

FCC Part 15C Compliance Test Report

Test Report no.:	Tre_FCC_0519_01.doc	Date of Report:	13.06.2005
Number of pages:	27	Customer's Contact person:	Ulla Valjakka
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FCC listing no.:	94436		
IC recognition no.:	3608		
Tested devices/ accessories:	GSM phone RM-109 / Battery BL-5C, AC-charger ACP-12U		
FCC ID:	QVVRM-109	IC:	661AE-RM109
Supplement reports:			
Testing has been carried out in accordance with:	CFR 47, FCC rules Part 15 Subpart C, ANSI C63.4 (2003) and IC standard RSS-210. Deviations, modifications or clarifications (if any) to above mentioned documents are written in each section under "Test method and limit".		
Documentation:	The test report must always be reproduced in full; reproduction of an excerpt only is subject to written approval of the testing laboratory. The documentation of the testing performed on the tested devices is archived for 15 years at TCC Nokia.		
Test Results:	The EUT complies with the requirements in respect of all parameters subject to the test. The test results relate only to devices specified in this document.		
Date and signature for the contents:			

1. Summary for FCC Part 15C Compliance Test Report

Date of receipt	4.5.2005
Testing completed	18.5.2005
The customer's contact person	Ulla Valjakka
Test Plan referred to	T:\Projects\RM-109\EMC\Test Plans\RM-109 EMC Testplan V0.2.xls
Notes	-
Document name	E:\Projects\RM-109\EMC\Results\FCC\Tre_FCC_0519_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
Phone	RM-109	35430003363737	5440	-	1.15.0 5	40251
Phone	RM-109	354350003363810	5440	-	1.15.0 5	40250
Battery	BL-5C		7.0	-	-	40104
Charger	ACP-12		1.3	-	-	40252
USB cable	DKU-2				-	40256
Laptop	DELL LATITUDE D600	0009321C-12800-8A5- 2913	-	-	-	40085
Laptop charger	PA-12	00085391	-	-	-	40086
Printer	HP deskjet 1600CC3540A	USB8302546	-	-	-	40077
Digital camera	FUJI DS-7	7102516	-	-	-	40076
Serial cable for camera	-	-	-	-	-	40088
Parallel cable for printer	-	-	-	-	-	40087

1.2. Summary of Test Results

Bluetooth:

Section in CFR 47	Section in RSS-210	Name of the test	Result
15.247(b)(1)	6.2.2(o)(a3)	Peak output power	Passed
15.247(c)	6.2.2 (o)(e1)	Band edge compliance of RF emissions	Passed
15.247(c)	6.2.2 (o)(e1)	Spurious RF conducted emissions	Passed
15.247(c), 15.209	6.2.2 (o)(e1)	Spurious radiated emissions	Passed
15.207	6.6	AC powerline conducted emissions	Passed
15.247(a)(1)	6.2.2(o)(a3)	20 dB bandwidth	Passed
15.247(a)(1)	6.2.2(o)(a1)	Carrier frequency separation	Passed
15.247(a)(1)(iii)	Amend I(ii)	Number of hopping frequencies	Passed
15.247(a)(1)(iii)	Amend I(ii)	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 by the TCC Nokia Tampere Laboratory.

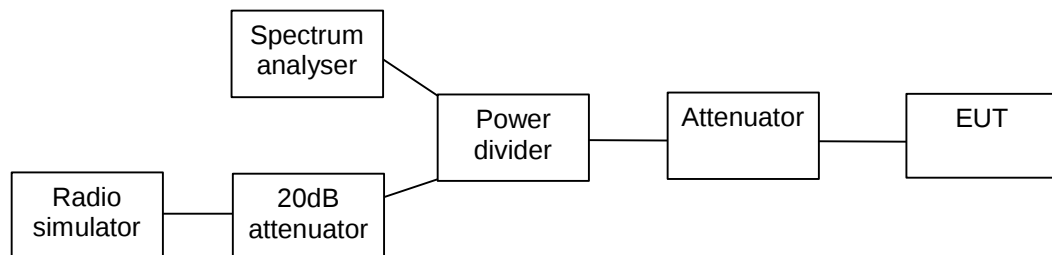
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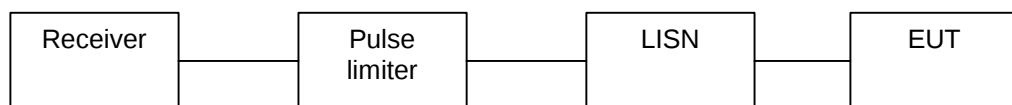
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2. Test setups

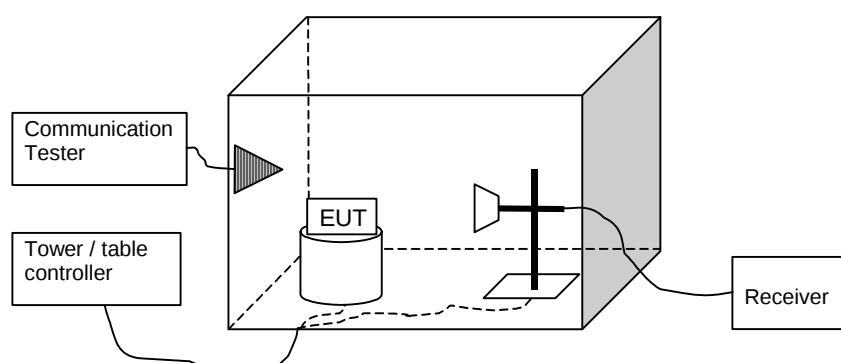
2.1. Conducted RF test setup



2.2. AC powerline conducted emissions test setup



2.3. Spurious radiated emissions test setup



3. Peak output power (FCC §15.247(b)(1), RSS-210 6.2.2(o)(a3))

EUT with DUT number	RM-109 DUT 40251
Accessories with DUT numbers	BL-5C DUT 40104
Operation Voltage V / Hz	-
Result	Passed
Remarks	
Temp °C / Humidity RH % / Air Pressure kPa	23/39/102.0
Date of measurements	13.05.2005
Measured by	Jan-Erik Lilja

3.1. Test method and limit

The measurement is made according to FCC rules part 15.247 and IC standard RSS-210.

Limits for peak output power measurements

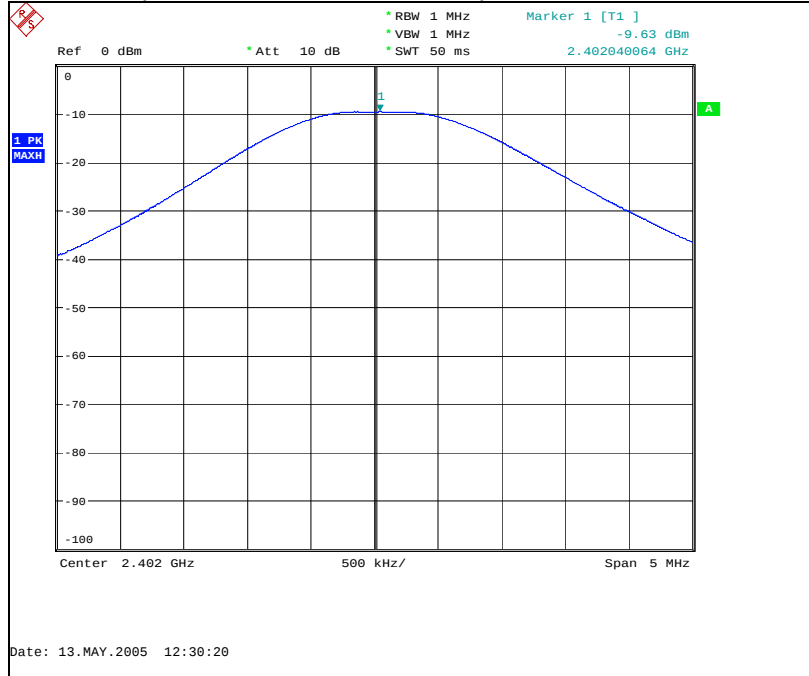
Frequency range / MHz	Limit / W	Limit / dBm
2400 – 2483.5	≤ 1	≤ 30

3.2. Bluetooth Test results

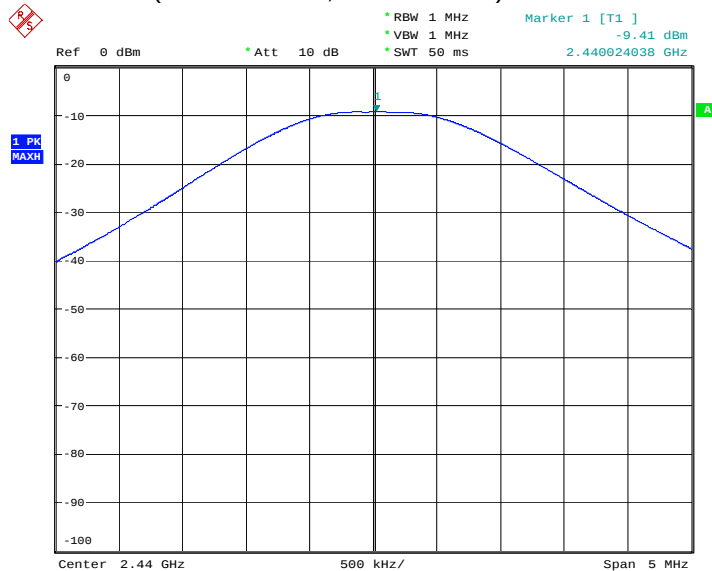
3.2.1 GSFK modulation, PRBS packet type

Channel	Frequency / MHz	Level / dBm	Level / W	A _{CORRECTION} / dB	Result
0	2402.0	1.35	0.00136	10.98	Passed
38	2440.0	1.71	0.00148	11.12	Passed
78	2480.0	2.04	0.00160	10.80	Passed

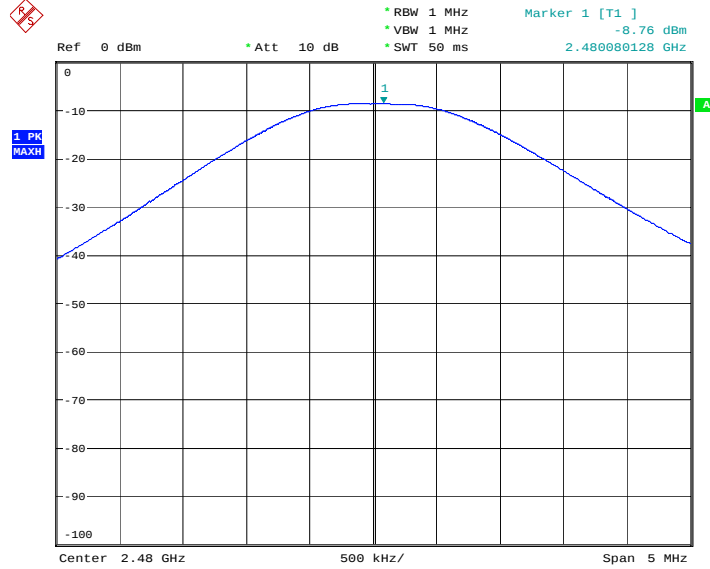
Channel 0 (Peak detector, RBW: 1 MHz)



Channel 38 (Peak detector, RBW: 1 MHz)



Channel 78 (Peak detector, RBW: 1 MHz)



Date: 13.MAY.2005 12:33:14

4. Band edge compliance of RF emissions (FCC §15.247(c), RSS-210 6.2.2(o)(e1))

EUT with DUT number	RM-109 DUT 40250
Accessories with DUT numbers	BL-5C DUT 40104, ACP-12 DUT 40252
Operation Voltage V / Hz	115/60
Result	Passed
Remarks	-
Temp °C / Humidity RH % / Air Pressure kPa	27/40/100.1
Date of measurements	6.5.2005
Measured by	Jari Jantunen

4.1. Test method and limit

The measurement is made according to FCC rules part 15.247 and IC standard RSS-210.

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

Frequency range / MHz	Limit / dBμV/m
Below 2390 and above 2483.5	≤ 54

4.2. Bluetooth Test results

4.2.1 GFSK modulation, PRBS packet type

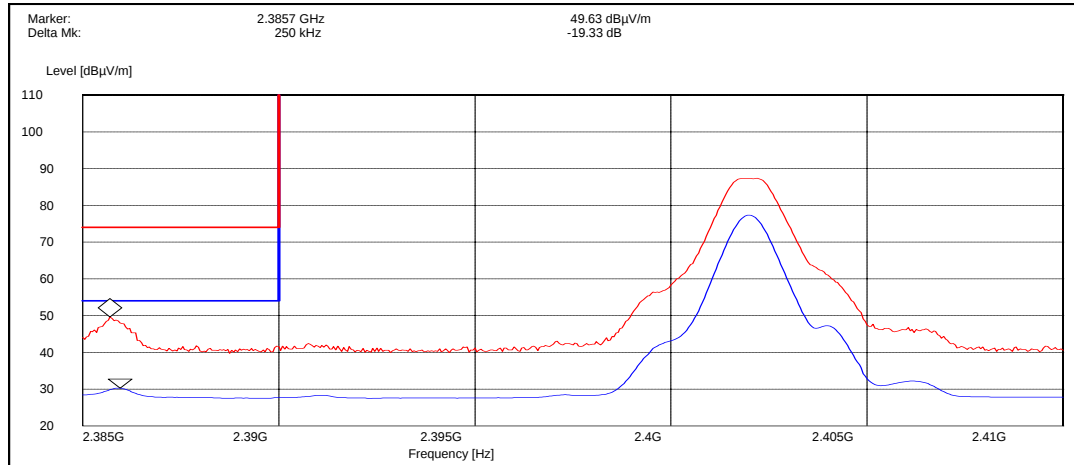
Average (RBW: 1 MHz)

Channel	Level / dBμV/m	Result
0	30.3	Passed
78	39.7	Passed
Hopping on, low end	28.0	Passed
Hopping on, high end	37.5	Passed

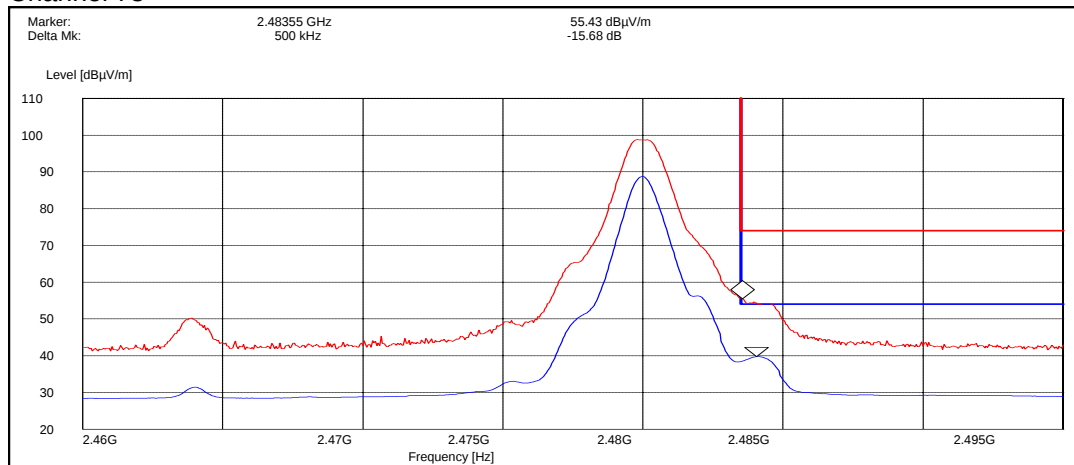
Peak (RBW: 1 MHz)

Channel	Level / dBμV/m	Result
0	49.6	Passed
78	55.4	Passed
Hopping on, low end	49.8	Passed
Hopping on, high end	64.7	Passed

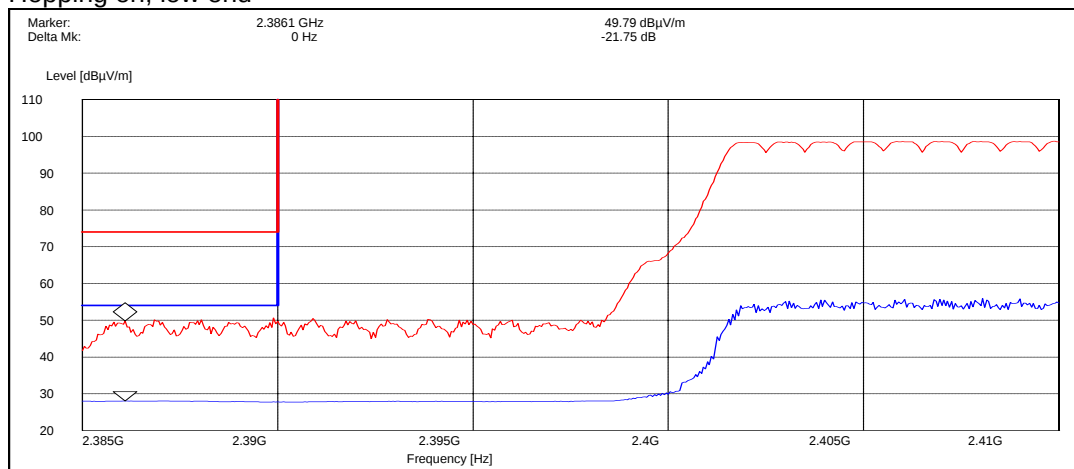
Channel 0



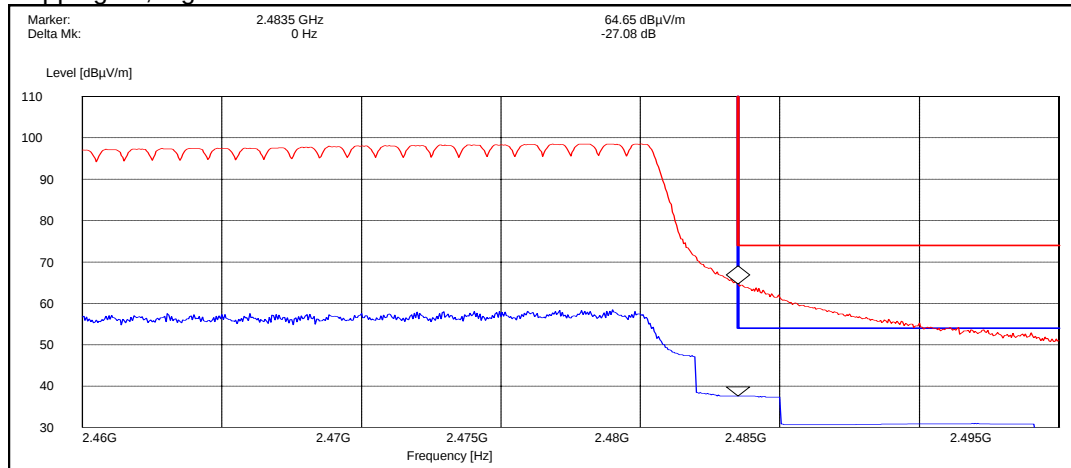
Channel 78



Hopping on, low end



Hopping on, high end



5. Spurious RF conducted emissions (FCC §15.247(c), RSS-210 6.2.2(o)(e1))

EUT with DUT number	RM-109 DUT 40251
Accessories with DUT numbers	BL-5C DUT 40140
Operation Voltage V / Hz	-
Result	Passed
Remarks	-
Temp °C / Humidity RH % / Air Pressure kPa	23/39/102.0
Date of measurements	13.05.2005
Measured by	Jan-Erik Lilja

5.1. Test method and limit

The measurement is made according to FCC rules part 15.247 and IC standard RSS-210.

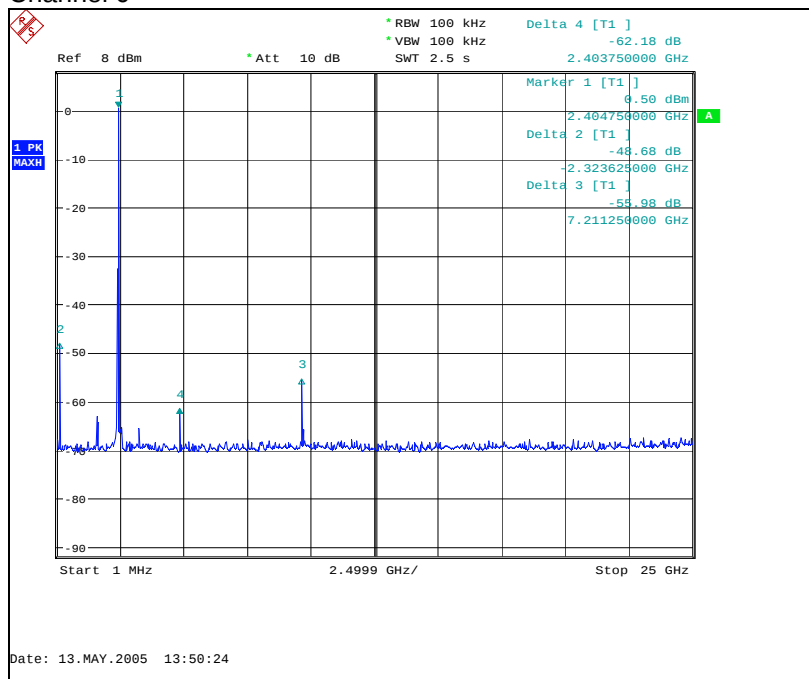
Limits for spurious RF conducted emissions measurements

Frequency range / MHz	Limit / dBc
1 – 25000	≤ -20

5.2. Bluetooth Test results

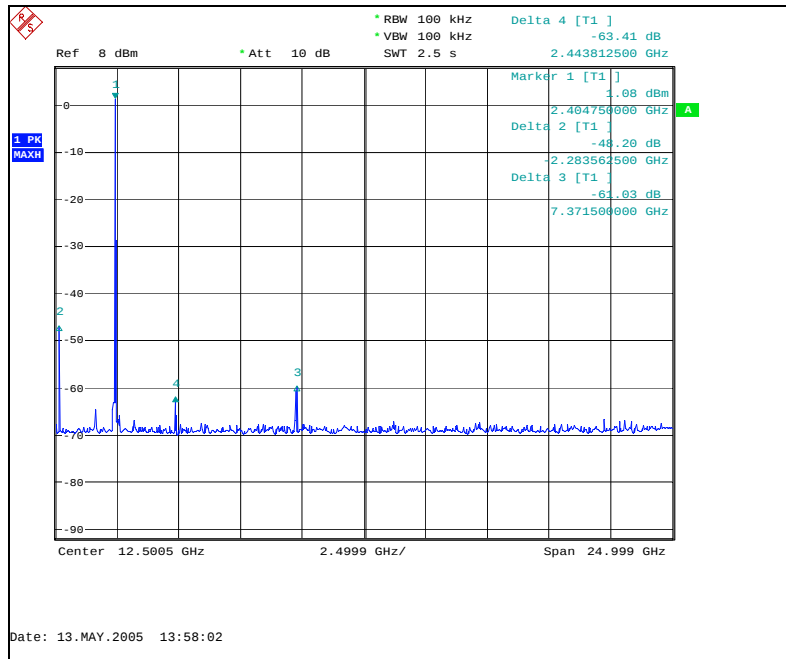
5.2.1 GFSK modulation, PRBS packet type

Channel 0



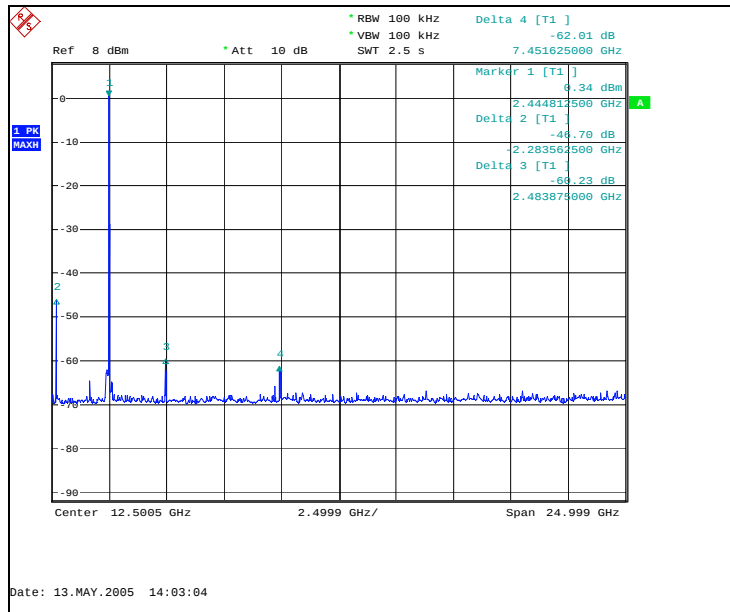
Frequency / MHz	Level / dBc	Result
81.125	-49.18	Passed
4808.5	-62.68	Passed
9616.0	-53.48	Passed

Channel 38



Frequency / MHz	Level / dBc	Result
121.188	-49.28	Passed
4848.563	-64.49	Passed
9776.25	-62.11	Passed

Channel 78



Frequency / MHz	Level / dBc	Result
161.25	-47.04	Passed
4928.69	-60.57	Passed
9696.44	-32.35	Passed

6. Spurious radiated emissions (FCC §15.247(c), §15.209, RSS-210 6.2.2(o)(e1))

EUT with DUT number	RM-109 DUT 40250
Accessories with DUT numbers	BL-5C DUT 40104, ACP-12 DUT 40252
Operation Voltage V / Hz	115/60
Result	Passed
Remarks	-
Temp °C / Humidity RH % / Air Pressure kPa	27/40/100.1
Date of measurements	6.5.2005
Measured by	Jan-Erik Lilja

6.1. Test method and limit

The measurement is made according to FCC rules part 15.247 and IC standard RSS-210 as follows:

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

The suspected frequencies are searched for in Preliminary Measurement with absorbers on the floor and measuring antenna at fixed height using 2-axis EUT position system.

The Final Measurement is performed in the Semi-Anechoic Chamber with conducting metal floor, if the Preliminary Measurement results are closer than 20 dB to the permissible value.

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

For each suspected frequency, the turntable is rotated 360 degrees and antenna is scanned from 1 to 4 m. This is repeated for both horizontal and vertical receive antenna polarizations.

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

The measurement results are obtained as described below:

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

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

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

Frequency range / MHz	Limit / $\mu\text{V/m}$	Limit / $\text{dB}\mu\text{V/m}$	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

Peak (RBW: 1 MHz)

Frequency / MHz	Level / $\text{dB}\mu\text{V/m}$	Level / $\mu\text{V/m}$	$A_{\text{CORRECTION}}$ / dB	Polarisation	Result
4946.393788	42.30	130.32	-1.60	VERTICAL	Passed
7276.045090	42.80	138.04	2.20	VERTICAL	Passed
7415.839679	43.60	151.36	2.40	VERTICAL	Passed
7938.369739	44.00	158.49	3.30	VERTICAL	Passed

Average (RBW: 1 MHz)

Frequency / MHz	Level / $\text{dB}\mu\text{V/m}$	Level / $\mu\text{V/m}$	$A_{\text{CORRECTION}}$ / dB	Polarisation	Result
4946.393788	29.40	29.51	-1.60	VERTICAL	Passed
7270.045090	30.00	31.62	2.20	VERTICAL	Passed
7421.339679	30.10	31.99	2.50	VERTICAL	Passed
7890.281563	30.50	33.50	3.20	VERTICAL	Passed

Channel 40

Quasi peak (RBW: 120 kHz)

Frequency / MHz	Level / $\text{dB}\mu\text{V/m}$	Level / $\mu\text{V/m}$	$A_{\text{CORRECTION}}$ / dB	Polarisation	Result
37.895391	19.50	9.44	-30.10	VERTICAL	Passed

Peak (RBW: 1 MHz)

Frequency / MHz	Level / $\text{dB}\mu\text{V/m}$	Level / $\mu\text{V/m}$	$A_{\text{CORRECTION}}$ / dB	Polarisation	Result
4946.393788	42.00	125.89	-1.60	VERTICAL	Passed
7272.039078	42.80	138.04	2.20	HORIZONTAL	Passed
7278.557114	43.10	142.89	2.20	HORIZONTAL	Passed
7422.839679	42.90	139.64	2.50	VERTICAL	Passed
7873.749499	43.20	144.54	3.30	HORIZONTAL	Passed

Average (RBW: 1 MHz)

Frequency / MHz	Level / dBμV/m	Level / μV/m	A _{CORRECTION} / dB	Polarisation	Result
4945.893788	30.10	31.99	-1.60	VERTICAL	Passed
7269.539078	30.00	31.62	2.20	HORIZONTAL	Passed
7277.557114	30.10	31.99	2.20	HORIZONTAL	Passed
7417.839679	30.00	31.62	2.50	VERTICAL	Passed

Channel 78

Peak (RBW: 1 MHz)

Frequency / MHz	Level / dBμV/m	Level / μV/m	A _{CORRECTION} / dB	Polarisation	Result
4946.393788	42.50	133.35	-1.60	VERTICAL	Passed
7253.007014	42.30	130.32	2.00	HORIZONTAL	Passed
7271.535070	42.60	134.90	2.20	VERTICAL	Passed
7331.667335	42.80	138.04	2.30	HORIZONTAL	Passed
7422.839679	42.80	138.04	2.50	VERTICAL	Passed

Average (RBW: 1 MHz)

Frequency / MHz	Level / dBμV/m	Level / μV/m	A _{CORRECTION} / dB	Polarisation	Result
4946.393788	29.00	28.18	-1.60	VERTICAL	Passed
7257.007014	29.60	30.20	2.00	HORIZONTAL	Passed
7271.035070	30.00	31.62	2.20	VERTICAL	Passed
7333.667335	30.00	31.62	2.30	HORIZONTAL	Passed
7420.839679	30.10	31.99	2.50	VERTICAL	Passed
7956.905812	30.50	33.50	3.20	VERTICAL	Passed

7. AC powerline conducted emissions (FCC §15.207, RSS-210 6.6)

EUT with DUT number	Phone: DUT 40250
Accessories with DUT numbers	Battery: DUT 40140 Charger: DUT 40252 USB cable: DUT 40256 Laptop: DUT 40085 Laptop charger: DUT 40086 Printer: DUT 40077 Digital camera: DUT 40076 Serial cable: DUT 40088 Parallel cable: DUT 40087
Operation Voltage V / Hz	115/60
Result	Passed
Remarks	-
Temp °C / Humidity RH % / Air Pressure kPa	20/50/101.9
Date of measurements	12.05.2005
Measured by	Jan-Erik Lilja

7.1. Test method and limit

The measurement is made according to FCC rules part 15.247 and IC standard RSS-210 as follows:

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

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

The measurement results are obtained as described below:

$$U [\mu V] = U_{RX} + A_{CORRECTIONS}$$

Where U_{RX} is receiver reading and $A_{CORRECTIONS}$ is combined correction factor including cable and pulse limiter attenuations.

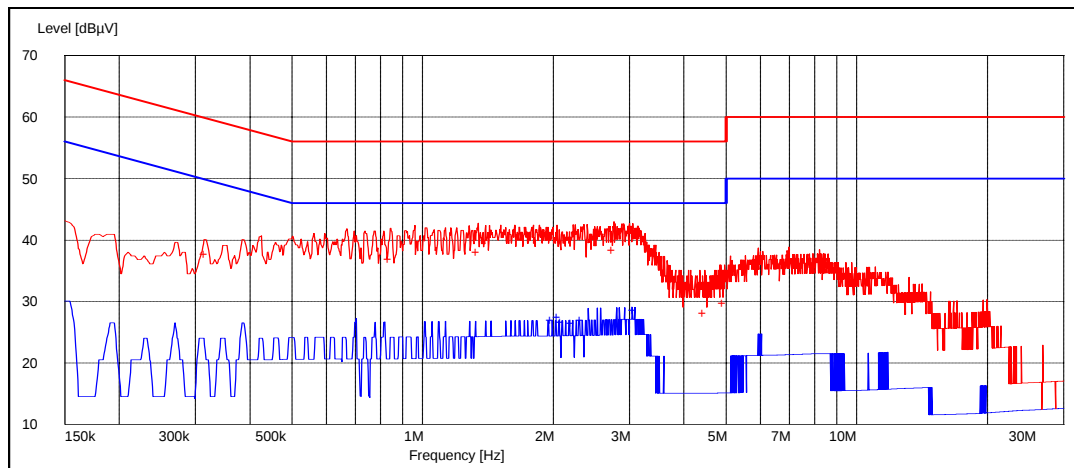
CISPR 22 Class B limits

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 38



Quasi peak (RBW: 9 kHz)

Frequency / MHz	Level / dBμV	Line	Result
0.316834	37.70	N	Passed
0.843287	36.90	N	Passed
1.343788	38.00	N	Passed
2.757515	38.30	N	Passed
4.470942	28.10	N	Passed
4.963928	29.70	N	Passed

Average (RBW: 9 kHz)

Frequency / MHz	Level / dBμV	Line	Result
1.988878	27.00	N	Passed
2.066132	27.50	N	Passed
2.102204	26.70	N	Passed
2.216433	26.50	N	Passed
2.336673	27.00	N	Passed
3.082164	28.60	N	Passed

8. 20 dB bandwidth (FCC §15.247(a)(1), RSS-210 6.2.2(o)(a3))

EUT with DUT number	RM-109 DUT 40251
Accessories with DUT numbers	BL-5C DUT 40140
Operation Voltage V / Hz	-
Result	Passed
Remarks	-
Temp °C / Humidity RH % / Air Pressure kPa	23/39/102.0
Date of measurements	13.05.2005
Measured by	Jan-Erik Lilja

8.1. Test method and limit

The measurement is made according to FCC rules part 15.247 and IC standard RSS-210.

Limits for 20 dB bandwidth measurements

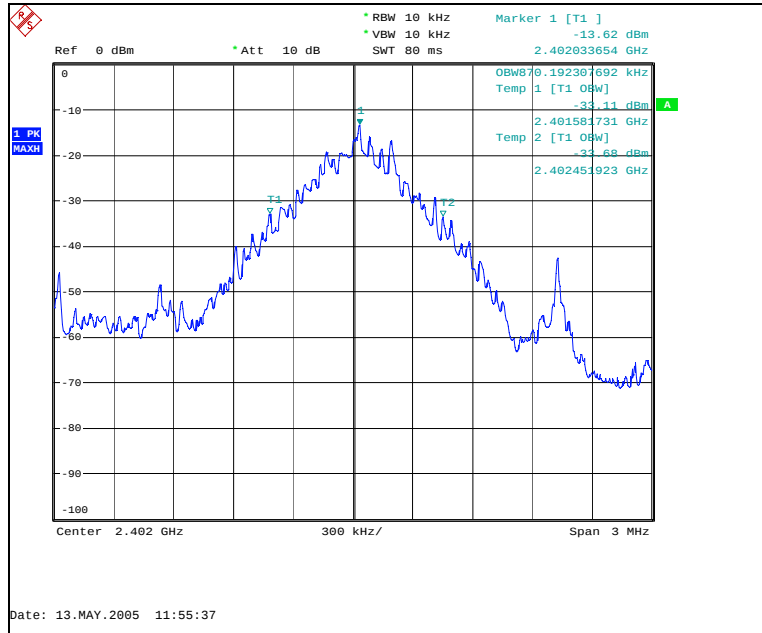
Limit / MHz
≤ 1

8.2. Bluetooth Test results

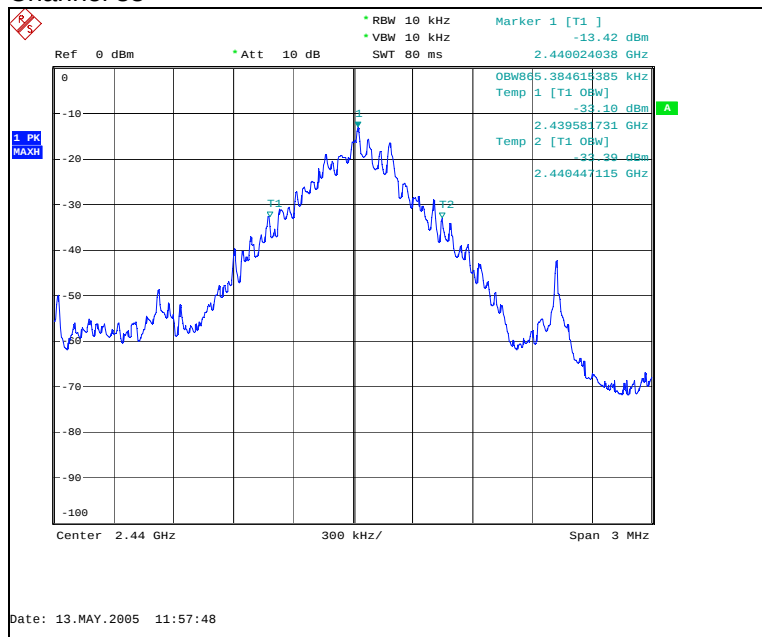
8.2.1 GFSK modulation, PRBS packet type

Channel	20 dB bandwidth / kHz	Result
0	870.19	Passed
38	865.39	Passed
78	870.19	Passed

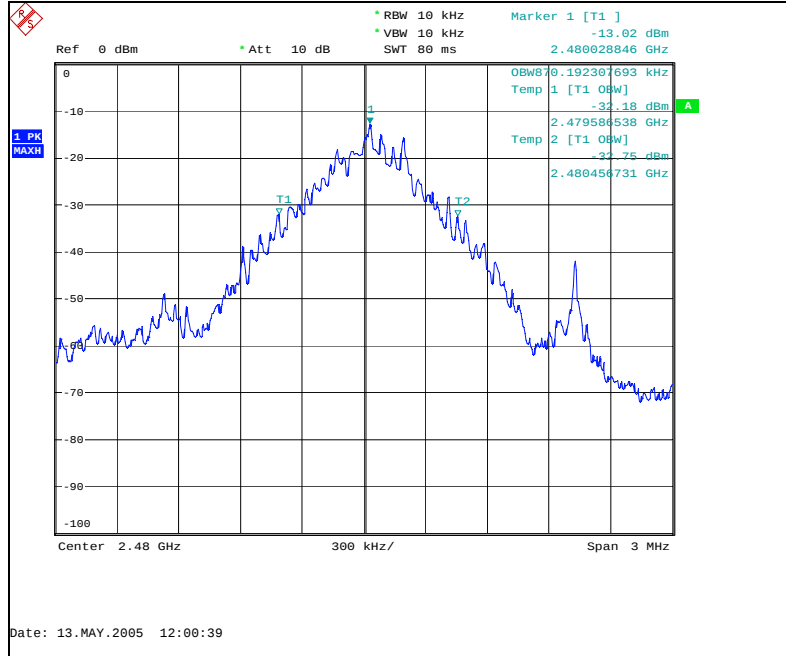
Channel 0



Channel 38



Channel 78



9. Carrier frequency separation (FCC §15.247(a)(1), RSS-210 6.2.2(o)(a1))

EUT with DUT number	RM-109 DUT 40251
Accessories with DUT numbers	BL-5C DUT 40140
Operation Voltage V / Hz	-
Result	Passed
Remarks	-
Temp °C / Humidity RH % / Air Pressure kPa	21/40/101.9
Date of measurements	12.05.2005
Measured by	Jan-Erik Lilja

9.1. Test method and limit

The measurement is made according to FCC rules part 15.247 and IC standard RSS-210.

Limits for carrier frequency separation measurements

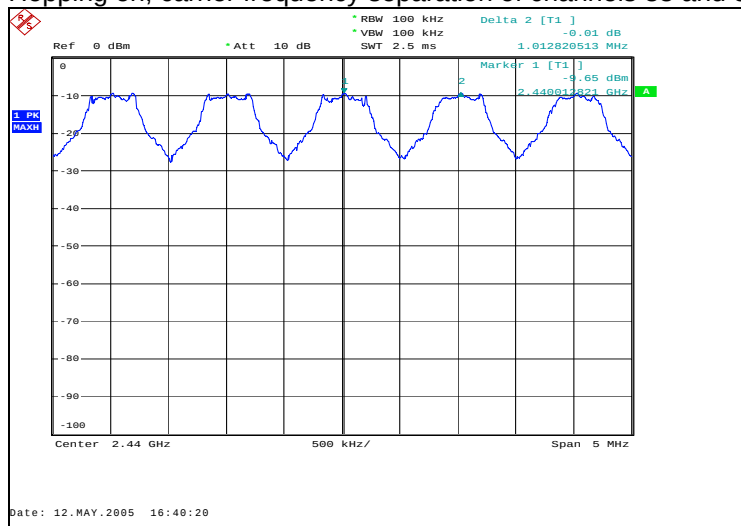
Limit / MHz
≥ 0.025 or 20 dB bandwidth

9.2. Bluetooth Test results

9.2.1 GFSK modulation, PRBS packet type

Carrier frequency separation / kHz	Result
1001.2	Passed

Hopping on, carrier frequency separation of channels 38 and 39



10. Number of hopping frequencies (FCC §15.247(a)(1)(iii), RSS-210 Amend I(ii))

EUT with DUT number	RM-109 DUT 40251
Accessories with DUT numbers	BL-5C DUT 40140
Operation Voltage V / Hz	-
Result	Passed
Remarks	
Temp °C / Humidity RH % / Air Pressure kPa	21/40/101.9
Date of measurements	12.05.2005
Measured by	Jan-Erik Lilja

10.1. Test method and limit

The measurement is made according to FCC rules part 15.247 and IC standard RSS-210.

Limits for number of hopping frequencies measurements

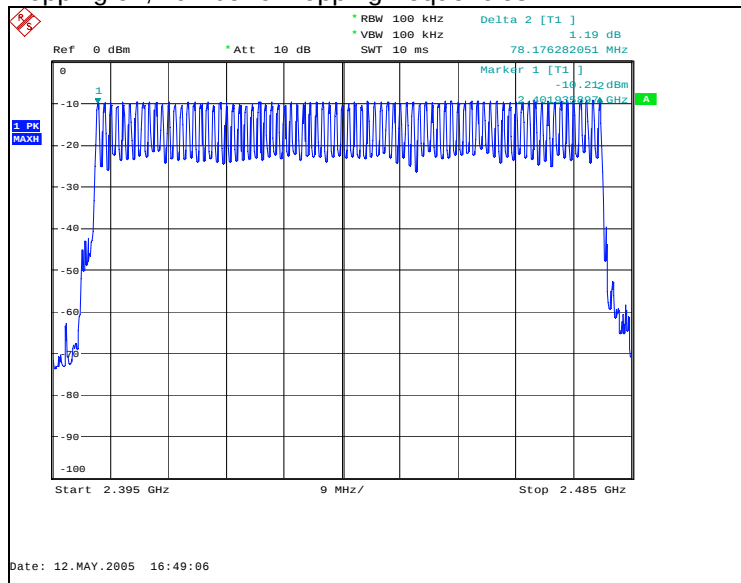
Limit / number
≥ 75

10.2. Bluetooth Test results

10.2.1 GFSK modulation, PRBS packet type

Measured number of hopping frequencies	Result
79	Passed

Hopping on, number of hopping frequencies



11. Time of occupancy (FCC §15.247(a)(1)(iii), RSS-210 Amend I(ii))

EUT with DUT number	RM-109 DUT 40251
Accessories with DUT numbers	BL-5C DUT 40140
Operation Voltage V / Hz	-
Result	Passed
Remarks	-
Temp °C / Humidity RH % / Air Pressure kPa	23/39/102.0
Date of measurements	13.05.2005
Measured by	Jan-Erik Lilja

11.1. Test method and limit

The measurement is made according to FCC rules part 15.247 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

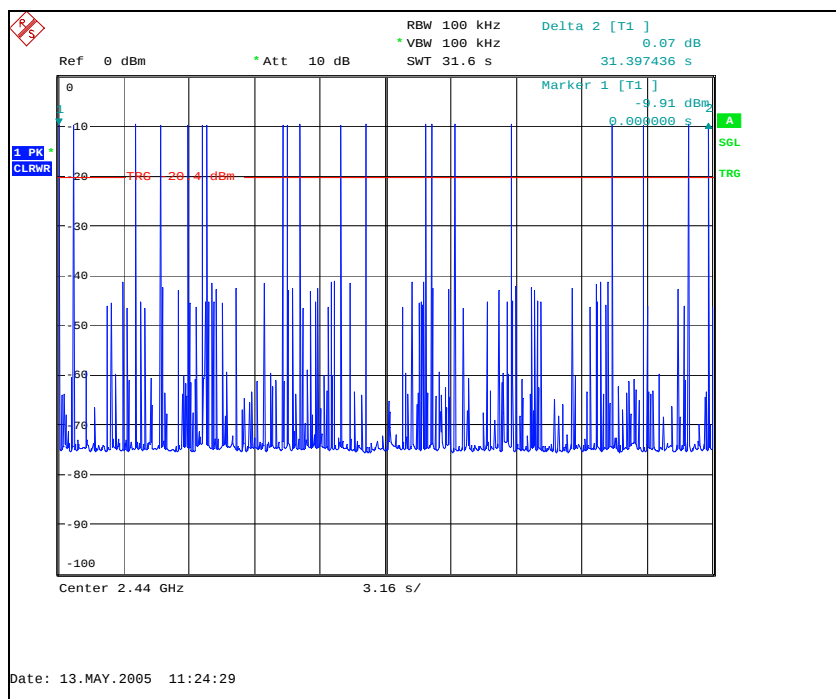
Limit / s
≤ 0.4

11.2. Bluetooth test results

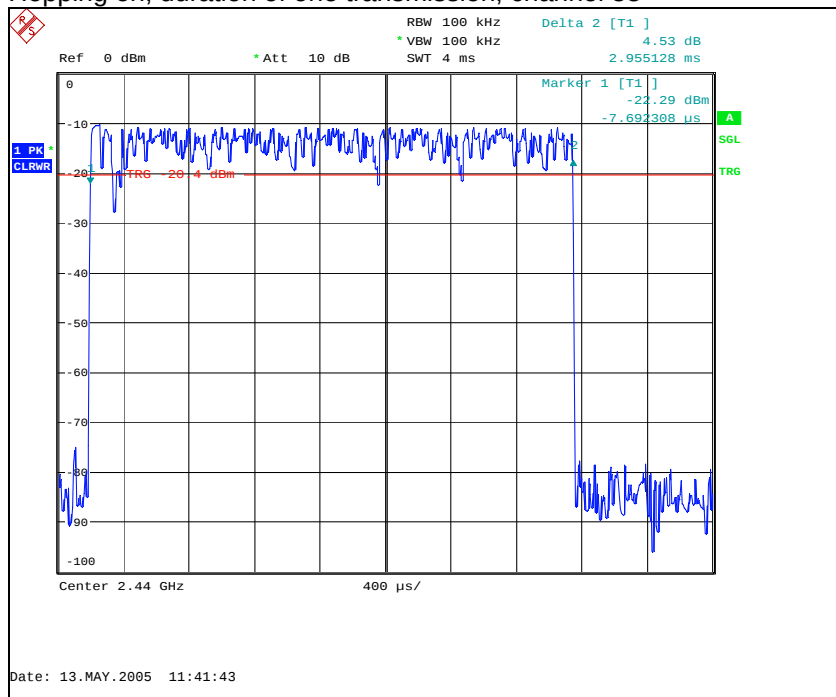
11.2.1 GFSK modulation, PRBS packet type

Measured number of transmissions	Duration of one ransmission / ms	Time of occupancy / s	Result
20	2.955	0.059	Passed

Hopping on, number of transmissions, channel 38



Hopping on, duration of one transmission, channel 38



12. Test Equipment

12.1. Conducted measurements

Eq. No	Equipment	Type	Manufacturer	Used in
TM37610	Spectrum analyzer	FSU	R&S	15C,22/24
TM37678	Radio communication tester	CMU-200	R&S	15C,22/24
	Attenuator 10 dB	6251.17.A	Huber+Suhner AG	15C,22/24
TM22901	Step attenuator 110dB	8496A	Agilent	15C,22/24
TM37499	Power splitter	11667A	Agilent	15C,22/24
	Temperature chamber	VT4002	Vötsch	15C,22/24
TM38112	DC power supply	6632A	Agilent	15C,22/24
TM38111	Multimeter	34401A	Agilent	15C,22/24
TM38845	EMI receiver	ESI 40	R&S	15B,15C
TM37773	Radio communication tester	CMU-200	R&S	15B,15C
TM38631	Signal generator	83640L	Agilent	15B,15C
TM38114	DC power supply	6632A	Agilent	15B,15C
TM22835	Multimeter	87	Fluke	15B,15C
TM30600	Pulse Limiter	ESH3-Z2	R&S	15B,15C
TM26490	LISN 50 µH	ESH3-Z5/	R&S	15B,15C
TM30636	LISN 50 µH	L2-16/	PMM	15B,15C

12.2. Radiated measurements

Eq. No	Equipment	Type	Manufacturer	Used in
TM30599	3m semi-anechoic chamber		TDK	15B,15C, 22/24
TM38845	EMI receiver	ESI 40	R&S	15B,15C, 22/24
TM37498	Preamplifier	AMF-5D-020180-26-10P	MITEQ	15B,15C, 22/24
TM37523	Preamplifier	AMF-4D-10M-3G-25-20P	MITEQ	15B,15C, 22/24
TM37516	Biconilog antenna	HL562	R&S	15B,15C, 22/24
TM26496	Double ridged waveguide antenna	3115	EMCO	15B,15C, 22/24
TM39158	Horn antenna	3116	EMCO	15B,15C, 22/24
TM26492	Reference dipole set	UHAP/VHAP	Schwarzbeck	15B,15C, 22/24
TM37501	Dipole antenna	3125-870	EMCO	22/24
TM37502	Dipole antenna	3125-1880	EMCO	22/24
TM37773	Radio communication tester	CMU-200	R&S	15B,15C, 22/24
TM38631	Signal generator	83640L	Agilent	15B,15C, 22/24
TM38066	High pass filter	4HC3000/18000-3-KK	Trilithic	15B,15C, 22/24
	High pass filter	WHK2010-10SS	Trilithic	15B,15C, 22/24
	Low pass filter	WLK1750-10SS	Trilithic	15B,15C, 22/24
TM26511	Tunable notch filter	WRCA870	Wainwright	22/24
TM38215	Tunable notch filter	WRCD1850/1910-0.2/40	Wainwright	22/24
TM38214	Band reject filter	WRCT 2402/2480-2400/2483.5-30	Wainwright	15C
TM30642	Turntable controller	HD-100	Deisel	15B,15C, 22/24
TM26500	Turntable	DS412	Deisel	15B,15C, 22/24
TM38842	Antenna mast controller	2090	EMCO	15B,15C, 22/24
TM38843	Antenna mast	2075	EMCO	15B,15C, 22/24
TM38114	DC power supply	6632A	Agilent	15B,15C, 22/24
TM22835	Multimeter	87	Fluke	15B,15C, 22/24