, NBM-4		
FCC ID	ZORNBM-4	IC:	7347C-NBM4

Referred documents:	CFR 47, FCC rules Part 15 Subpart C, ANSI C63.4 (2003), Public Notice DA 00-705, IC standards RSS-GEN and RSS-210. Deviations or clarifications to these standards are noted in the related test result under "test method and limit".
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	FCC listing no.:	881111	IC recognition no.:	7847A-1
	Laboratory manager:	Jürgen Mitterer		

Test result	The EUT complies with the requirements made in the referred test documents.
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Date and signature:

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1. Summary for FCC Part 15C Compliance Test Report

Date of receipt	28-Sep-2011
Testing completed	05-Oct-2011
The customer's contact person	Bernhard Bläcker
Notes	none
Document name	NBM-3_FCC_Part_15C_Compliance_Test_Report_01.doc

1.1. EUT and Accessory Information

The EUT is a Bluetooth device. Bluetooth is tested with maximum rated TX power.

Product	Type	SN	HW	MV	SW	DUT
Bluetooth Headset Module	NBM-4	LIL003	MP	-	1.08	LIL003
Bluetooth Headset Module	NBM-4	LIL004	MP	-	1.08	LIL004

1.2. Summary of Test Results

Bluetooth:

Section in CFR 47	Section in <i>RSS-GEN</i> or <i>RSS-210</i>	Name of the test	Result
15.247(b)(1)	A8.4 (b)	Conducted peak output power	PASSED
15.247(d)	A8.5	Band edge compliance of RF emissions	PASSED
15.247(c)	A8.5	Spurious RF conducted emissions	PASSED
15.247(c), 15.209	A8.5	Spurious radiated emissions	PASSED
15.207	7.2.2	AC powerline conducted emissions	PASSED
15.247(a)(1)	A8.1 (a)	20 dB bandwidth	PASSED
15.247(a)(1)	A8.1 (b)	Carrier frequency separation	PASSED
15.247(a)(1)(iii)	A8.1 (d)	Number of hopping frequencies	PASSED
15.247(a)(1)(iii)	A8.1 (d)	Time of occupancy	PASSED

PASSED: The EUT complies with the essential requirements in the standard.

FAILED: The EUT does not comply with the essential requirements in the standard.

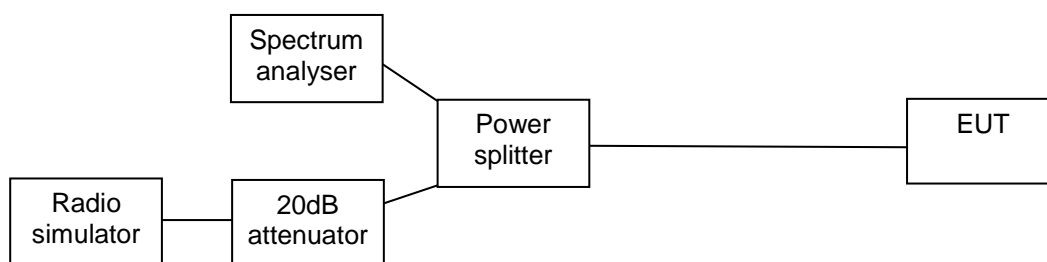
NP: The test was not performed.

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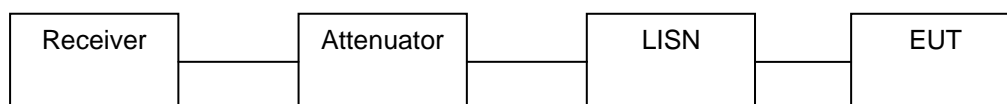
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2. Test setups

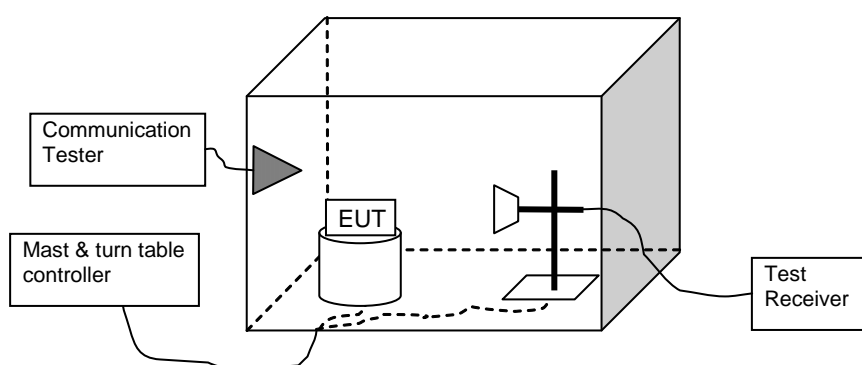
2.1. Conducted RF test setup



2.2. AC power line conducted emissions test setup



2.3. Spurious radiated emissions test setup



3. Conducted peak output power (FCC §15.247(b)(1), RSS-210 A8.4 (2))

EUT with DUT number	LIL004
Accessories with DUT numbers	None
Operation Voltage [V] / [Hz]	3.7 / DC
Result	PASSED
Remarks	None
Temp [°C] / Humidity [%RH]	25 / 50
Date of measurements	05-Oct-2011
Measured by	Robert Müller

3.1. Test method and limit

The measurement is made according to Public notice DA 00-705 and IC standard RSS-210.

Limits for conducted peak output power measurements

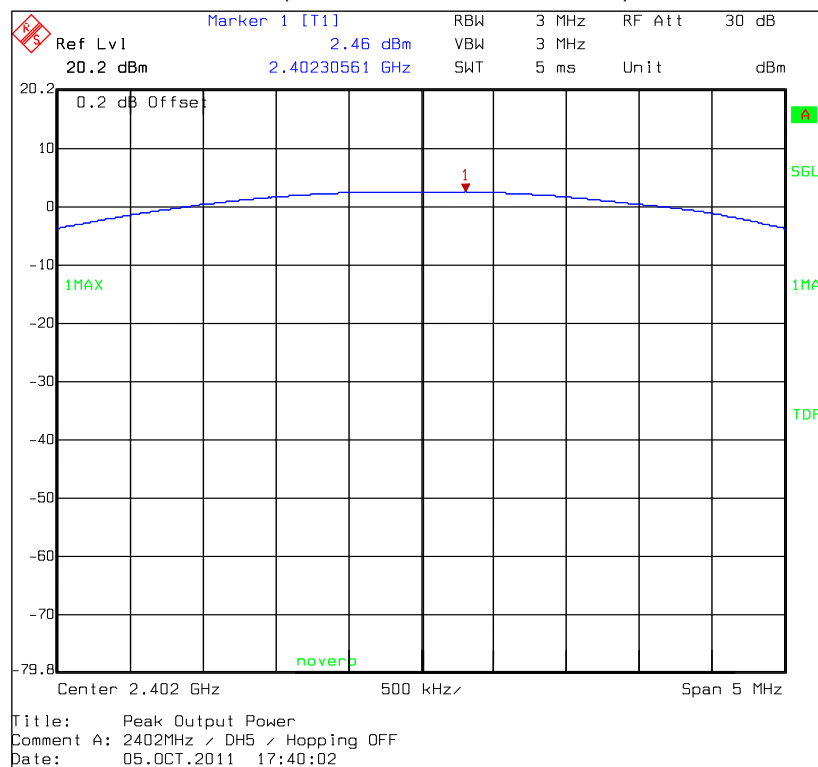
Frequency range [MHz]	Limit [W]	Limit [dBm]
2400 – 2483.5	≤ 1	≤ 30

3.2. Bluetooth Test results

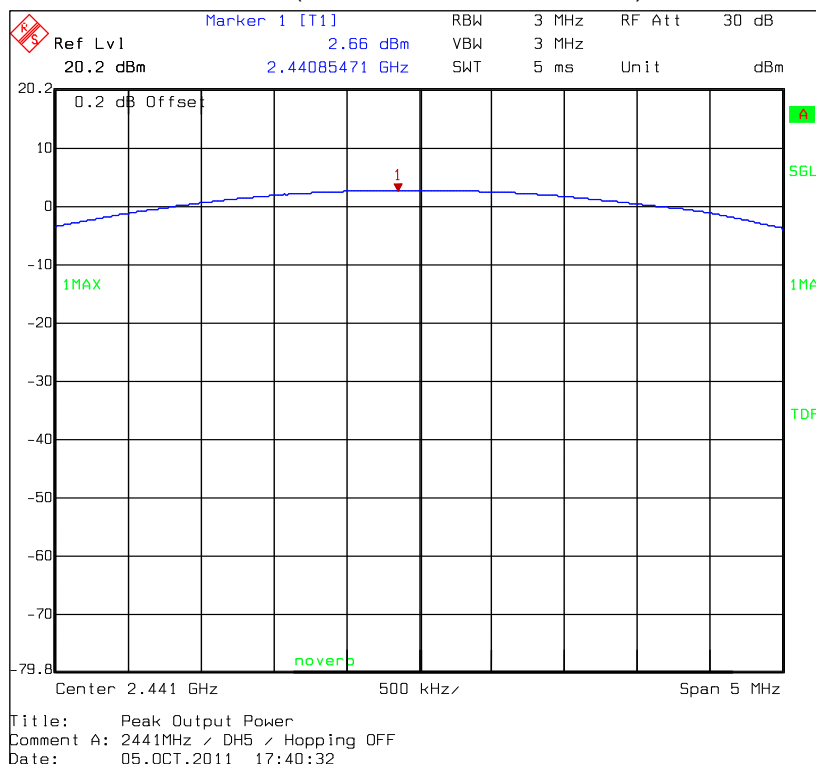
3.2.1 GFSK modulation, PRBS packet type

Channel / f_c [MHz]	P [dBm]	P [mW]	Result
0 / 2402	2.46	1.76	PASSED
39 / 2441	2.66	1.85	PASSED
78 / 2480	2.54	1.79	PASSED

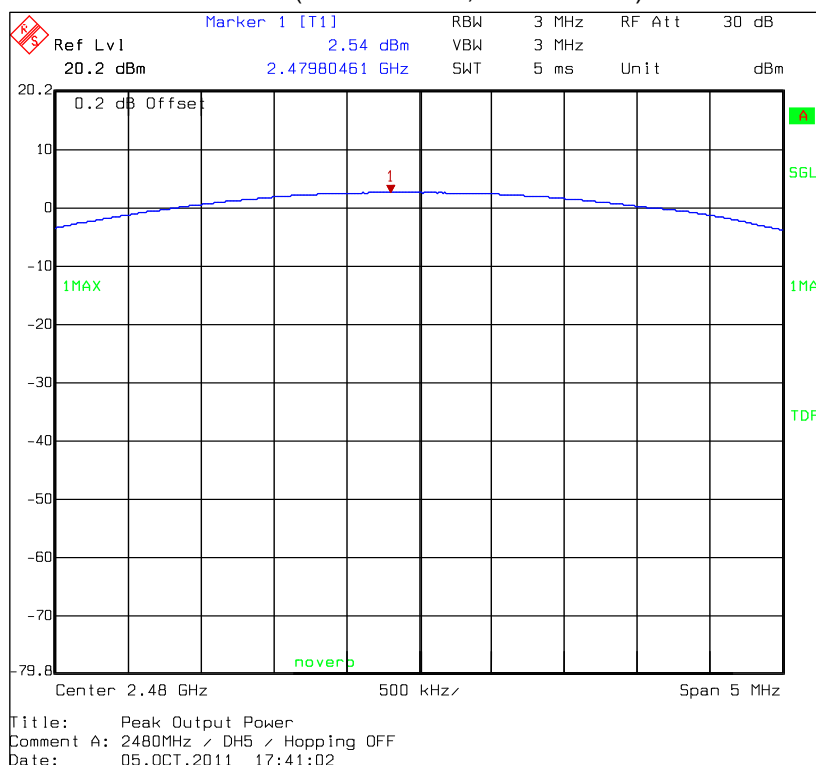
Channel 0 / 2402 MHz (Peak detector, RBW: 3 MHz)



Channel 39 / 2441 MHz (Peak detector, RBW: 3 MHz)



Channel 78 / 2480 MHz (Peak detector, RBW: 3 MHz)



4. Band edge compliance of RF emissions (FCC §15.247(d), RSS-210 A8.5)

EUT with DUT number	LIL003 / LIL004
Accessories with DUT numbers	None
Operation Voltage [V] / [Hz]	Battery powered
Result	PASSED
Remarks	None
Temp [°C] / Humidity [%RH]	25 / 50
Date of measurements	04-Oct-2011 / 05-Oct-2011
Measured by	Robert Müller

4.1. Test method and limit

The measurement is made according to Public notice DA 00-705 and IC standard RSS-210.

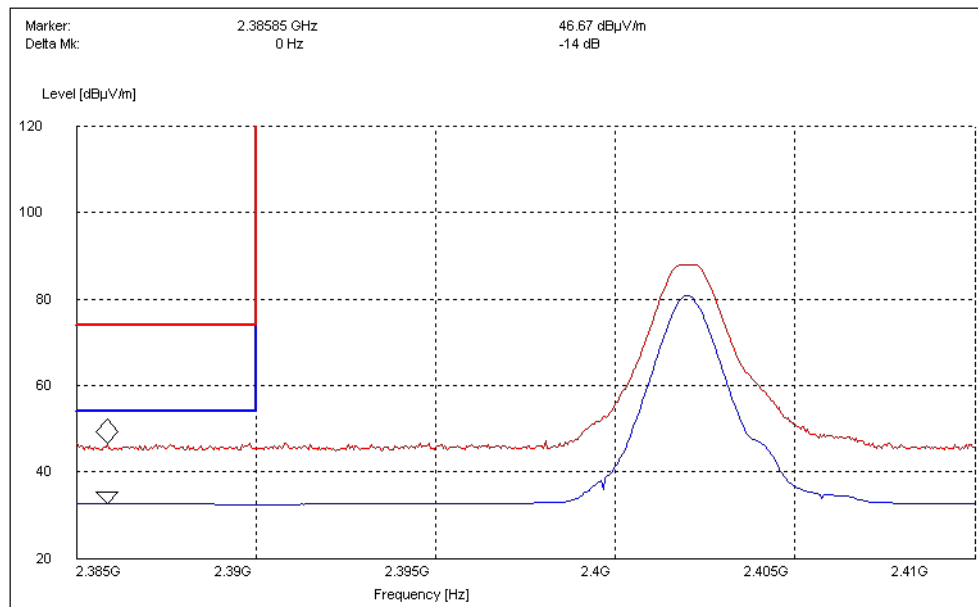
Limits for band edge compliance of RF emissions measurements (3 m measurement distance)

Frequency range [MHz]	Limit Average [dBµV/m]	Limit Peak [dBµV/m]
Below 2390 and above 2483.5	≤ 54	≤ 74

4.2. Bluetooth Test results

4.2.1 GFSK modulation, PRBS packet type

Radiated, channel 0 / 2402 MHz, hopping off



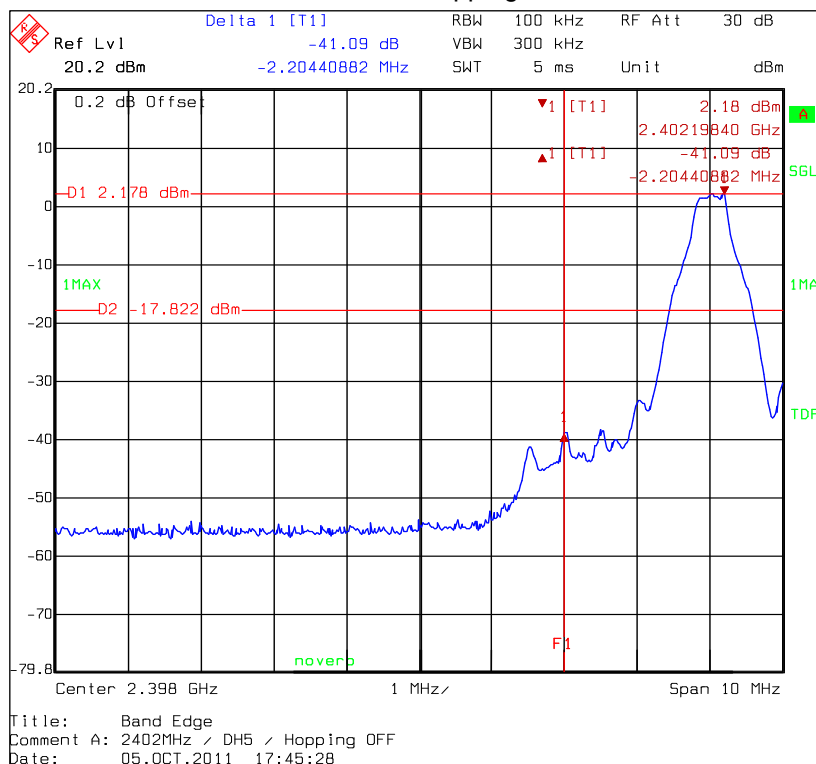
Peak (RBW: 1 MHz)

Channel / f_c [MHz]	E [dBμV/m]	Result
0 / 2402	46.67	PASSED

Average (RBW: 1 MHz)

Channel / f_c [MHz]	E [dBμV/m]	Result
0 / 2402	32.67	PASSED

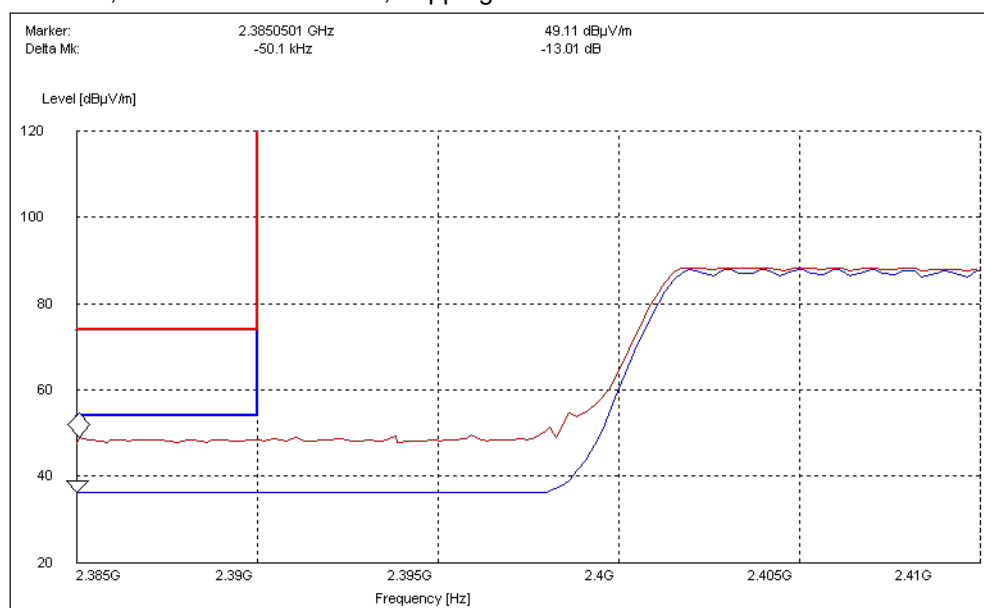
Conducted, channel 0 / 2402 MHz, hopping off



Peak (RBW: 100 KHz)

Channel / f_c [MHz]	P [dBc]	Result
0 / 2402	-41.09	PASSED

Radiated, channel 0 / 2402 MHz, hopping on



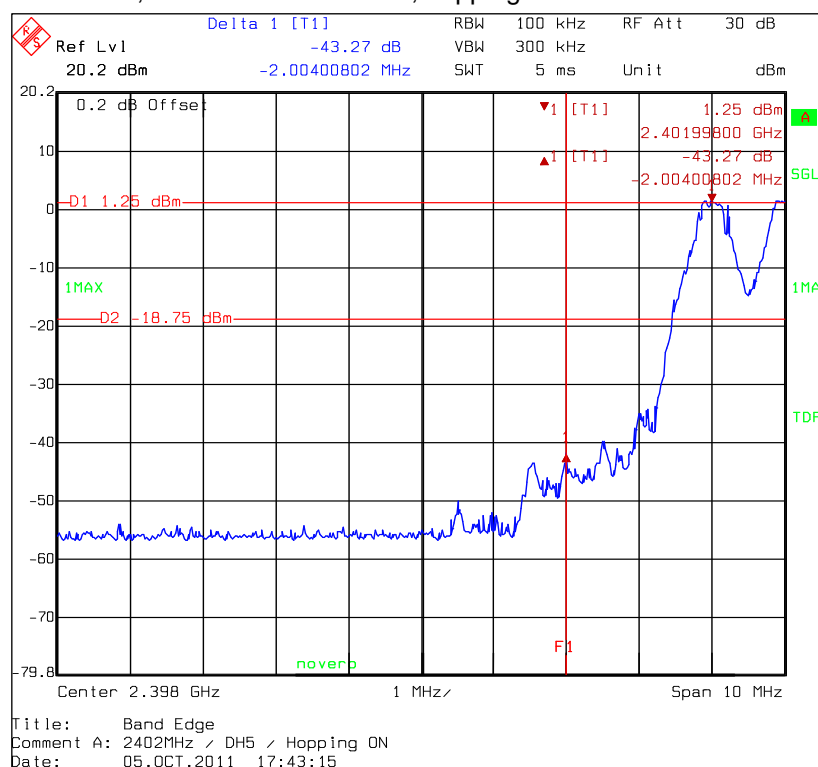
Peak (RBW: 1 MHz)

Channel / f _c [MHz]	E [dBμV/m]	Result
0 / 2402	49.11	PASSED

Average (RBW: 1 MHz)

Channel / f _c [MHz]	E [dBμV/m]	Result
0 / 2402	36.10	PASSED

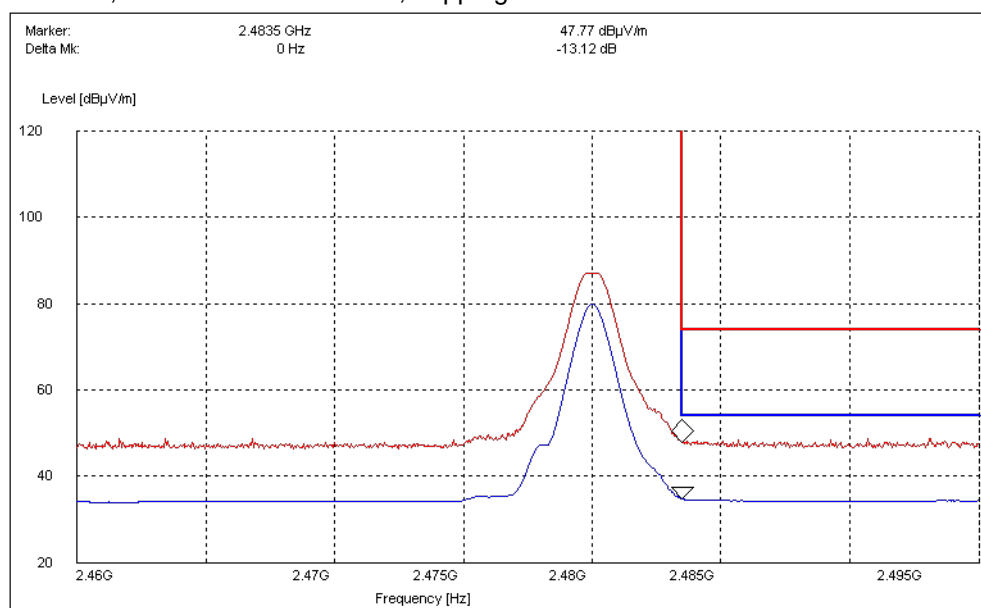
Conducted, channel 0 / 2402 MHz, hopping on



Peak (RBW: 100 KHz)

Channel / f_c [MHz]	P [dBc]	Result
0 / 2402	-43.27	PASSED

Radiated, channel 78 / 2480 MHz, hopping off



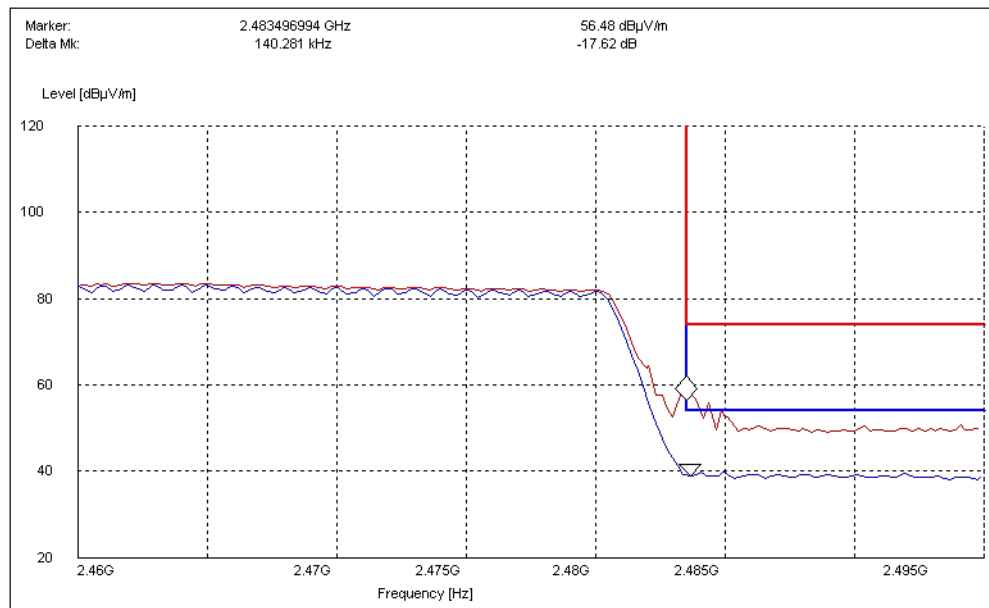
Peak (RBW: 1 MHz)

Channel / f _c [MHz]	E [dBμV/m]	Result
78 / 2480	47.77	PASSED

Average (RBW: 1 MHz)

Channel / f _c [MHz]	E [dBμV/m]	Result
78 / 2480	34.65	PASSED

Radiated, channel 78 / 2480 MHz, hopping on



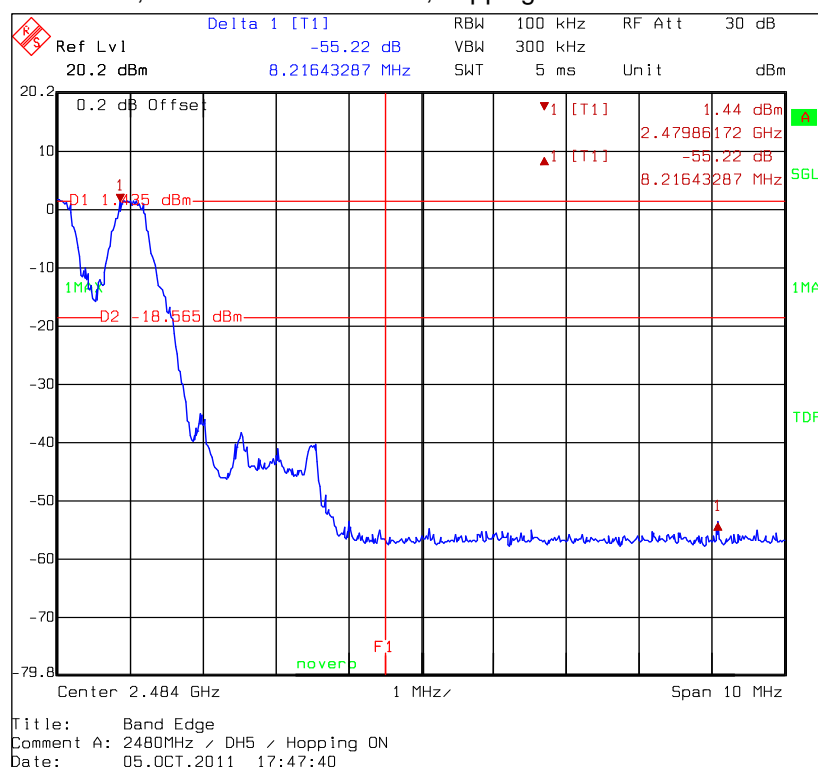
Peak (RBW: 1 MHz)

Channel / f_c [MHz]	E [dB μ V/m]	Result
78 / 2480	56.48	PASSED

Average (RBW: 1 MHz)

Channel / f_c [MHz]	E [dB μ V/m]	Result
78 / 2480	38.86	PASSED

Conducted, channel 78 / 2480 MHz, hopping on



Peak (RBW: 100 KHz)

Channel / f_c [MHz]	P [dBc]	Result
0 / 2402	-55.22	PASSED

5. Spurious RF conducted emissions (FCC §15.247(d), RSS-A8.5)

EUT with DUT number	LIL004
Accessories with DUT numbers	None
Operation Voltage [V] / [Hz]	3.7 / DC
Result	PASSED
Remarks	None
Temp [°C] / Humidity [%RH]	25 / 50
Date of measurements	05-Oct-2011
Measured by	Robert Müller

5.1. Test method and limit

The measurement is made according to Public notice DA 00-705 and IC standard RSS-210.

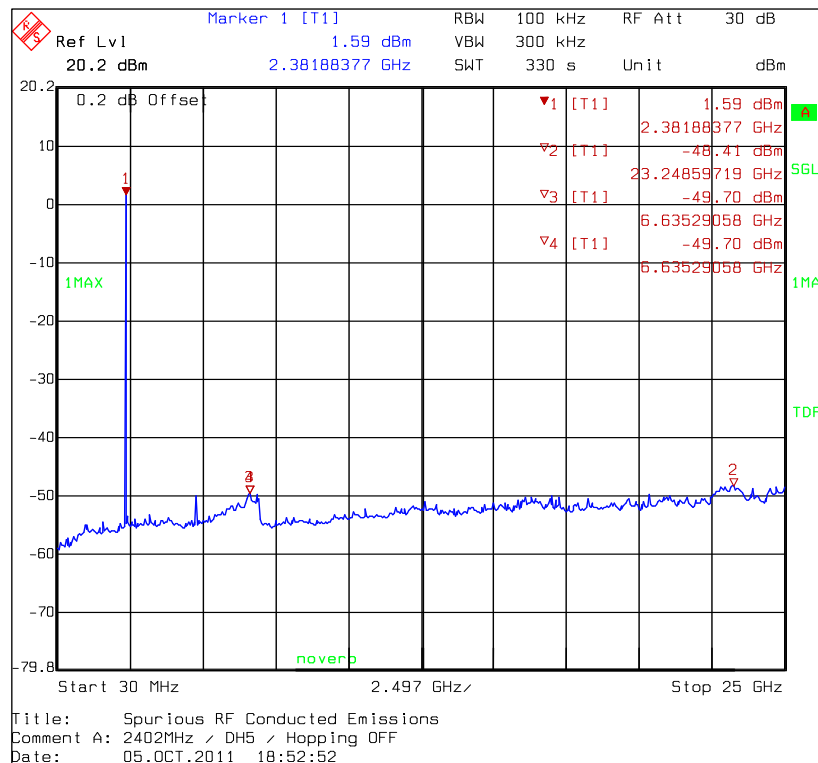
Limits for spurious RF conducted emissions measurements

Frequency range [MHz]	Limit [dBc]
1 – 25000	≤ -20

5.2. Bluetooth Test results

5.2.1 GFSK modulation, PRBS packet type

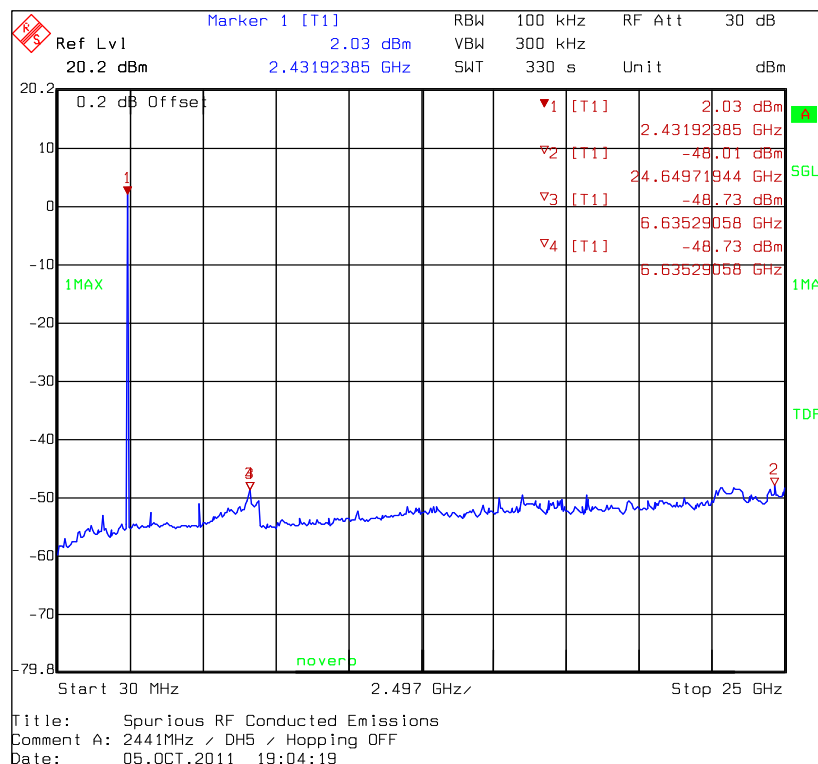
Channel 0 / 2402 MHz



Peak (RBW: 100 KHz)

Frequency [MHz]	P [dBc]	Result
6635.29	-49.70	PASSED
23248.60	-48.41	PASSED

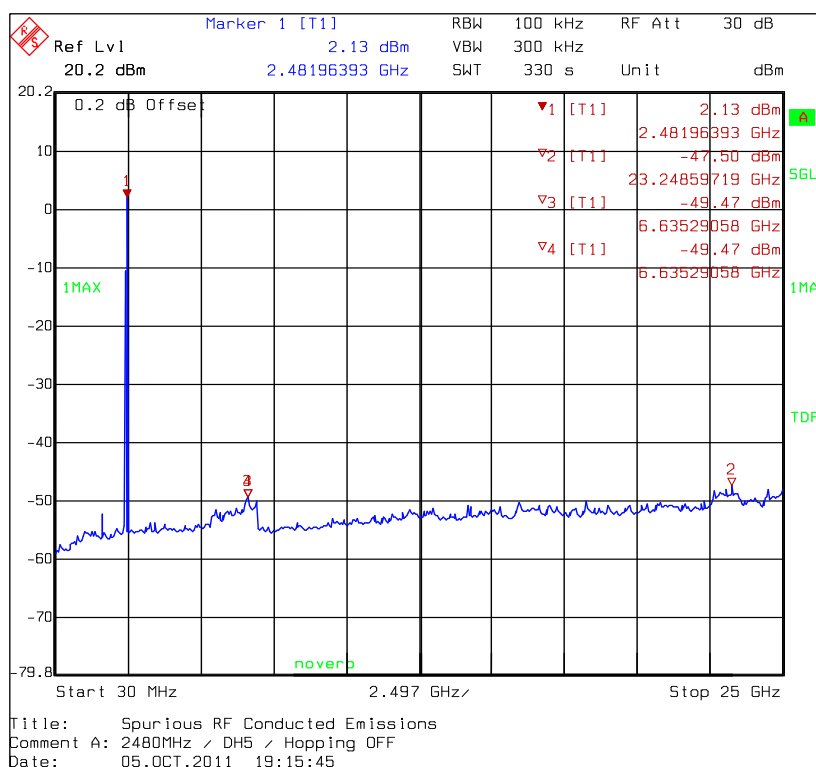
Channel 39 / 2441 MHz



Peak (RBW: 100 KHz)

Frequency [MHz]	P [dBc]	Result
6636.29	-48.73	PASSED
24649.72	-48.01	PASSED

Channel 78 / 2480 MHz



Peak (RBW: 100 KHz)

Frequency [MHz]	P [dBc]	Result
6635.29	-49.47	PASSED
23248.60	-47.50	PASSED

6. Spurious radiated emissions (FCC §15.247(d), §15.209, RSS-210 A8.5)

EUT with DUT number	LIL003
Accessories with DUT numbers	None
Operation Voltage [V] / [Hz]	Battery powered
Result	PASSED
Remarks	None
Temp [°C] / Humidity [%RH]	24.8 / 50
Date of measurements	04-Oct-2011
Measured by	Robert Müller

6.1. Test method and limit

The measurement is made according to Public notice DA 00-705 and IC standard RSS-210 as follows:

Below 1GHz:

The Preliminary Measurement and the Final Measurement is performed in 3m distance by rotating the turntable of 360 degrees and moving the antenna height between 1-4m.

The Preliminary Measurement is performed with floor absorbers on the floor and measuring antenna at fixed height using 2-axis EUT position system.

The Final Measurement is performed without floor absorbers, if the Preliminary Measurement results are closer than 20 dB to the permissible limit.

Between 1-3GHz:

The Preliminary Measurement and the Final Measurement is performed in 3m distance by rotating the turntable of 360 degrees at fixed height.

The Preliminary Measurement and the Final Measurement with absorbers on the floor and measuring antenna at fixed height using 2-axis EUT position system.

The Final Measurement is performed, if the Preliminary Measurement results are closer than 20 dB to the permissible limit.

Above 3GHz:

The Preliminary Measurement and the Final Measurement is performed in 1.5m distance by rotating the turntable of 360 degrees at fixed height.

The Preliminary Measurement and the Final Measurement with absorbers on the floor and measuring antenna at fixed height using 2-axis EUT position system.

The Final Measurement is performed, if the Preliminary Measurement results are closer than 20 dB to the permissible limit.

General:

The measurement is divided into the Preliminary Measurement and the Final Measurement.

The EUT is placed at nonconductive plate at the turntable center.

The emissions less than 20 dB below the permissible value are reported.

The measurement results are obtained as described below:

$$E [\mu V/m] = U_{RX} + A_{CF}$$

Where U_{RX} is receiver reading and A_{CF} is total correction factor including cable loss, antenna factor and preamplifier gain ($A_{CF} = L_{CABLES} + AF - G_{PREAMP}$).

Limits for spurious radiated emissions measurements (3 m measurement distance)

Frequency range [MHz]	Limit [μ V/m]	Limit [dB μ V/m]	Detector
30 – 88	100	40	Quasi peak
88 – 216	150	43.5	Quasi peak
216 – 960	200	46	Quasi peak
960 – 1000	500	54	Quasi peak
Above 1000	500	54	Average
Above 1000	5000	74	Peak

6.2. Bluetooth Test results

6.2.1 GFSK modulation, PRBS packet type

Channel 0 / 2402 MHz

Peak (RBW: 1 MHz)

Frequency [MHz]	E [dB μ V/m]	E [μ V/m]	U_{RX} [dB μ V]	A_{CF} [dB]	Polarisation	Result
4803.61	60.80	1097	76.70	-15.90	VERTICAL	PASSED
7324.66	42.20	129	51.00	-8.80	VERTICAL	PASSED
17747	54.70	543	49.00	5.70	HORIZONTAL	PASSED

Average (RBW: 1 MHz)

Frequency [MHz]	E [dB μ V/m]	E [μ V/m]	U_{RX} [dB μ V]	A_{CF} [dB]	Polarisation	Result
4804.11	52.40	432	68.40	-16.00	VERTICAL	PASSED
7327.66	29.30	29.2	38.10	-8.80	VERTICAL	PASSED
17751.50	41.50	119	35.80	5.70	HORIZONTAL	PASSED

Channel 39 / 2441 MHz

Quasi peak (RBW: 120 kHz)

Frequency [MHz]	E [dBµV/m]	E [µV/m]	U _{RX} [dBµV]	A _{CF} [dB]	Polarisation	Result
131.42	18.60	8.51	50.00	-31.40	VERTICAL	PASSED

Peak (RBW: 1 MHz)

Frequency [MHz]	E [dBµV/m]	E [µV/m]	U _{RX} [dBµV]	A _{CF} [dB]	Polarisation	Result
4881.77	62.60	1349	78.80	-16.20	VERTICAL	PASSED
7325.16	42.40	132	51.20	-8.80	HORIZONTAL	PASSED
17877.25	54.10	507	49.20	4.90	HORIZONTAL	PASSED

Average (RBW: 1 MHz)

Frequency [MHz]	E [dBµV/m]	E [µV/m]	U _{RX} [dBµV]	A _{CF} [dB]	Polarisation	Result
4882.27	52.80	437	59.00	-16.20	VERTICAL	PASSED
7326.66	29.30	29.2	38.10	-8.80	HORIZONTAL	PASSED
17875.25	41.20	115	36.70	4.90	HORIZONTAL	PASSED

No further emissions found less than 20dB to the regulatory limit

Channel 78 / 2480 MHz

Peak (RBW: 1 MHz)

Frequency [MHz]	E [dBµV/m]	E [µV/m]	U _{RX} [dBµV]	A _{CF} [dB]	Polarisation	Result
4959.92	61.00	1122	77.00	-16.00	VERTICAL	PASSED
7435.37	42.80	138	49.70	-6.90	VERTICAL	PASSED
17740.48	55.10	569	49.30	5.80	VERTICAL	PASSED

Average (RBW: 1 MHz)

Frequency [MHz]	E [dBµV/m]	E [µV/m]	U _{RX} [dBµV]	A _{CF} [dB]	Polarisation	Result
4959.92	52.30	412	68.30	-16.00	VERTICAL	PASSED
7436.37	30.20	32.4	37.10	-6.90	VERTICAL	PASSED
17739.98	41.80	123	36.00	5.80	VERTICAL	PASSED

No further emissions found less than 20dB to the regulatory limit

7. AC powerline conducted emissions (FCC §15.207, RSS-GEN 7.2.2)

EUT with DUT number	LIL003
Accessories with DUT numbers	None
Operation Voltage [V] / [Hz]	115 / 60
Result	PASSED
Remarks	None
Temp [°C] / Humidity [%RH]	23.8 / 56.5
Date of measurements	28-Sep-2011
Measured by	Robert Müller

7.1. Test method and limit

The measurement is made according to Public notice DA 00-705 and IC standard RSS-GEN as follows:

The EUT is placed on a wooden table 80 cm above the reference ground plane.

The EUT is connected via LISN to a test power supply.

The measurement results are obtained as described below:

$$U [\text{dB}\mu\text{V}] = U_{RX} + A_{CF}$$

Where U_{RX} is receiver reading and A_{CF} is total correction factor including cable and attenuator.

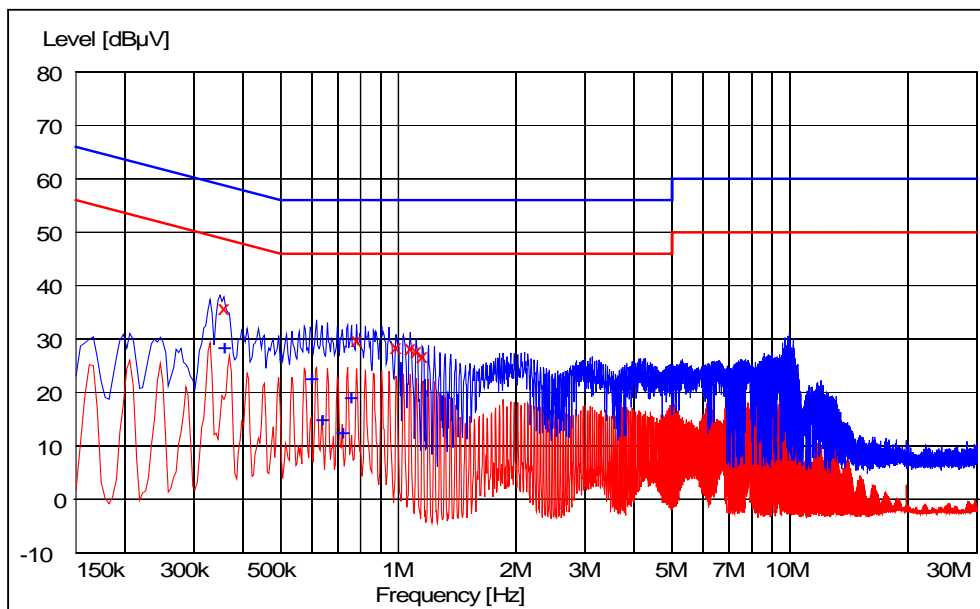
CISPR 22 Class B limits

Frequency range [MHz]	Quasi peak limit [dBμV]	Average limit [dBμV]
0.15 - 0.5	66 - 56	56 - 46
0.5 - 5	56	46
5 - 30	60	50

7.2. Bluetooth Test results

7.2.1 GFSK modulation, PRBS packet type

Channel 39 / 2441 MHz



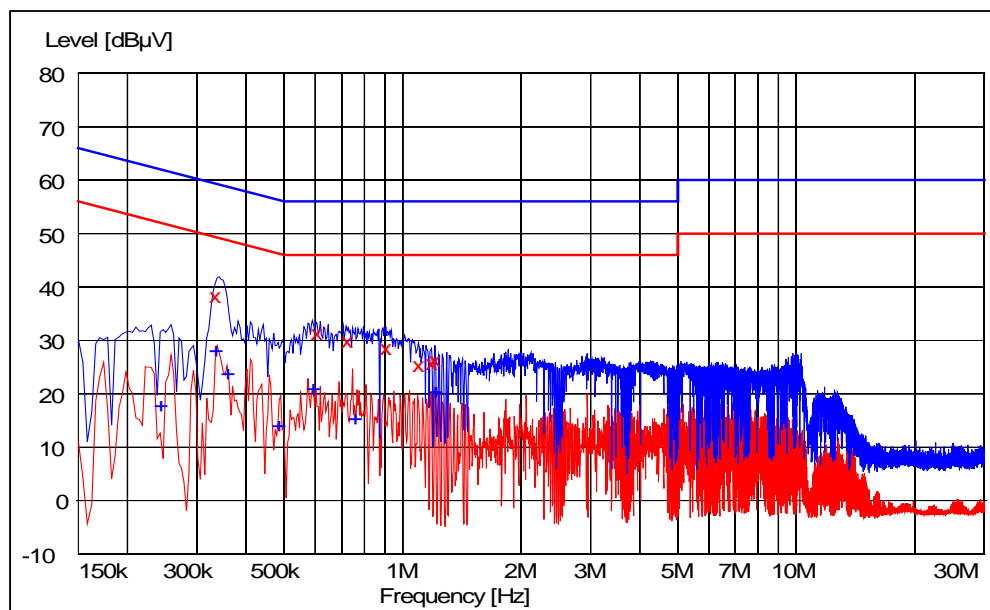
Quasi peak (RBW: 9 kHz)

Frequency [MHz]	U [dBμV]	Line	Result
358	36.20	L1	PASSED
782	30.20	L1	PASSED
986	28.90	L1	PASSED
1070	28.80	L1	PASSED
1110	28.10	L1	PASSED
1150	27.30	L1	PASSED

Average (RBW: 9 kHz)

Frequency [MHz]	U [dBμV]	Line	Result
358	28.90	L1	PASSED
598	23.10	L1	PASSED
638	15.40	L1	PASSED
718	13.00	L1	PASSED
754	19.60	L1	PASSED

Channel 39 / 2441 MHz



Quasi peak (RBW: 9 kHz)

Frequency [MHz]	U [dBμV]	Line	Result
334	38.70	N	PASSED
606	31.70	N	PASSED
722	30.20	N	PASSED
906	29.00	N	PASSED
1098	25.80	N	PASSED
1182	26.10	N	PASSED
1210	26.70	N	PASSED

Average (RBW: 9 kHz)

Frequency [MHz]	U [dBμV]	Line	Result
242	18.40	N	PASSED
334	28.50	N	PASSED
358	24.20	N	PASSED
482	14.50	N	PASSED
590	21.50	N	PASSED
754	15.80	N	PASSED
1210	20.90	N	PASSED

8. 20 dB bandwidth

(FCC §15.247(a)(1), RSS-210 A8.1 (a))

EUT with DUT number	LIL004
Accessories with DUT numbers	None
Operation Voltage [V] / [Hz]	3.7 / DC
Result	PASSED
Remarks	None
Temp [°C] / Humidity [%RH]	25 / 50
Date of measurements	05-Oct-2011
Measured by	Robert Müller

8.1. Test method and limit

The measurement is made according to Public notice DA 00-705 and IC standard RSS-210.

Limits for 20 dB bandwidth measurements

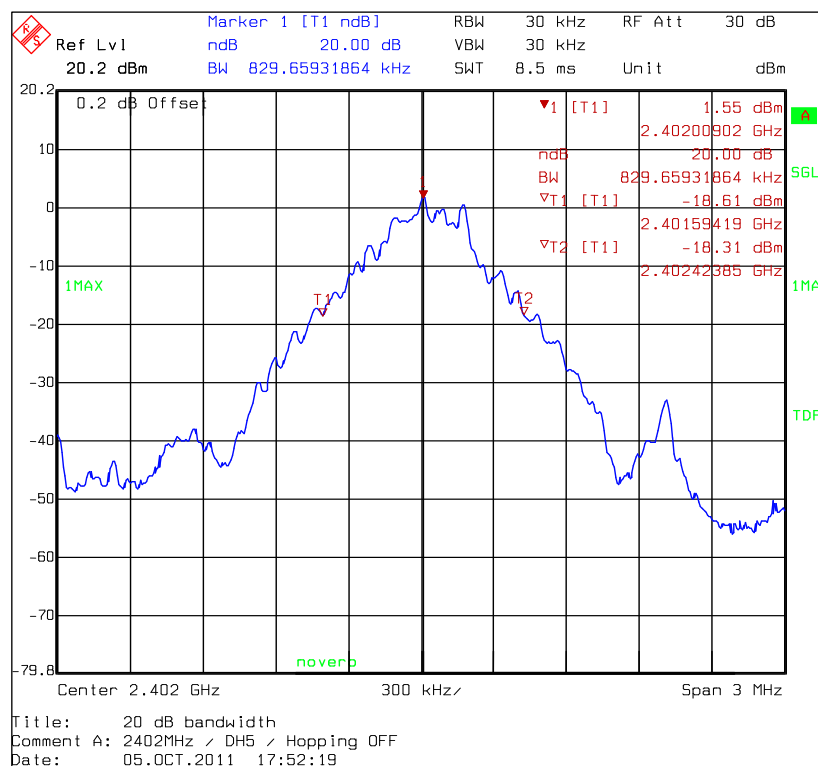
Limit [MHz]
N/A

8.2. Bluetooth Test results

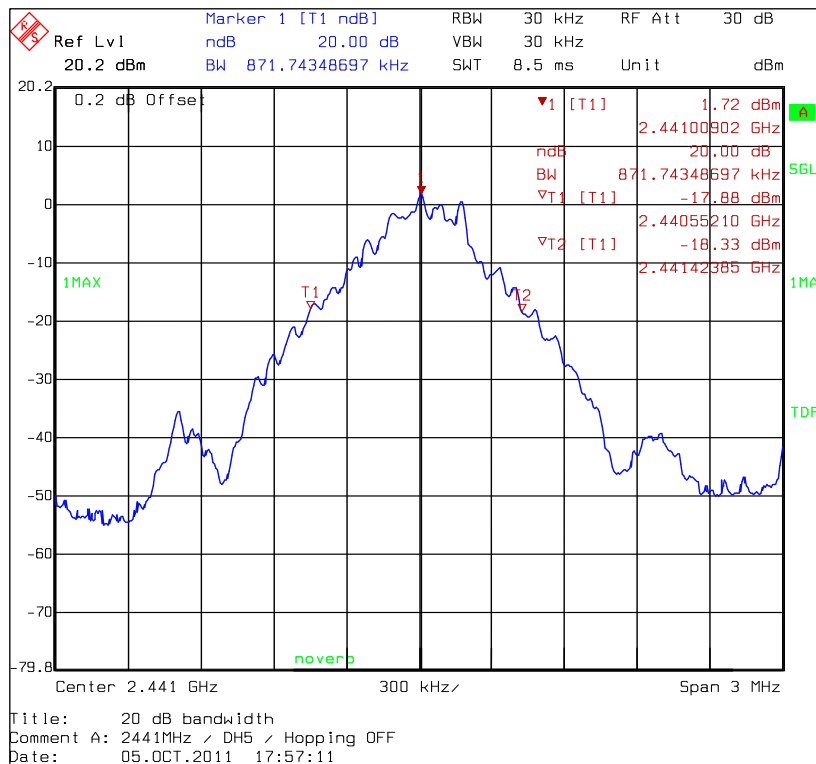
8.2.1 GFSK modulation, PRBS packet type

Channel / f_c [MHz]	20 dB bandwidth [kHz]	Result
0 / 2402	829.66	PASSED
39 / 2442	871.74	PASSED
78 / 2480	829.66	PASSED

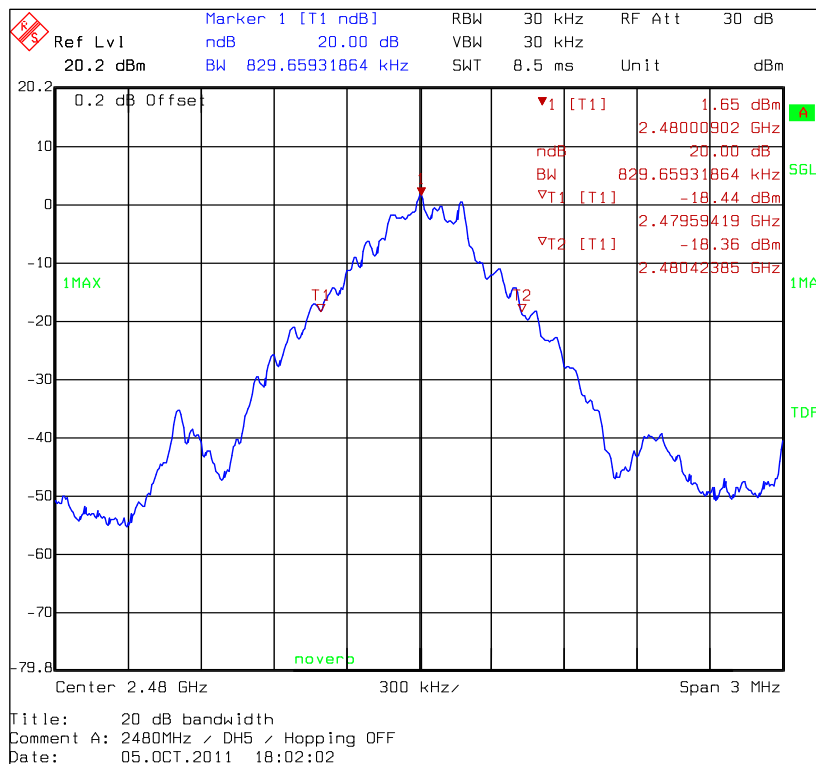
Channel 0 / 2402 MHz



Channel 39 / 2442 MHz



Channel 78 / 2480 MHz



9. Carrier frequency separation

(FCC §15.247(a)(1), RSS-210 A8.1 (b))

EUT with DUT number	LIL004
Accessories with DUT numbers	None
Operation Voltage [V] / [Hz]	3.7 / DC
Result	PASSED
Remarks	None
Temp [°C] / Humidity [%RH]	25 / 50
Date of measurements	05-Oct-2011
Measured by	Robert Müller

9.1. Test method and limit

The measurement is made according to Public notice DA 00-705 and IC standard RSS-210.

Limits for carrier frequency separation measurements

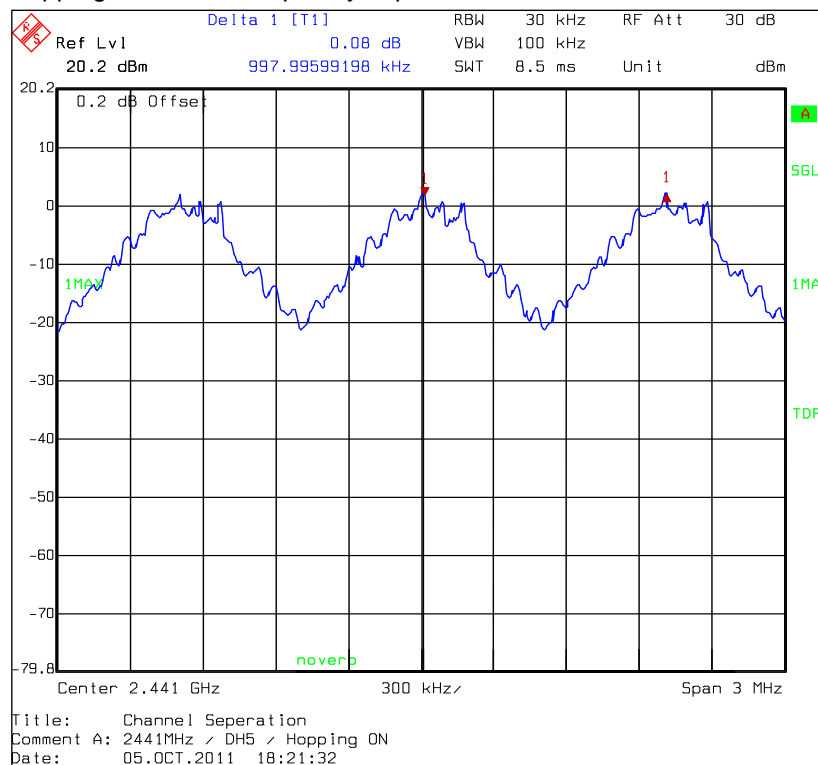
Limit [MHz]
≥ 0.025 or $2/3$ of the 20 dB bandwidth

9.2. Bluetooth Test results

9.2.1 GFSK modulation, PRBS packet type

Carrier frequency separation [kHz]	Result
998	PASSED

Hopping on, carrier frequency separation of channels 39 / 2441 MHz and 39 / 2442 MHz



Number of hopping frequencies

(FCC §15.247(a)(1)(iii), RSS-210 A8.1 (d))

EUT with DUT number	LIL004
Accessories with DUT numbers	None
Operation Voltage [V] / [Hz]	3.7 / DC
Result	PASSED
Remarks	None
Temp [°C] / Humidity [%RH]	25 / 50
Date of measurements	05-Oct-2011
Measured by	Robert Müller

9.3. Test method and limit

The measurement is made according to Public notice DA 00-705 and IC standard RSS-210.

Limits for number of hopping frequencies measurements

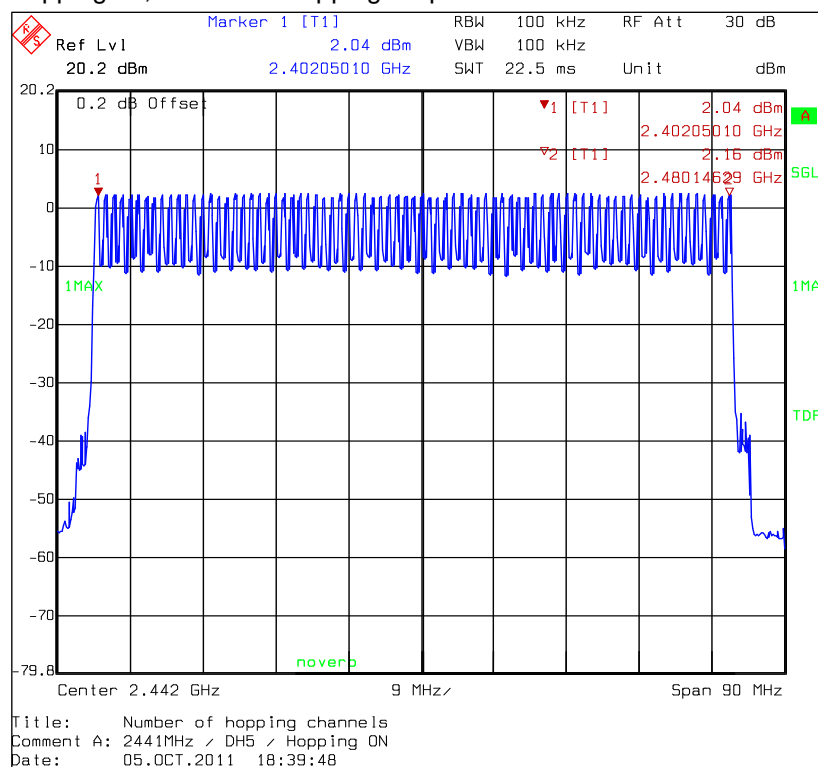
Limit [number]
≥ 15

9.4. Bluetooth Test results

9.4.1 GFSK modulation, PRBS packet type

Measured number of hopping frequencies	Result
79	PASSED

Hopping on, number of hopping frequencies



10. Time of occupancy (FCC §15.247(a)(1)(iii), RSS-210 A8.1 (d))

EUT with DUT number	LIL004
Accessories with DUT numbers	None
Operation Voltage [V] / [Hz]	3.7 / DC
Result	PASSED
Remarks	None
Temp [°C] / Humidity [%RH]	25 / 50
Date of measurements	05-Oct-2011
Measured by	Robert Müller

10.1. Test method and limit

The measurement is made according to Public notice DA 00-705 and IC standard RSS-210 as follows:

The total time of occupancy is get by multiplying the measured number of transmissions occurred during 31.6 second period with the duration of one transmission.

Limits for time of occupancy measurements

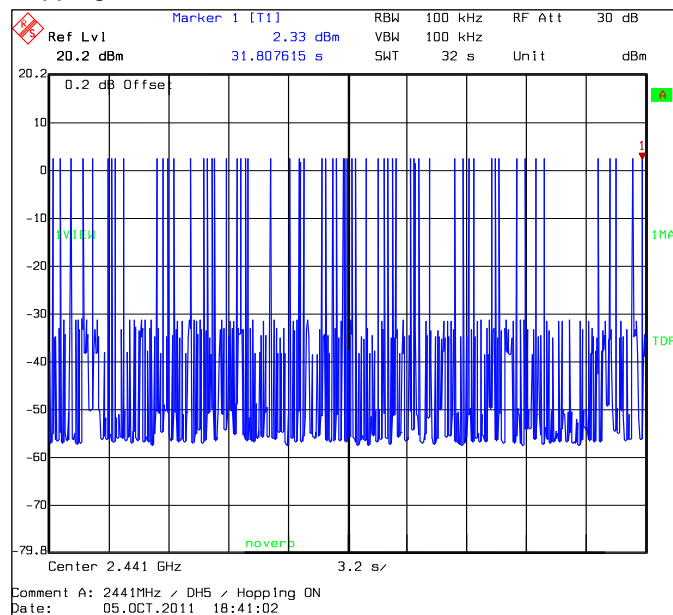
Limit [s]
≤ 0.4

10.2. Bluetooth test results

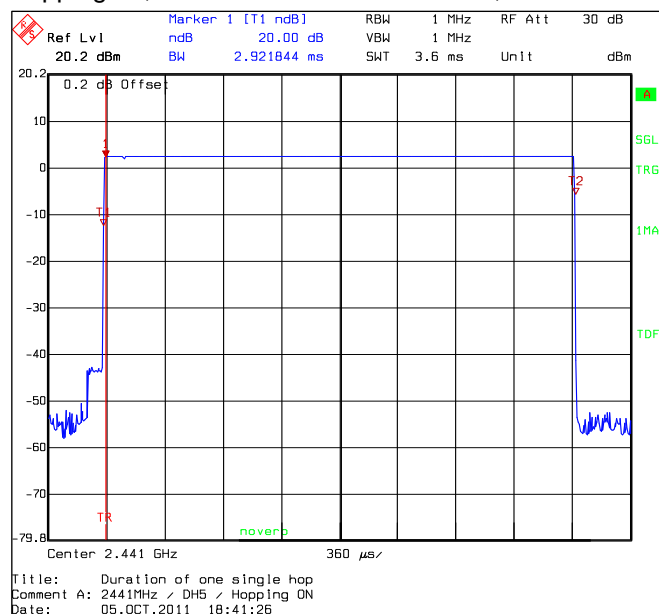
10.2.1 GFSK modulation, PRBS packet type

Measured number of transmissions	Duration of one transmission [μs]	Time of occupancy [s]	Result
61	2929	0.178669	PASSED

Hopping on, number of transmissions, channel 39 / 2441 MHz, DH5



Hopping on, duration of one transmission, channel 39 / 2441 MHz, DH5



11. Test Equipment

11.1. Conducted measurements

Equipment	Type	Manufacturer	Calibrated	Cycle [Years]
EMI Test Receiver	ESCS 30	R&S	May 2011	1
LISN 50 µH	ESH3-Z5	R&S	Jul 2011	1
LISN 50 µH	ESH3-Z5	R&S	Jul 2011	1
V network	ESH3-Z6	R&S	May 2011	1
V network	ESH3-Z6	R&S	May 2011	1
T-ISO	ISN T800	Teseq	Jul 2010	2
Thermo- Hygrograph	OPUS 10	Lufft	Jun 2011	2
EM Injection clamp	F-33-1	Fischer	Feb 2011	2
Signal generator	SML01	R&S	Feb 2010	2
Digital Radio Communication Tester	CMU200	R&S	Feb 2010	2
Bluetooth Tester	MT8850A	Anritsu	Feb 2010	2
RF Emission Software	ES-K1 v.1.71	R&S	n.a.	--
EMI Test Receiver	FSEM30	R&S	Jul 2011	1
Temperature Test system	VT4004	Vötsch	May 2010	2
Power Supply	E3632A	Agilent	May 2011	2
Signal generator	SMP02	R&S	Jun 2011	2
Bluetooth/WLAN Tester	N 4010 A	Agilent	May 2011	2
RF Radio Software	RADIO	novero	n.a.	--

11.2. Radiated measurements

Equipment	Type	Manufacturer	Calibrated	Cycle [Years]
Controller	2090	ETS	n.a.	--
MAST	2075	ETS	n.a.	--
Ultra Broadband Antenna	HL562	R&S	May 2009	3
Digital Radio Communication Tester	CMU200	R&S	Jul 2011	2
EMI Test receiver	ESIB26	R&S	May 2011	1
Yaesu controller	G-1000DXC	YAESU	n.a.	--
Computer controller (Yaesu)	GS-232B	YAESU	n.a.	--
Anechoic chamber	3 meter semi/full anechoic chamber	ETS Euroshield	Mar 2011	3
Horn Antenna	3115	EMCO	Jun 2009	3
Standard Horn Antenna	3160-09	EMCO	n.a.	--
Thermo- Hygrograph	OPUS 10	Lufft	Jun 2011	2
Band Reject Filter	WRCG 2400/2485 - 2375/2510 - 60/20EE	Wainwright	Jun 2011	1
Notch Filter GSM850	WRCD 800/880-0,2/40-5SSSD	Wainwright	Jun 2011	1
Notch Filter GSM1900	WRCD 1700/2000-0,2/40-5SSSD	Wainwright	Jun 2011	1
Bluetooth Tester	MT8850A	Anritsu	Feb 2010	2
RF Emission Software	ES-K1 v.1.71	R&S	n.a.	--