FCC ID: 2ADPZ-INETBOXA IC: 12552-INETBOXA

EMI – TEST REPORT

- FCC Part 15.247, RSS210 -

Test Report No. : **T39073-00-05TK**	21. April 2015 Date of issue

Type / Model Name : iNet Box

Product Description : Interface box with Bluetooth 2.1+EDR module

Applicant : Truma Gerätetechnik GmbH & Co. KG

Address : Wernher-von-Braun-Strasse 12

85640 PUTZBRUNN, GERMANY

Manufacturer : Feo Elektronik GmbH

Address : Zwergerstrasse 15

88214 RAVENSBURG, GERMANY

Licence holder : Truma Gerätetechnik GmbH & Co. KG

Address : Wernher-von-Braun-Strasse 12

85640 PUTZBRUNN, GERMANY

Test Result according to the standards listed in clause 1 test standards:	**POSITIVE**

ilac-MRA DAkkS Deutsche Akkreditierungsstelle D-PL-12030-01-00

Contents

1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 15, Subpart A - General (September, 2014)

Part 15, Subpart A, Section 15.31	Measurement standards
Part 15, Subpart A, Section 15.33	Frequency range of radiated measurements
Part 15, Subpart A, Section 15.35	Measurement detector functions and bandwidths

FCC Rules and Regulations Part 15, Subpart C - Intentional Radiators (September, 2014)

Part 15, Subpart C, Section 15.203	Antenna requirement
Part 15, Subpart C, Section 15.204	External radio frequency power amplifiers and antenna modifications
Part 15, Subpart C, Section 15.205	Restricted bands of operation
Part 15, Subpart C, Section 15.207	Conducted limits
Part 15, Subpart C, Section 15.209	Radiated emission limits, general requirements
Part 15, Subpart C, Section 15.247	Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz and 5725 - 5850 MHz

FCC Rules and Regulations Part 1, Subpart I - Procedures Implementing the National Environmental Policy Act of 1969

Part 1, Subpart I, Section 1.1310	Radiofrequency radiation exposure limits
Part 1, Subpart 2, Section 2.1093	Radiofrequency radiation exposure evaluation: portable device

OET Bulletin 65, 65A, 65B, 65C Edition 97-01, August 1997 – Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.

ANSI C63.4: 2014	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
ANSI C63.10: 2013	Testing Unlicensed Wireless Devices
ANSI C95.1: 2005	IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz
CISPR 16-4-2: 2013	Uncertainty in EMC measurement
DA 00-705	Filing and measurement guidelines for FHSS systems

2 EQUIPMENT UNDER TEST

2.1 Photo documentation of the EUT – Detailed photos see ATTACHMENT A

2.2 Equipment type, category

Bluetooth 2.1 BR/EDR device, fixed equipment.

2.3 Short description of the equipment under test (EUT)

The EUT uses a TI Bluetooth chipset which is compliant to Bluetooth 2.1 with Basic Rate and Enhanced Data Rate capability. A temporary connector is not implemented. Therefore all tests were performed radiated. A special test software was used to state the needed EUT test mode for TX continuous and RX continuous. Other parts of the EUT than the Bluetooth section were inactive during tests. The communication with the Bluetooth section was performed via an USB to serial converter.

Items	Description
BT version	2.1 BR+EDR
BT chipset type	Texas Instruments CC2564B
Modulation	FHSS (GFSK / π/4-DQPSK / 8DPSK)
Frequency range	2400 MHz to 2483.5 MHz
Channel numbers	79
Data rate (Mbps)	1 (GFSK), 2 (π/4-DQPSK), 3 (8DPSK)
Antenna type	PCB

Number of tested samples: 1
Serial number: Pre-production sample #2

EUT configuration:
(The CDF filled by the applicant can be viewed at the test laboratory.)

2.4 Variants of the EUT

None

2.5 Operation frequency and channel plan

The operating frequency is 2400 MHz to 2483.5 MHz.

Channel plan IEEE-Standard 802.15.1:

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2402	21	2422	41	2442	61	2462
2	2403	22	2423	42	2443	62	2463
3	2404	23	2424	43	2444	63	2464
4	2405	24	2425	44	2445	64	2465
5	2406	25	2426	45	2446	65	2466
6	2407	26	2427	46	2447	66	2467
7	2408	27	2428	47	2448	67	2468
8	2409	28	2429	48	2449	68	2469
9	2410	29	2430	49	2450	69	2470
10	2411	30	2431	50	2451	70	2471
11	2412	31	2432	51	2452	71	2472
12	2413	32	2433	52	2453	72	2473
13	2414	33	2434	53	2454	73	2474
14	2415	34	2435	54	2455	74	2475
15	2416	35	2436	55	2456	75	2476
16	2417	36	2437	56	2457	76	2477
17	2418	37	2438	57	2458	77	2478
18	2419	38	2439	58	2459	78	2479
19	2420	39	2440	59	2460	79	2480
20	2421	40	2441	60	2461		

Note: the marked frequencies are determined for final testing.

2.6 Antenna

The following antenna shall be used with the EUT:

Number	Characteristic	Certification name	Plug	Frequency range (MHz)	Gain (dBi)
1	Omni	PCB antenna	none	2.4 - 2.4835	3.3

2.7 Transmit operating modes

- synchronous mode (SCO or eSCO traffic, for HV, DV or DM packets) for transmitting voice or data,
- asynchronous mode (ACL traffic, for DM or DH packets) for transmitting data,
- mixed transfer mode (for voice and data)

The most important mode is the ACL mode at a data rate of 3 Mbps for the worst case.

Packets:
A summary of the packets in ACL mode and their characteristics is shown in the following table:

Type	Payload Header (bytes)	User Payload (bytes)	FEC	CRC	Symmetric Max. Rate (kb/s)	Asymmetric Max. Rate (kb/s)	
						Forward	Reverse
DM1	1	0 - 17	2/3	yes	108.8	108.8	108.8
DH1	1	0 - 27	no	yes	172.8	172.8	172.8
DM3	2	0 - 121	2/3	yes	258.1	387.2	54.4
DH3	2	0 - 183	no	yes	390.4	585.6	86.4
DM5	2	0 - 224	2/3	yes	286.7	477.8	36.3
DH5	2	0 - 339	no	yes	433.9	723.2	57.6
AUX1	1	0 - 29	no	no	185.6	185.6	185.6
2-DH1	2	0 - 54	no	yes	345.6	345.6	345.6
2-DH3	2	0 - 367	no	yes	782.9	1174.4	172.8
2-DH5	2	0 - 679	no	yes	869.1	1448.5	115.2
3-DH1	2	0 - 83	no	yes	531.2	531.2	531.2
3-DH3	2	0 - 552	no	yes	1177.6	1766.4	235.6
3-DH5	2	0 - 1021	no	yes	1306.9	2178.1	177.1

2.8 Power supply system utilised

Power supply voltage, V_{nom} : 13.2 VDC
Power supply voltage (alternative) : 8 VDC to 30 VDC

2.9 Peripheral devices and interface cables

The following peripheral devices and interface cables are connected during the measurements:

- Notebook computer Model : Vobis, 15M9
- Notebook computer Model : Toshiba, TECRA A11-127
- Serial to TTL adaptor Model : FEO GmbH
- Model :

2.10 Determination of worst case conditions for final measurement

Measurements are made in all three orthogonal axes and the settings of the EUT are changed to locate at which position and at what setting of the EUT produce the maximum of the emissions. For the further measurement the EUT is set in X position.

The tests are carried out in the following frequency band:

2400 MHz – 2483.5 MHz

Preliminary tests were performed to find the worst case mode from all possible combinations between available modulations and data rates. On customer demands the output power was set to P_{max} (4 dBm) with the test software.

For the final test the following channels and test modes are selected:

IEEE 802.15.1	Available channels	Tested channels	Power setting	Modulation
BT 2.1 BR/EDR	1 to 79	1, 40, 79	4 dBm	GFSK, 8DPSK

- TX mode, GFSK
- TX mode, 8DPSK

2.10.1 Test jig

No special test jig was used for testing.

2.10.2 Test software

The special test software "***CC256x Bluetooth Hardware Evaluation Tool***" was used to set test parameters for output power, channel frequency, modulation type and TX continuous or RX continuous transmission.

3 TEST RESULT SUMMERY

Bluetooth device using frequency hopping:

Operating in the 2402 MHz – 2480 MHz band:

FCC Rule Part	RSS Rule Part	Description	Result
15.207(a)	RSS Gen, 8.8	AC power line conducted emissions	not applicable
15.247(a)(1)	RSS210, A8.1(a)	20 dB EBW	passed
15.247(a)(1)	RSS-210, A8.1(b)	Channel separation	passed
15.247(a)(1)	RSS-210, A8.1(d)	Dwell time	passed
15.247(b)(1)	RSS-210, A8.4(2)	Peak power	passed
15.247(d)	RSS-210, A8.5	Spurious emissions	passed
15.247(d)	RSS-210, A8.5	Out-of-band emission, radiated	passed
15.247(d)	RSS-Gen, 8.10	Emissions in restricted bands	passed
15.247(e)	RSS-210, A8.2(b)	Hopping sequence	passed
15.247(a)	RSS-210, A8.1(b)	Receiver input bandwidth	passed
15.247(a)	RSS-210, A8.1(d)	Number of hopping channels	passed
15.247(a)	-	Equal hopping frequency use	passed
15.35(c)	RSS-Gen, 6.10	Pulsed operation	passed
15.247(b)(4)	RSS-210, A8.4(4)	Antenna requirement	passed
	RSS-Gen, 6.11	Transmitter frequency stability	not applicable

The mentioned RSS Rule Parts in the above table are related to:
RSS Gen, Issue 4, November 2014
RSS 210, Issue 8, December 2010
RSS 102, Issue 4, March 2010

3.1 Final assessment

The equipment under test fulfills the EMI requirements cited in clause 1 test standards.

Date of receipt of test sample : acc. to storage records

Testing commenced on : 08 December 2014

Testing concluded on : 01 April 2015

Checked by:

Klaus Gegenfurtner
I confirm the correctness and Integrity of this documents
2015.05.08 12:30:49 +02'00'

Klaus Gegenfurtner
Teamleader Radio

Tested by:

Tobias Kammerer
I`m the author of this document
2015.05.08 12:13:40 +02'00'

Tobias Kammerer
Radio Team

4 TEST ENVIRONMENT

4.1 Address of the test laboratory

CSA Group Bayern GmbH
Ohmstrasse 1-4
94342 STRASSKIRCHEN
GERMANY

4.2 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	15-35 ° C
Humidity:	30-60 %
Atmospheric pressure:	86-106 kPa

4.3 Statement of the measurement uncertainty

The data and results seeenced in this document are true and accurate. It is noted that the expanded measurement uncertainty corresponds to the measurement results from the standard measurement uncertainty multiplied by the coverage factor k = 2. The true value is located in the corresponding interval with a probability of 95 % The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16-4-2 / 11.2003 „Uncertainties, statistics and limit modelling – Uncertainty in EMC measurements“ and is documented in the quality system acc. to DIN EN ISO/IEC 17025. For all measurements shown in this report, the measurement uncertainty of the test laboratory, CSA Group Bayern GmbH, is below the measurement uncertainty as defined by CISPR. Therefore, no special measures must be taken into consideration with regard to the limits according to CISPR. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

4.4 Measurement protocol for FCC and IC

4.4.1 GENERAL INFORMATION

4.4.1.1 Test methodology

Conducted and radiated disturbance testing is performed according to the procedures set out by the International Special Committee on Radio Interference (CISPR) Publication 22, European Standard EN 55022 as shown under section 1 of this report.

The Open Area test site is a listed Open Site under the Canadian Test-Sites File-No:

IC 3009A-1

In compliance with RSS 210 testing for RSS compliance may be achieved by following the procedures set out in ANSI C63.4 and applying the CISPR 22 limits.

4.4.1.2 Justification

The equipment under test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral using the appropriate impedance characteristic or left unterminated. Where appropriate, cables are manually manipulated with respect to each other thus obtaining maximum disturbances from the unit.

4.4.1.3 Details of test procedures

The test methods used comply with CISPR Publication 22, EN 55022 - " Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement" and with ANSI C63.4 - "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz". In compliance with 47 CFR Part 15 Subpart A, Section 15.38 testing for FCC compliance may be achieved by following the procedures set out in ANSI C63.4 and applying the CISPR 22 limits.

5 TEST CONDITIONS AND RESULTS

5.1 Conducted emissions

For test instruments and accessories used see section 6 Part **A 4**.

5.1.1 Description of the test location

Test location: NONE

Remarks: The measurement is not applicable, because the EUT has no AC mains connection.

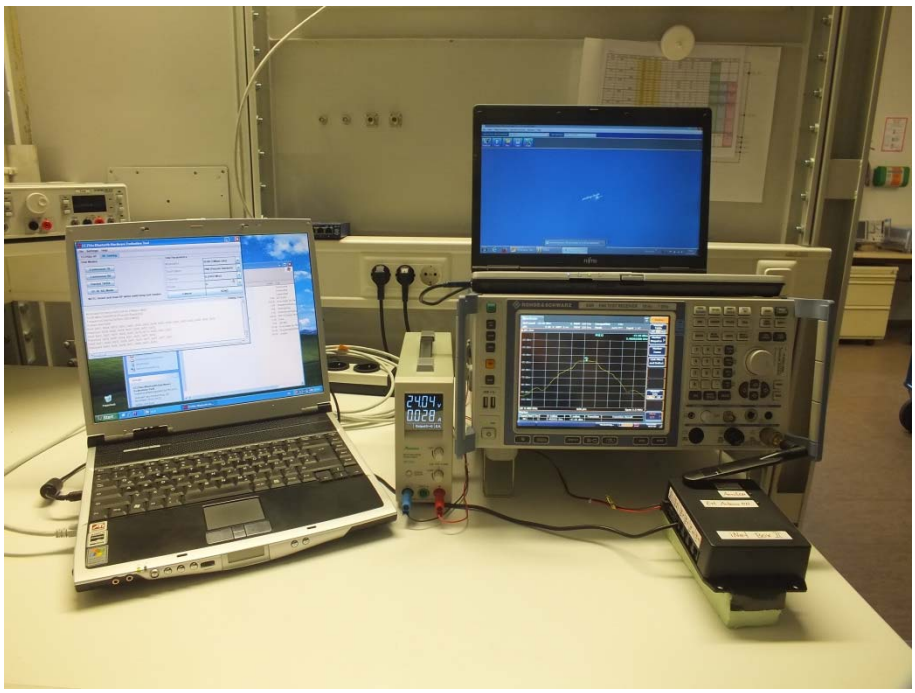
5.2 Emission bandwidth

For test instruments and accessories used see section 6 Part **MB**.

5.2.1 Description of the test location

Test location: AREA4

5.2.2 Photo documentation of the test set-up



5.2.1 Applicable standard

According to FCC Part 15C, Section 15.247(a):
Frequency hopping systems shall have hopping carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

5.2.2 Description of Measurement

The bandwidth is measured at an amplitude level reduced from the reference level by a specified ratio of -20 dB. The reference level is the level of the highest signal amplitude observed from the transmitter at either the fundamental frequency or the first-order modulation products in all typical modes of operation including the unmodulated carrier, even if atypical.
Analyser settings:
RBW: 30 kHz, VBW: 100 kHz, Sweep time: auto, Detector: Peak, Trace mode: Max hold

5.2.3 Test result

GFSK, DH5 Packet

Channel number	Channel frequency (MHz)	EBW (kHz)
1	2402	897.0
40	2441	892.5
79	2480	901.5

8DPSK, 3-DH5 Packet

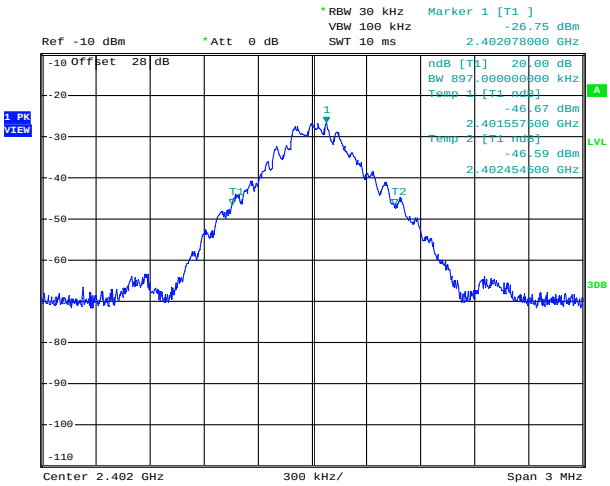
Channel number	Channel frequency (MHz)	EBW (kHz)
1	2402	1351.5
40	2441	1351.5
79	2480	1354.5

There is no bandwidth limit according to FCC Part15C, Section 15.247(a).

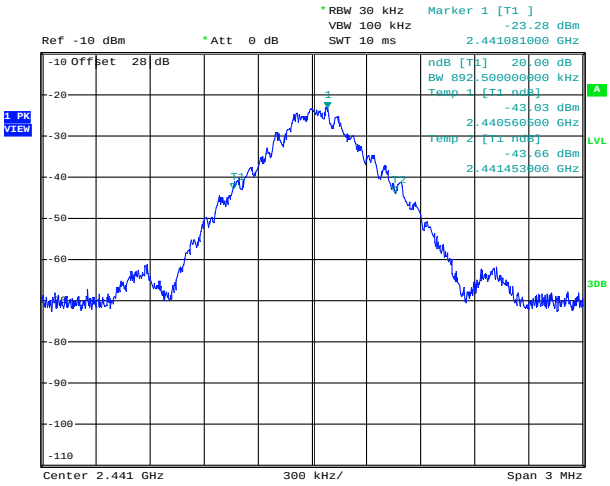
Remarks: For detailed test result please see to following test protocols.

5.2.4 Test protocol

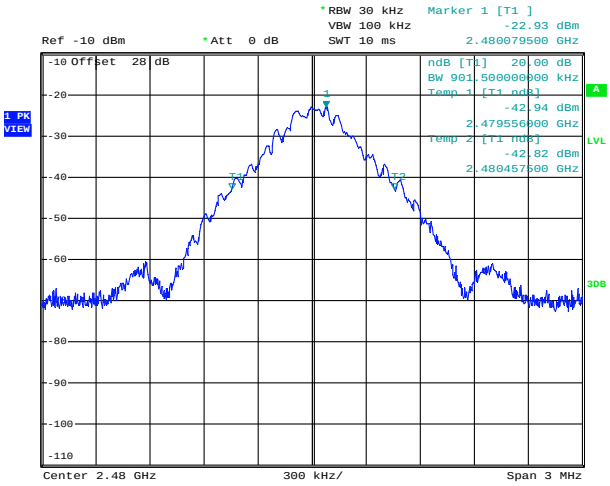
Emission bandwidth, channel 1, DH5 Packet



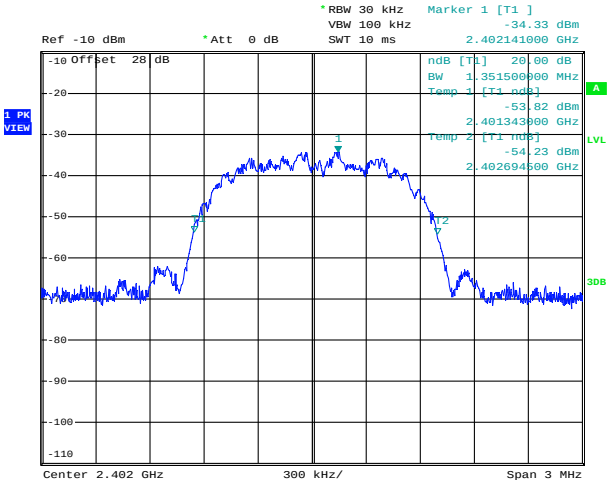
Emission bandwidth, channel 40, DH5 Packet



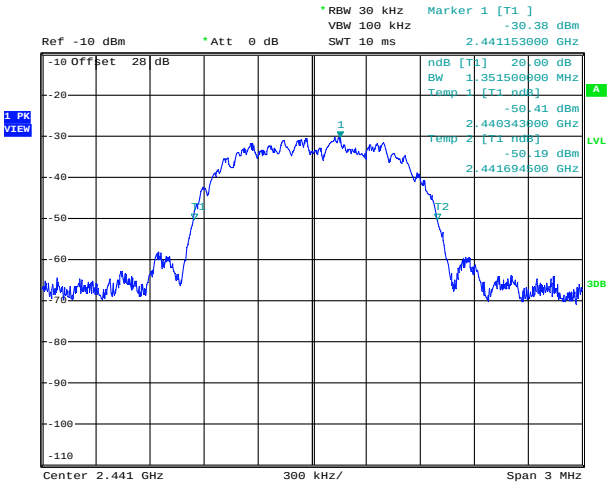
Emission bandwidth, channel 79, DH5 Packet



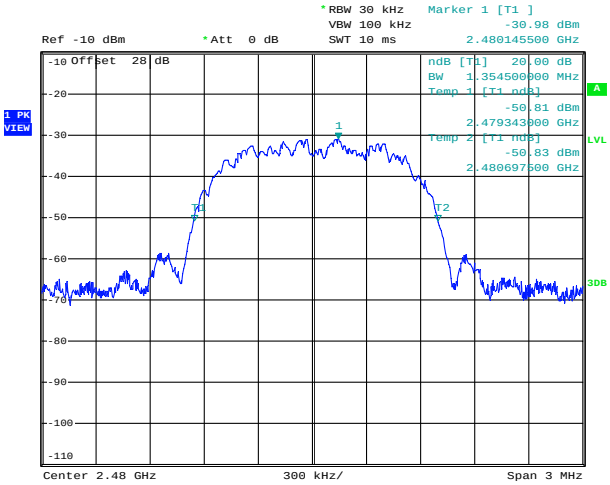
Emission bandwidth, channel 1, 3-DH5 Packet



Emission bandwidth, channel 40, 3-DH5 Packet



Emission bandwidth, channel 79, 3-DH5 Packet



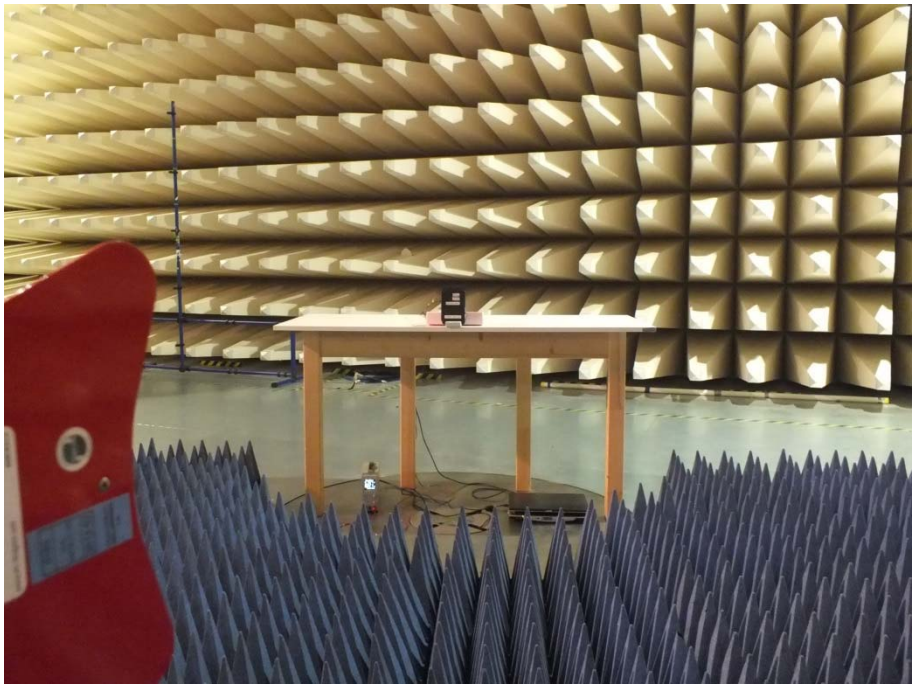
5.3 Maximum peak output power radiated

For test instruments and accessories used see section 6 Part **CPR 3**.

5.3.1 Description of the test location

Test location: Anechoic chamber 1

5.3.2 Photo documentation of the test set-up



5.3.3 Applicable standard

According to FCC Part 15C, Section 15.247(a)(1):
The maximum peak output power of an intentional radiator shall not exceed the limit defined in dependency of the channel separation and of the number of hopping channels.

5.3.4 Description of Measurement

A spectrum analyser is used to measure the EIRP of the transmitter while the EUT is operating in transmit mode using the assigned frequency according to DA 00-705. The transducer factor or the measurement system is taken into account during measurements.

Analyser settings:
RBW: 3 MHz, VBW ≥ RBW, Detector: Max peak, Trace: Max hold, Sweep time: auto

5.3.5 Test result

GFSK

802.15.1, GFSK, TX		Test results radiated			
		Fieldstrength E (dBµV/m)	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)
Lowest frequency: CH1					
T_{nom}	V_{nom}	94.4	-0.8	36.0	-36.8
Middle frequency: CH40					
T_{nom}	V_{nom}	93.4	-1.8	36.0	-37.8
Highest frequency: CH79					
T_{nom}	V_{nom}	93.4	-1.8	36.0	-37.8

Calculated conducted output power:

802.15.1, GFSK, TX		Test results conducted		
		EIRP (dBm)	Antenna Gain (dBi)	$P_{conducted}$ (dBm)
Lowest frequency: CH1				
T_{nom}	V_{nom}	-0.8	3.3	-4.1
Middle frequency: CH40				
T_{nom}	V_{nom}	-1.8	3.3	-5.1
Highest frequency: CH79				
T_{nom}	V_{nom}	-1.8	3.3	-5.1

8DPSK

802.15.1, 8DPSK, TX		Test results radiated			
		Fieldstrength E (dBµV/m)	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)
Lowest frequency: CH1					
T_{nom}	V_{nom}	96.9	1.7	36.0	-34.3
Middle frequency: CH40					
T_{nom}	V_{nom}	95.9	0.6	36.0	-35.4
Highest frequency: CH79					
T_{nom}	V_{nom}	96.4	1.1	36.0	-34.9

Calculated conducted output power:

802.15.1, 8DPSK, TX		Test results conducted		
		EIRP (dBm)	Antenna Gain (dBi)	$P_{conducted}$ (dBm)
Lowest frequency: CH1				
T_{nom}	V_{nom}	1.7	3.3	-1.6
Middle frequency: CH40				
T_{nom}	V_{nom}	0.6	3.3	-2.7
Highest frequency: CH79				
T_{nom}	V_{nom}	1.1	3.3	-2.2

Peak Power Limit according to FCC Part 15C, Section 15.247(b)(1):

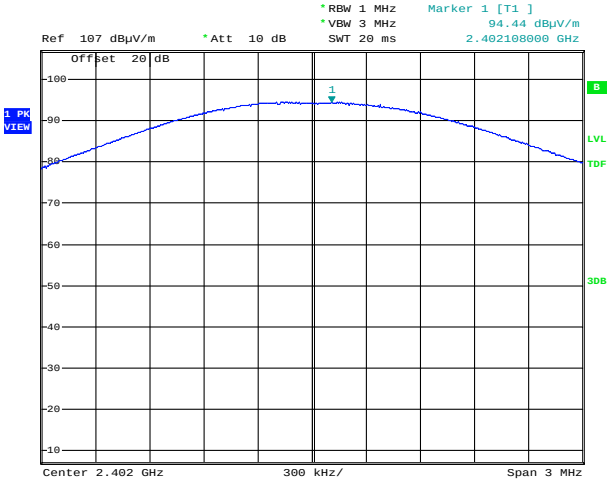
Frequency (MHz)	Hopping channels	Peak power limit conducted(radiated)	
		(dBm)	(Watt)
2400 - 2483.5	≥ 75	30(**36**)	1(**4**)

The requirements are **FULFILLED.**

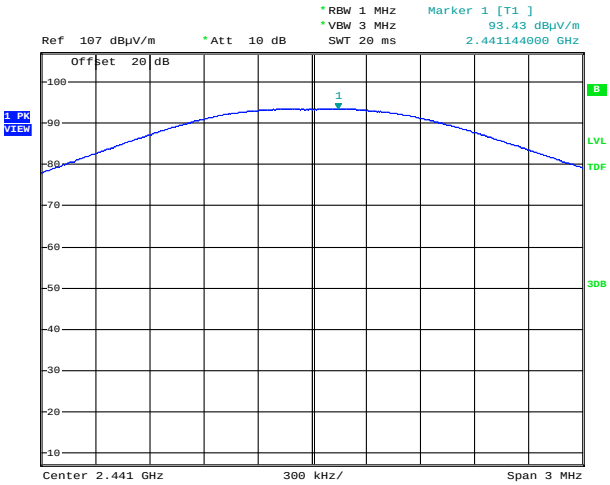
Remarks: For detailed test result please see to following test protocols.

5.3.6 Test protocols

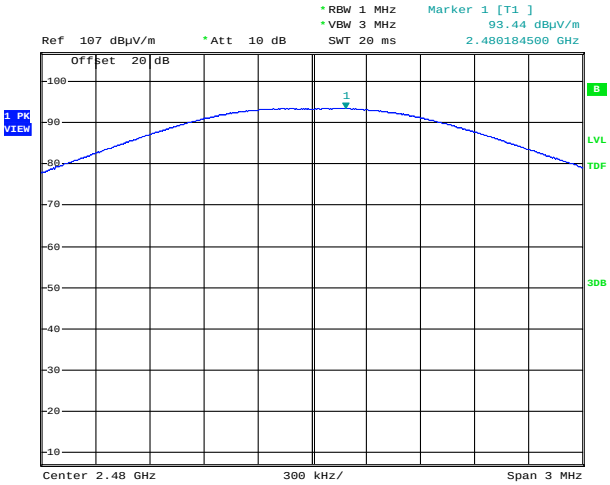
GFSK, CH1



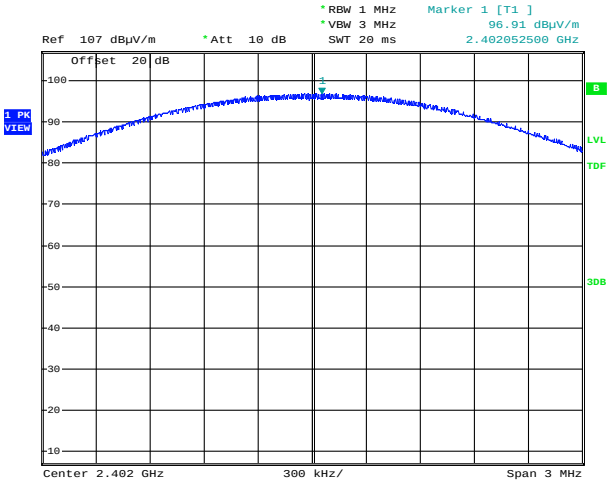
GFSK, CH40



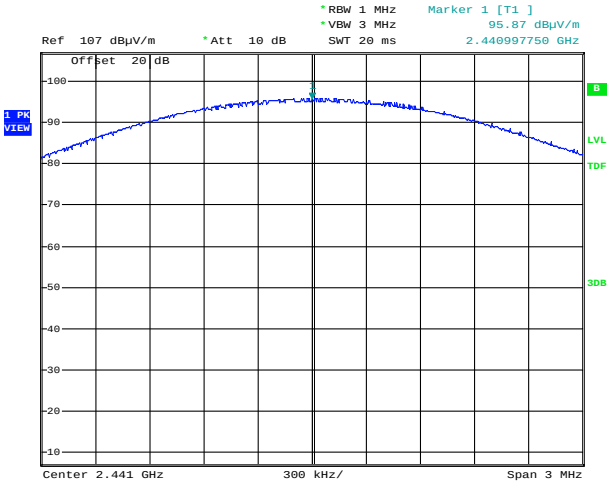
GFSK, CH79



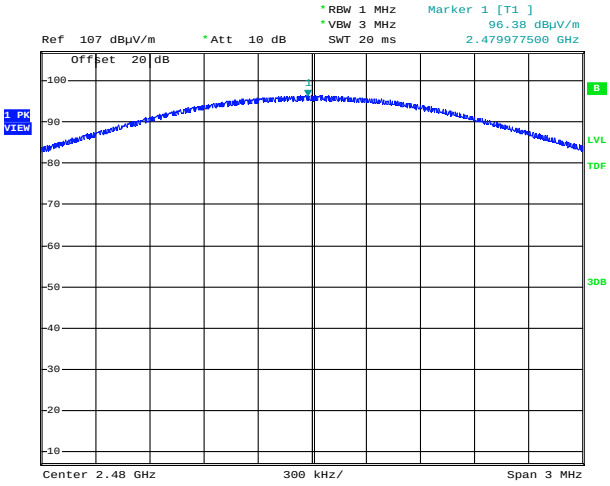
8DPSK, CH1



8DPSK, CH40



8DPSK, CH79



5.4 Spurious emissions radiated

For test instruments and accessories used see section 6 Part **SER1, SER2 and SER3**.

5.4.1 Description of the test location

Test location: NONE

5.4.2 Applicable standard

According to FCC Part 15C, Section 15.247(d):
In any 100 kHz bandwidth outside the frequency bands 2400 – 2483.5 MHz and 5725 – 5850 MHz, the digitally modulated 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 an radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required.

Remarks: The device fulfills the radiated emission limits according to FCC §15.209 within the spurious emissions measurements in restricted bands. Also refer section 5.6 of the present document.

5.5 Band edge compliance

For test instruments and accessories used see section 6 Part **SER3**.

5.5.1 Description of the test location

Test location: Anechoic chamber 1

5.5.2 Applicable standard

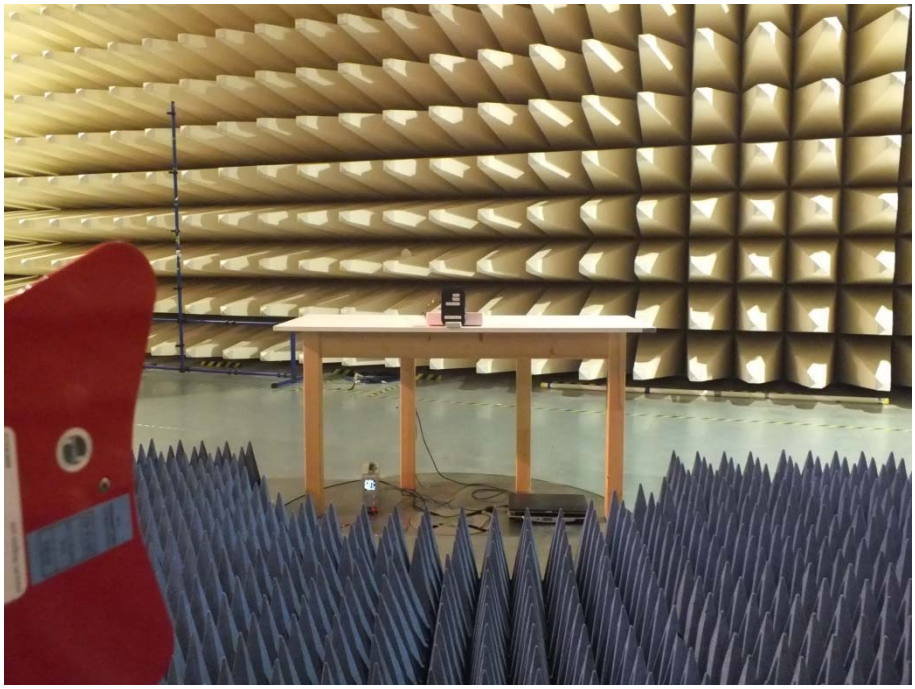
According to FCC Part 15C, Section 15.247(d):
In any 100 kHz bandwidth outside the frequency bands 2400 – 2483.5 MHz and 5725 – 5850 MHz, the digitally modulated radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or an radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required.

5.5.3 Description of Measurement

A spectrum analyser is connected to the output of the transmitter via a suitable attenuator while EUT was operating in transmit mode at the assigned frequency according DA 00-705:2000.

Spectrum analyser settings:
RBW: 100 kHz, VBW: 300 kHz, Detector: Max peak, Trace: Max hold, Sweep: auto

5.5.4 Photo documentation of the test set-up



5.5.5 Test result

GFSK

f (MHz)	Band edge frequency (MHz)	Limit (dBc)
2402	2402.030	< -20
2480	2480.580	< -20

8DPSK

f (MHz)	Band edge frequency (MHz)	Limit (dBc)
2402	2401.310	< -20
2480	2480.750	< -20

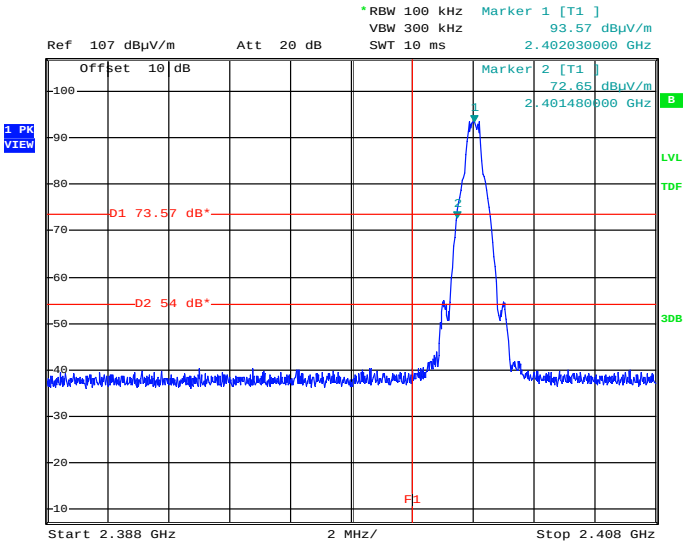
Peak-Limit according to FCC Part 15C, Section 15.247(d):
In any 100 kHz bandwidth outside the frequency band 2400 – 2483.50 MHz, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. 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 limit specified in Section 15.209(a).

The requirements are **FULFILLED.**

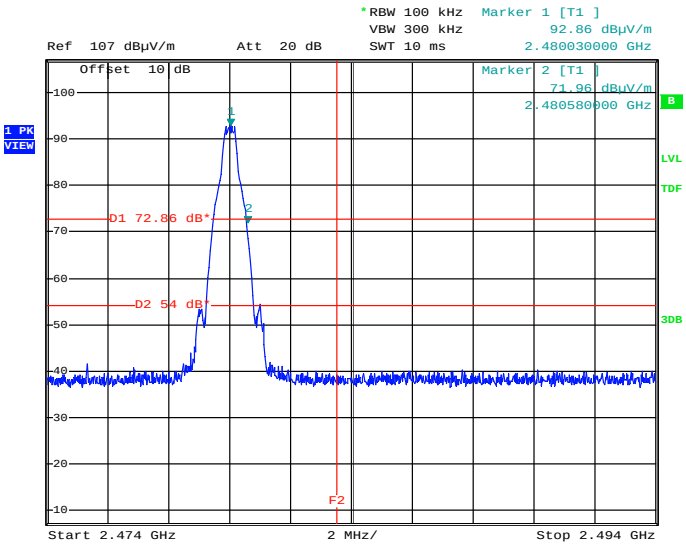
Remarks: For detailed test result please see to following test protocols. The device fulfills the general requirements acc. to FCC §15.209(a) for radiated emission limits.

5.5.6 Test protocol

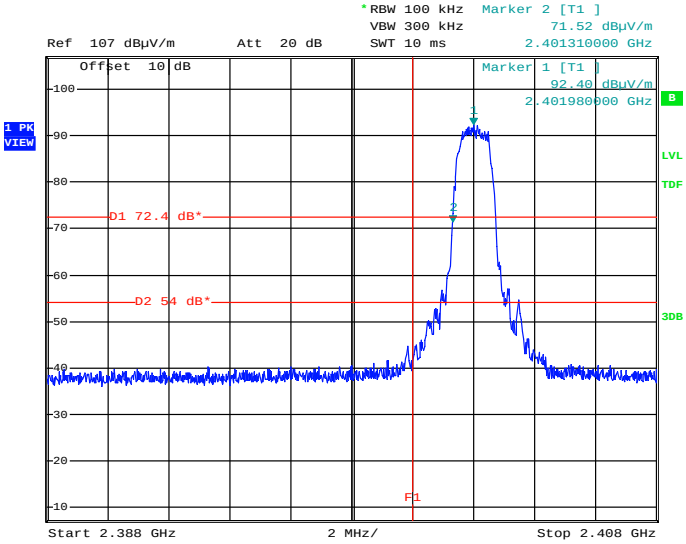
GFSK, CH0



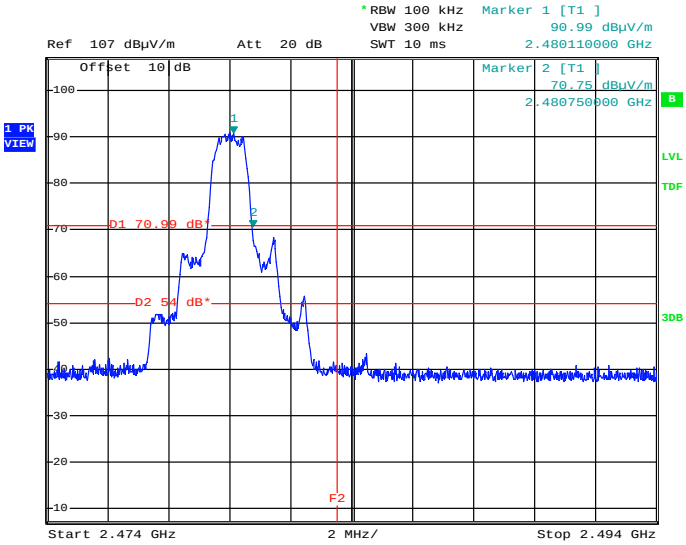
GFSK, CH79



8DPSK, CH0



8DPSK, CH79



5.6 Radiated emissions in restricted bands

For test instruments and accessories used see section 6 Part **SER2** and **SER3**.

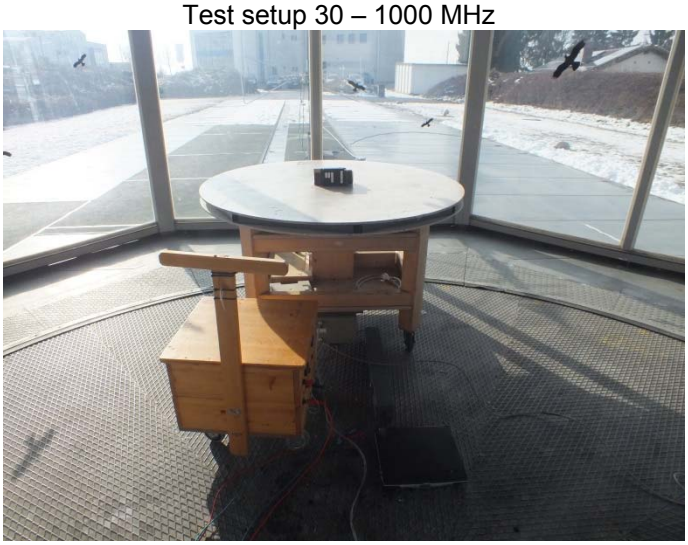
5.6.1 Description of the test location

Test location: OATS 1
Test distance: 3 m

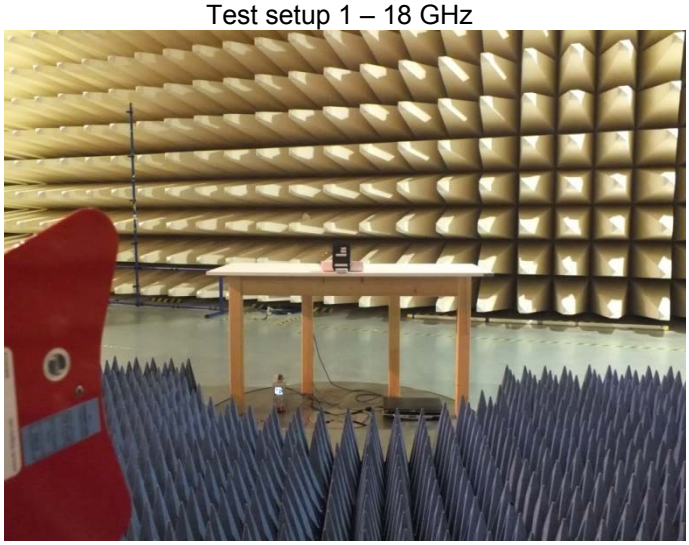
Test location: Anechoic chamber 1
Test distance: 3 m

5.6.2 Photo documentation of the test set-up

Test setup 30 – 1000 MHz



Test setup 1 – 18 GHz



5.6.3 Applicable standard

According to FCC Part 15, Section 15.205(a):
In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limit specified in Section 15.209(a).

5.6.4 Description of Measurement

The restricted bands were measured radiated. Pre-measurements were performed from 9 kHz up to 30 MHz. The span of the spectrum analyser was set wide enough to capture the restricted band and measure 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.

Test receiver settings for SER2:
RBW: 120 MHz, Detector: Quasi peak, Mes. Time: 1 s,

Spectrum analyser settings for SER3:
RBW: 1 MHz, VBW: 3 MHz, Detector: Max. peak, Trace: Max. hold, Sweep: Auto

Spectrum analyser settings for SER3:
RBW: 1 MHz, VBW: 3 MHz, Detector: RMS, Trace: Max. hold, Sweep: Auto

5.6.5 Test result

GFSK and 8DPSK modulation, 30 -1000 MHz

Frequency: Hopping							
Test conditions:							
GFSK, 8DPSK, TX			Test results				
Start requency (MHz)	Stop frequency (MHz)	RBW (kHz)	Maximum emission		AV Limit (dBµV/m)	Margin (dB)	Detector
			(MHz)	(dBµV/m)			
30	1000	120	39.70	27.2	40.0	-12.8	QP
30	1000	120	51.83	23.2	40.0	-16.8	QP
30	1000	120	79.96	24.7	40.0	-15.3	QP
30	1000	120	95.28	24.9	43.5	-18.6	QP
30	1000	120	266.20	25.2	46.0	-20.8	QP
30	1000	120	345.93	28.4	46.0	-17.6	QP
Measurement uncertainty				±6 dB			

Note:
Between GFSK and 8DPSK no diference could be detected in the range from 30 MHz up to 1000 MHz.

GFSK, 1 – 25 GHz

Lowest frequency: CH1								
Test conditions:								
802.15.1, GFSK, TX			Test results					
Start requency (MHz)	Stop frequency (MHz)	RBW (kHz)	Maximum emission		AV Limit (dBµV/m)	Duty cycle correction (dB)	Margin (dB)	Detector
			(MHz)	(dBµV/m)				
1000	2400	1000	1594.30	42.4	54.0	0	-11.6	PK
2483.5	4000	1000	2661.69	46.5	54.0	0	-7.5	PK
4000	8000	1000	7206.00	59.5	54.0	0	5.5	PK
4000	8000	1000	7206.00	59.5	54.0	-24.8	-19.3	PK
8000	12000	1000	11922.00	51.2	54.0	0	-2.8	PK
12000	18000	1000	17979.00	57.3	54.0	0	3.3	PK
12000	18000	1000	17955.75	48.7	55.0	0	-6.3	RMS
18000	25000	1000	24195.00	56.2	54.0	0	2.2	PK
18000	25000	1000	23922.00	47.2	54.0	0	-6.8	RMS
Measurement uncertainty			±6 dB					

Middle frequency: CH40								
Test conditions:								
802.15.1, GFSK, TX			Test results					
Start requency (MHz)	Stop frequency (MHz)	RBW (kHz)	Maximum emission		AV Limit (dBµV/m)	Duty cycle correction (dB)	Margin (dB)	Detector
			(MHz)	(dBµV/m)				
1000	2400	1000	1595.70	44.6	54.0	0	-9.4	PK
2483.5	4000	1000	2657.52	44.5	54.0	0	-9.6	PK
4000	8000	1000	7323.00	61.1	54.0	0	7.1	PK
4000	8000	1000	7323.00	61.1	54.0	-24.8	-17.7	PK
8000	12000	1000	11950.00	51.5	54.0	0	-2.5	PK
12000	18000	1000	17979.00	57.3	54.0	0	3.3	PK
12000	18000	1000	17955.75	48.7	55.0	0	-6.3	RMS
18000	25000	1000	24195.00	56.2	54.0	0	2.2	PK
18000	25000	1000	23922.00	47.2	54.0	0	-6.8	RMS
Measurement uncertainty			±6 dB					

Highest frequency: CH79								
Test conditions:								
802.15.1, GFSK, TX			Test results					
Start requency (MHz)	Stop frequency (MHz)	RBW (kHz)	Maximum emission		AV Limit (dBµV/m)	Duty cycle correction (dB)	Margin (dB)	Detector
			(MHz)	(dBµV/m)				
1000	2400	1000	1595.70	44.7	54.0	0	-9.3	PK
2483.5	4000	1000	2663.21	45.1	54.0	0	-8.9	PK
4000	8000	1000	7441.00	59.9	54.0	0	5.9	PK
4000	8000	1000	7441.00	59.9	54.0	-24.8	-18.9	PK
8000	12000	1000	11946.00	51.3	54.0	0	-2.7	PK
12000	18000	1000	17979.00	57.3	54.0	0	3.3	PK
12000	18000	1000	17955.75	48.7	55.0	0	-6.3	RMS
18000	25000	1000	24195.00	56.2	54.0	0	2.2	PK
18000	25000	1000	23922.00	47.2	54.0	0	-6.8	RMS
Measurement uncertainty			±6 dB					

8DPSK, 1 – 25 GHz

Lowest frequency: CH1								
Test conditions:								
802.15.1, 8DPSK, TX			Test results					
Start requency (MHz)	Stop frequency (MHz)	RBW (kHz)	Maximum emission		AV Limit (dBµV/m)	Duty cycle correction (dB)	Margin (dB)	Detector
			(MHz)	(dBµV/m)				
1000	2400	1000	1592.90	44.8	54.0	0	-9.2	PK
2483.5	4000	1000	2654.11	44.3	54.0	0	-9.7	PK
4000	8000	1000	7207.00	61.4	54.0	0	7.4	PK
4000	8000	1000	7207.00	61.4	54.0	-24.8	-17.4	PK
8000	12000	1000	11996.00	51.4	54.0	0	-2.6	PK
12000	18000	1000	17952.75	57.3	54.0	0	3.3	PK
12000	18000	1000	17956.50	48.1	55.0	0	-6.9	RMS
18000	25000	1000	23873.00	56.2	54.0	0	2.2	PK
18000	25000	1000	23901.00	47.2	54.0	0	-6.8	RMS
Measurement uncertainty			±6 dB					

Middle frequency: CH40								
Test conditions:								
802.15.1, 8DPSK, TX			Test results					
Start requency (MHz)	Stop frequency (MHz)	RBW (kHz)	Maximum emission		AV Limit (dBµV/m)	Duty cycle correction (dB)	Margin (dB)	Detector
			(MHz)	(dBµV/m)				
1000	2400	1000	1596.40	45.3	54.0	0	-8.7	PK
2483.5	4000	1000	2654.86	45.6	54.0	0	-8.5	PK
4000	8000	1000	7324.00	60.4	54.0	0	6.4	PK
4000	8000	1000	7324.00	60.4	54.0	-24.8	-18.4	PK
8000	12000	1000	11917.00	51.1	54.0	0	-2.9	PK
12000	18000	1000	17952.75	57.3	54.0	0	3.3	PK
12000	18000	1000	17956.50	48.1	55.0	0	-6.9	RMS
18000	25000	1000	23873.00	56.2	54.0	0	2.2	PK
18000	25000	1000	23901.00	47.2	54.0	0	-6.8	RMS
Measurement uncertainty			±6 dB					

Highest frequency: CH79								
Test conditions:								
802.15.1, 8DPSK, TX			Test results					
Start requency (MHz)	Stop frequency (MHz)	RBW (kHz)	Maximum emission		AV Limit (dBµV/m)	Duty cycle correction (dB)	Margin (dB)	Detector
			(MHz)	(dBµV/m)				
1000	2400	1000	1594.30	44.6	54.0	0	-9.5	PK
2483.5	4000	1000	2518.76	45.0	54.0	0	-9.0	PK
4000	8000	1000	7440.00	61.9	54.0	0	7.9	PK
4000	8000	1000	7440.00	61.9	54.0	-24.8	-16.9	PK
8000	12000	1000	11937.00	51.5	54.0	0	-2.5	PK
12000	18000	1000	17952.75	57.3	54.0	0	3.3	PK
12000	18000	1000	17956.50	48.1	55.0	0	-6.9	RMS
18000	25000	1000	23873.00	56.2	54.0	0	2.2	PK
18000	25000	1000	23901.00	47.2	54.0	0	-6.8	RMS
Measurement uncertainty			±6 dB					

Peak-Limit according to FCC Part 15C, Section 15.205(a):
In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limit specified in Section 15.209(a).

Frequency	Limits acc. 15.209		Measurement distance
(MHz)	PK dB(µV/m)	AV dB(µV/m)	(m)
Above 960	74	54	3

Restricted bands of operation:
The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209:

MHz	MHz	MHz	GHz
0.090 – 0.110	16.42 – 16.423	399.9 – 410	4.5 – 5.15
0.495 – 0.505	16.69475 – 16.69525	608 – 614	5.35 – 5.46
2.1735 – 2.1905	16.80425 – 16.80475	960 – 1240	7.25 – 7.75
4.125 – 4.128	25.5 – 25.67	1300 – 1427	8.025 – 8.5
4.17725 – 4.17775	37.5 – 38.25	1435 – 1626.5	9.0 – 9.2
4.20725 – 4.20775	73 – 74.6	1645.5 – 1646.5	9.3 – 9.5
6.215 – 6.218	74.8 – 75.2	1660 – 1710	10.6 – 12.7
6.26775 – 6.26825	108 – 121.94	1718.8 – 1722.2	13.25 – 13.4
6.31175 – 6.31225	123 – 138	2200 – 2300	14.47 – 14.5
8.291 – 8.294	149.9 – 150.05	2310 – 2390	15.35 – 16.2
8.362 – 8.366	156.52475 – 156.52525	2483.5 – 2500	17.7 – 21.4
8.37625 – 8.38675	156.7 – 156.9	2690 – 2900	22.01 – 23.12
8.41425 – 8.41475	162.0125 – 167.17	3260 – 3267	23.6 – 24.0
12.29 – 12.293	167.72 – 173.2	3332 – 3339	31.2 – 31.8
12.51975 – 12.52025	240 – 285	3345.8 – 3358	36.43 – 36.5
12.57675 – 12.57725	322 – 335.4	3600 – 4400	Above 38.6

The requirements are **FULFILLED.**

Remarks: For detailed test results please see to following test protocols.

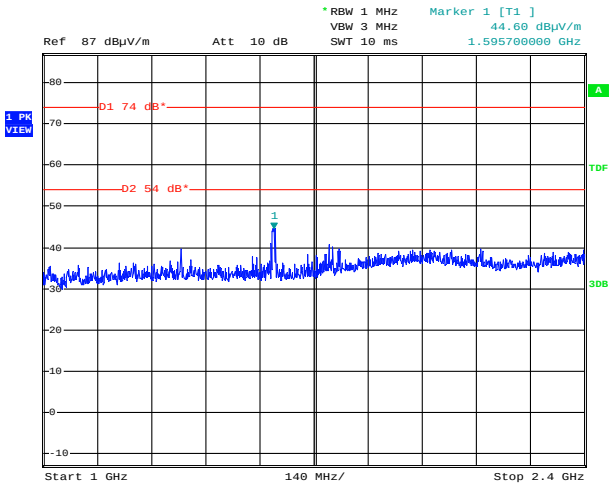
The measurement was performed up to the 10th harmonic.

The frequency range from 12 GHz to 25 GHz shows no difference between different emission modes. Only the worst case plots are listed.

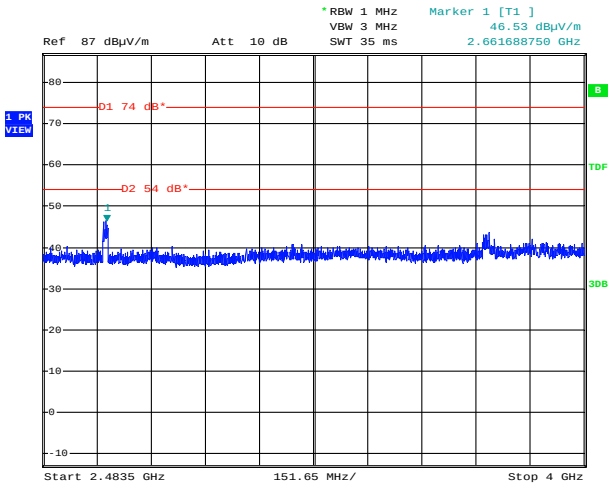
Test protocol

2402 MHz, GFSK

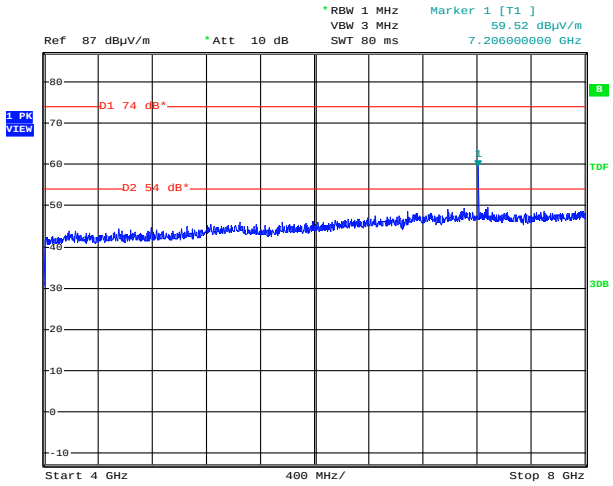
1 – 2.4 GHz



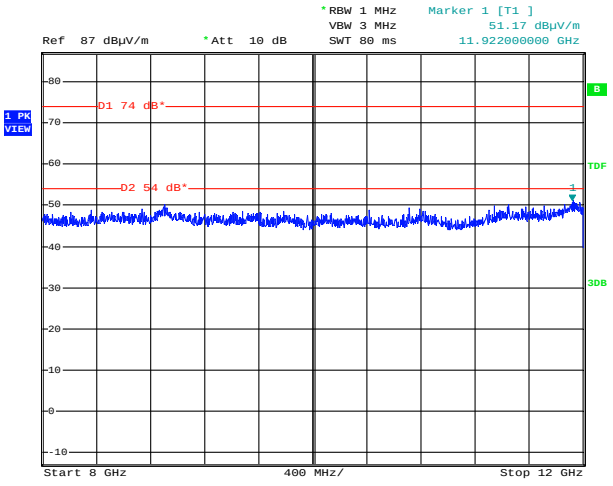
2.483.5 - 4 GHz



4 - 8 GHz

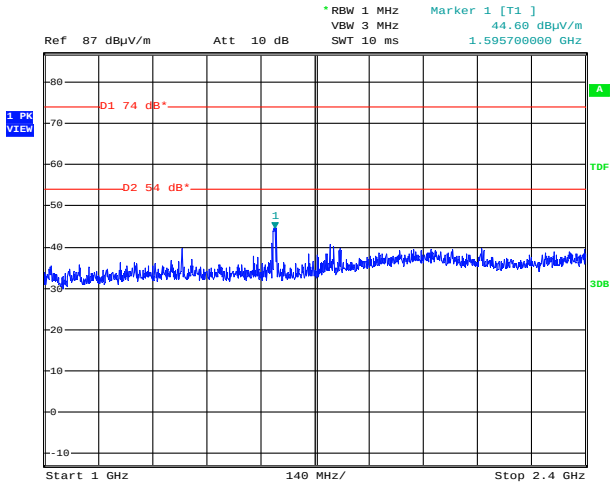


8 - 12 GHz

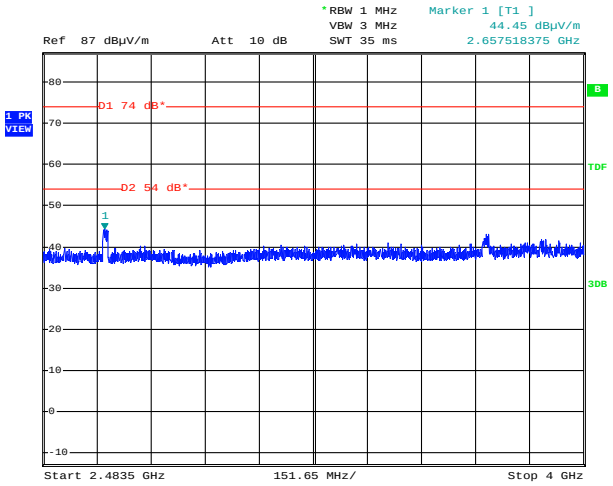


2441 MHz, GFSK

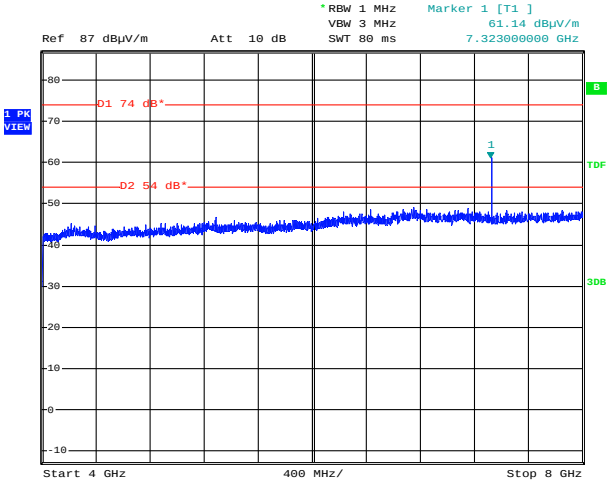
1 – 2.4 GHz



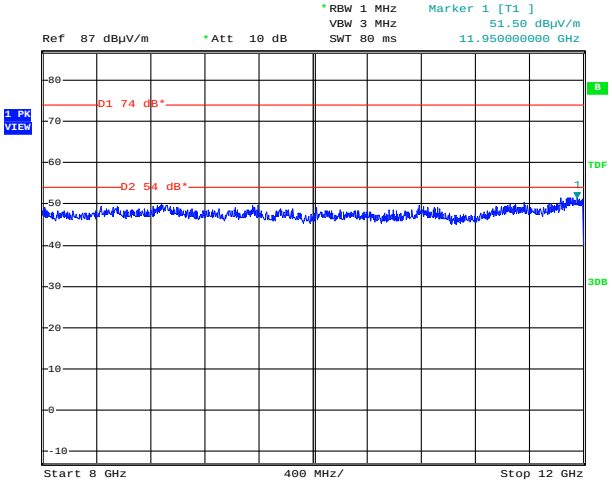
2.483.5 - 4 GHz



4 - 8 GHz

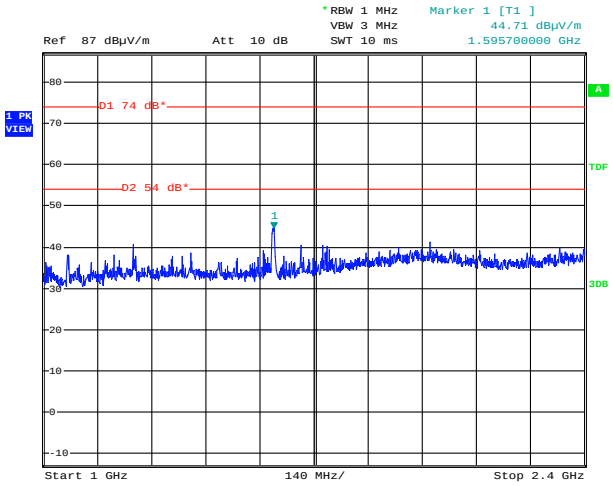


8 - 12 GHz

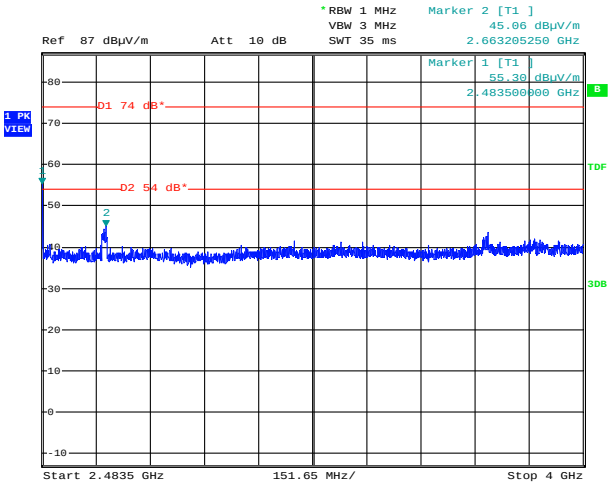


2480 MHz, GFSK

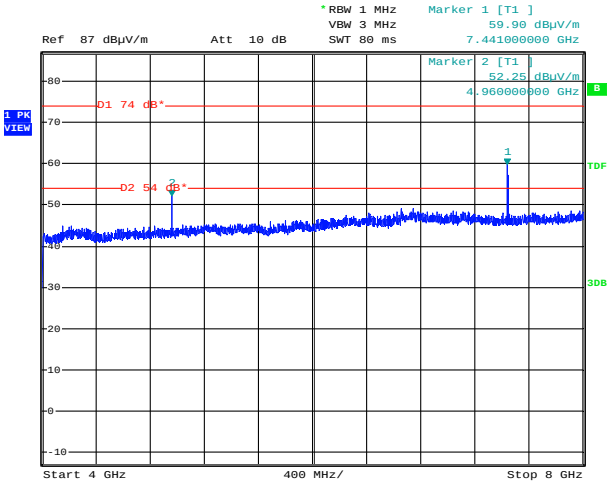
1 – 2.4 GHz



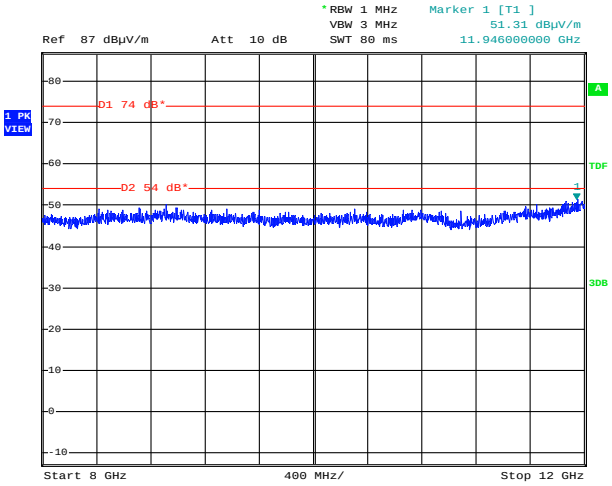
2.483.5 - 4 GHz



4 - 8 GHz

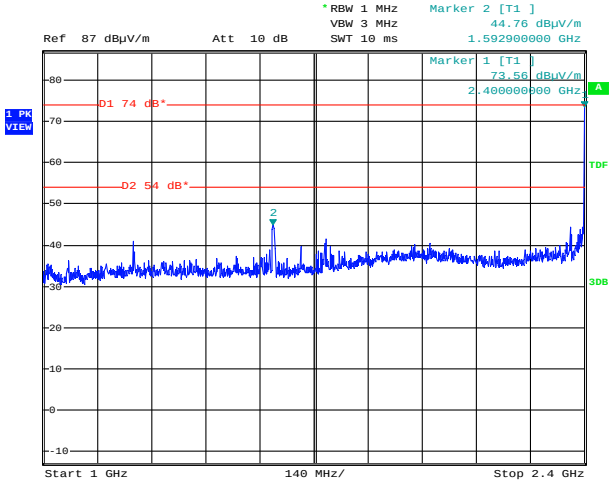


8 - 12 GHz

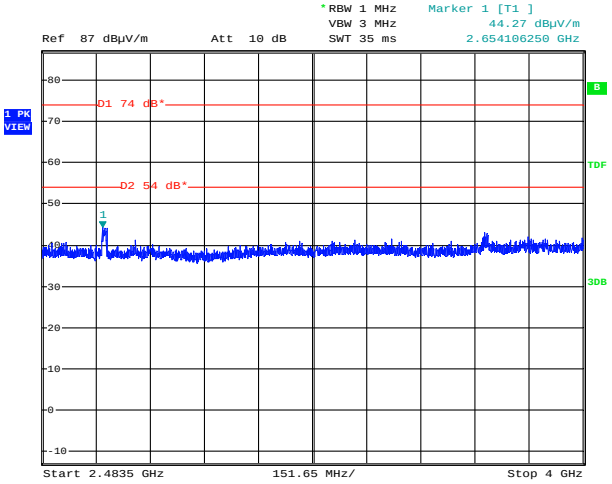


2402 MHz, 8DPSK

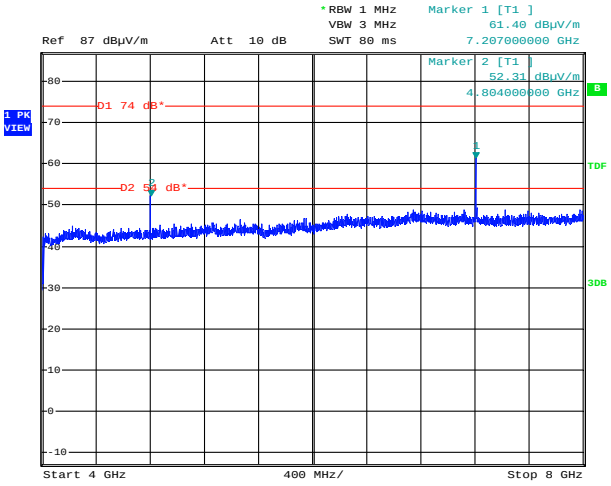
1 – 2.4 GHz



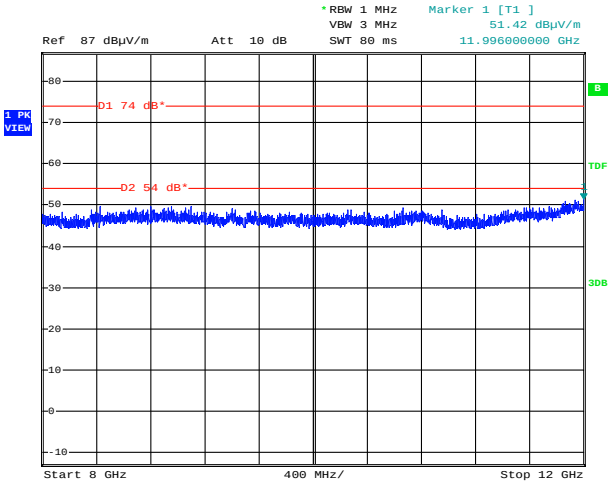
2.483.5 - 4 GHz



4 - 8 GHz

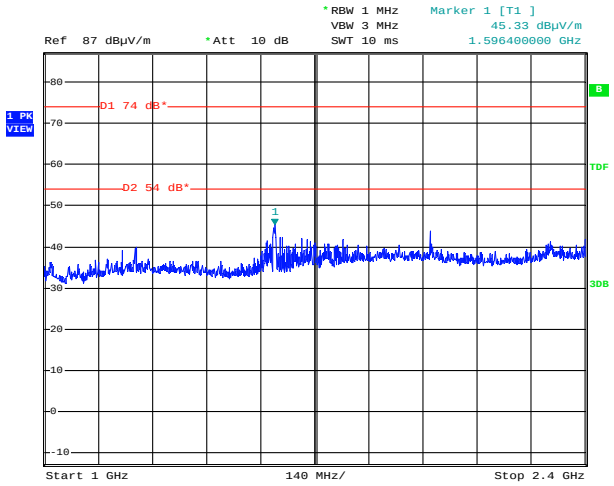


8 - 12 GHz

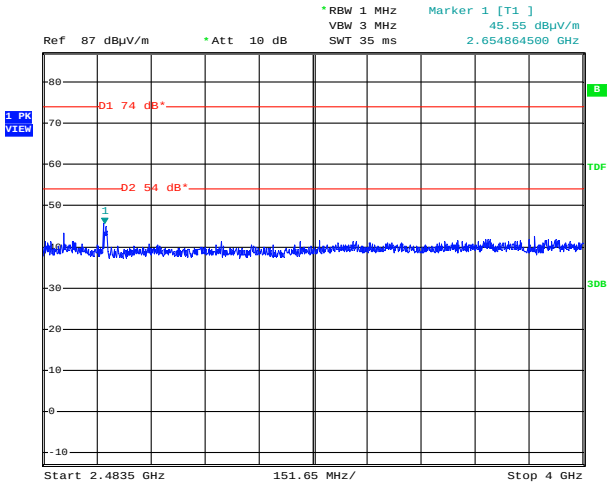


2441 MHz, 8DPSK

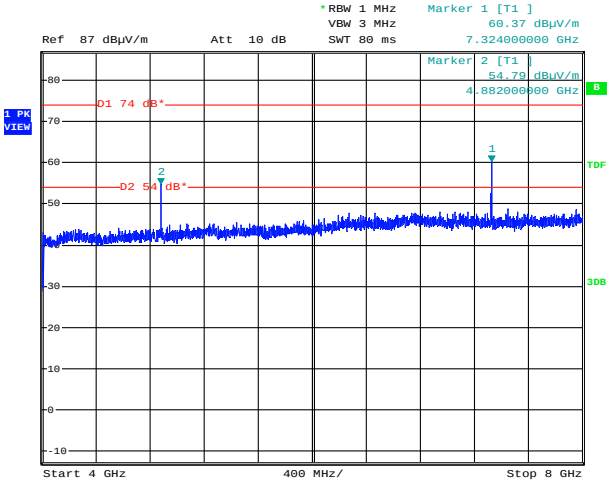
1 – 2.4 GHz



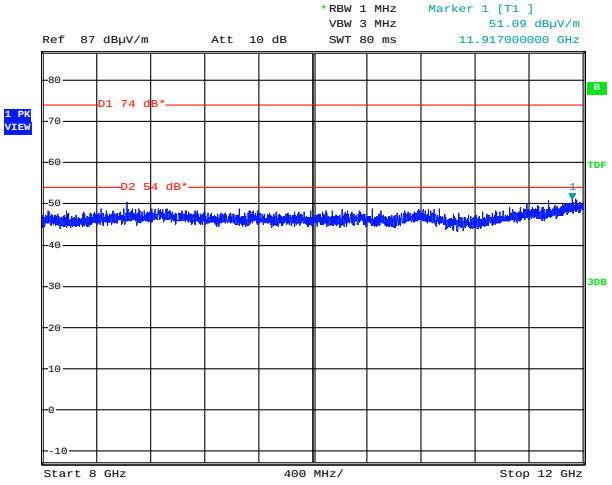
2.483.5 - 4 GHz



4 - 8 GHz

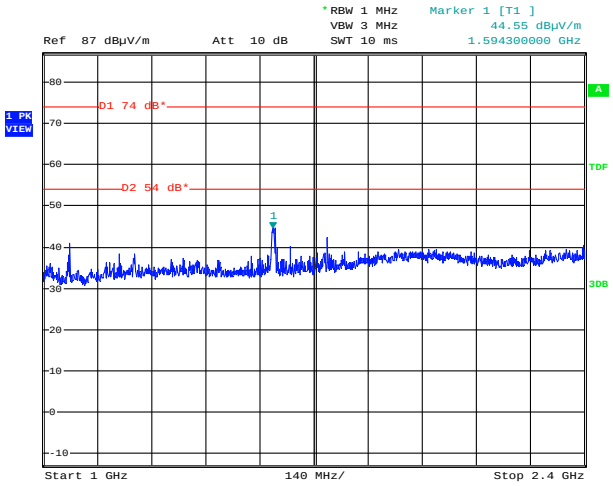


8 - 12 GHz

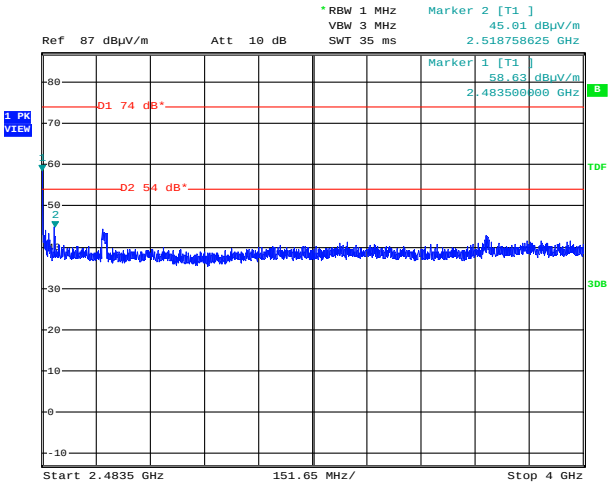


2480 MHz, 8DPSK

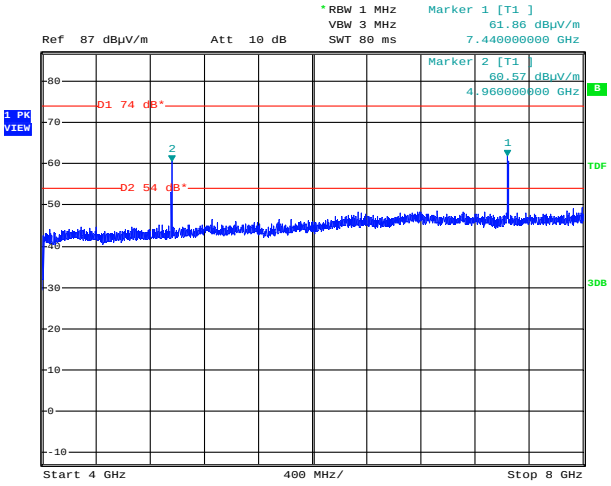
1 – 2.4 GHz



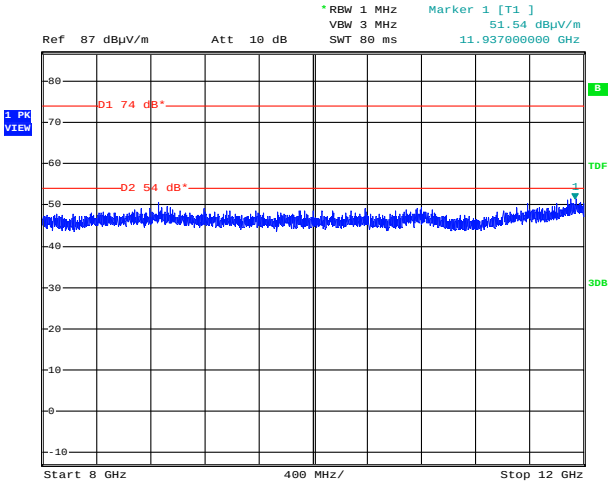
2.483.5 - 4 GHz



4 - 8 GHz

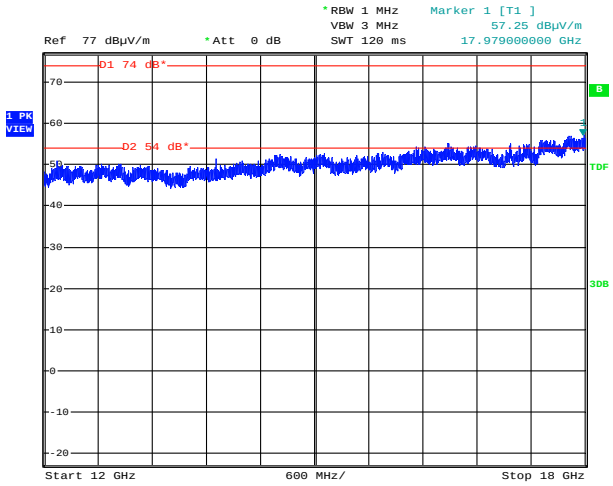


8 - 12 GHz

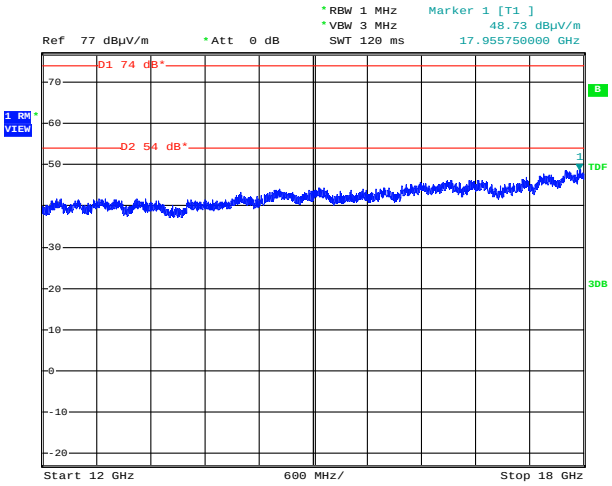


GFSK above 12 GHz

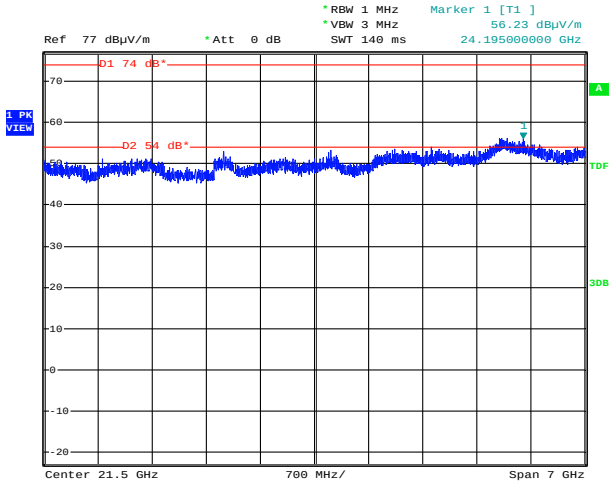
12 - 18 GHz



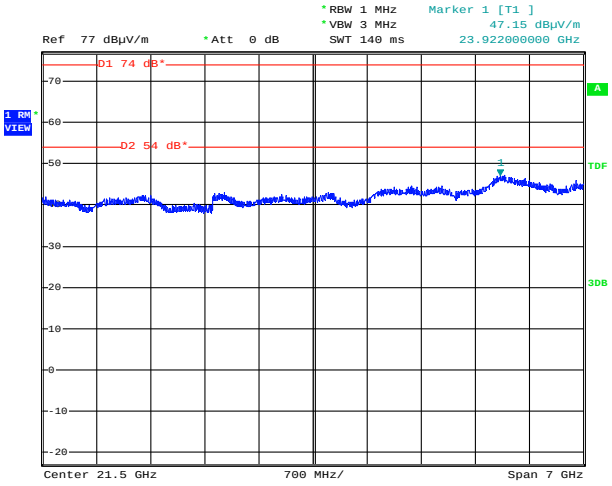
12 - 18 GHz, RMS



12 - 18 GHz

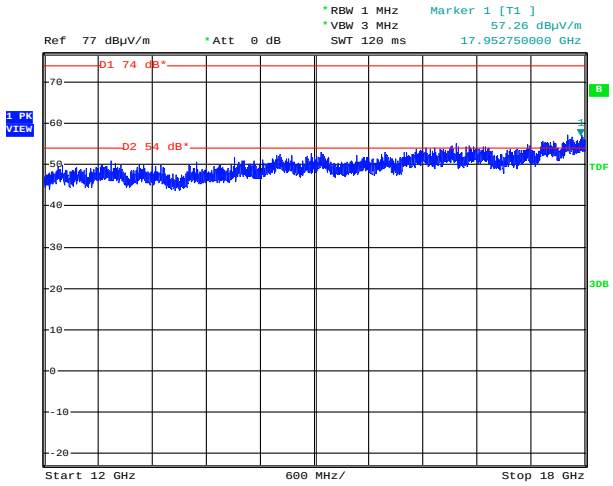


12 - 18 GHz, RMS

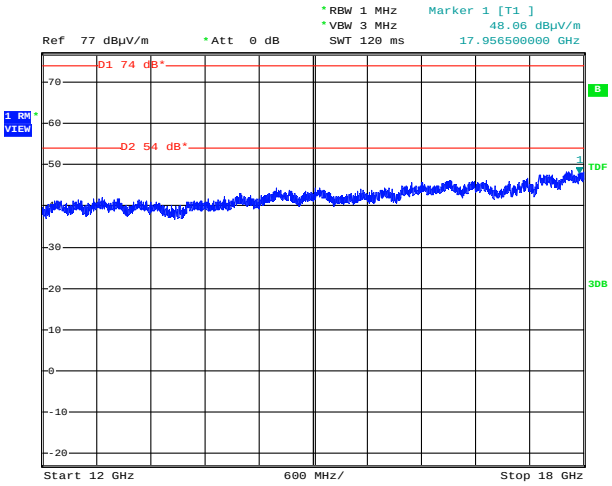


8DPSK above 12 GHz

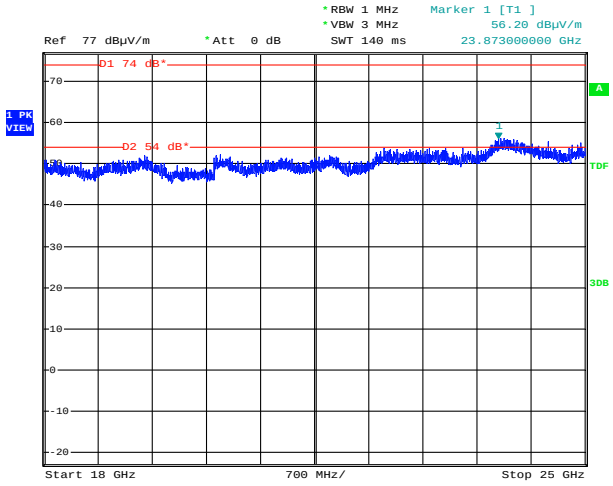
12 - 18 GHz



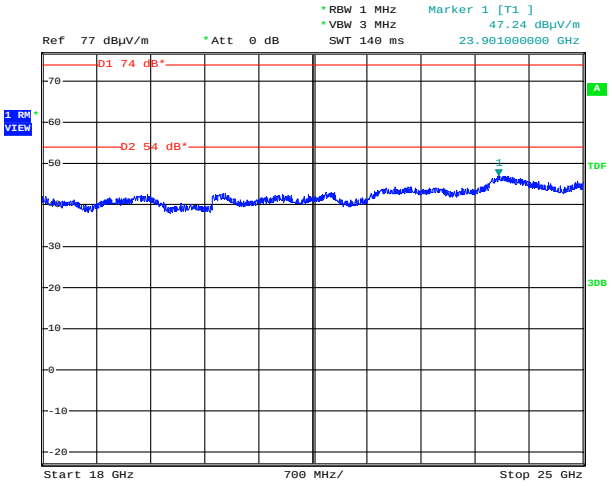
12 - 18 GHz, RMS



18 - 25 GHz



18 - 25 GHz, RMS



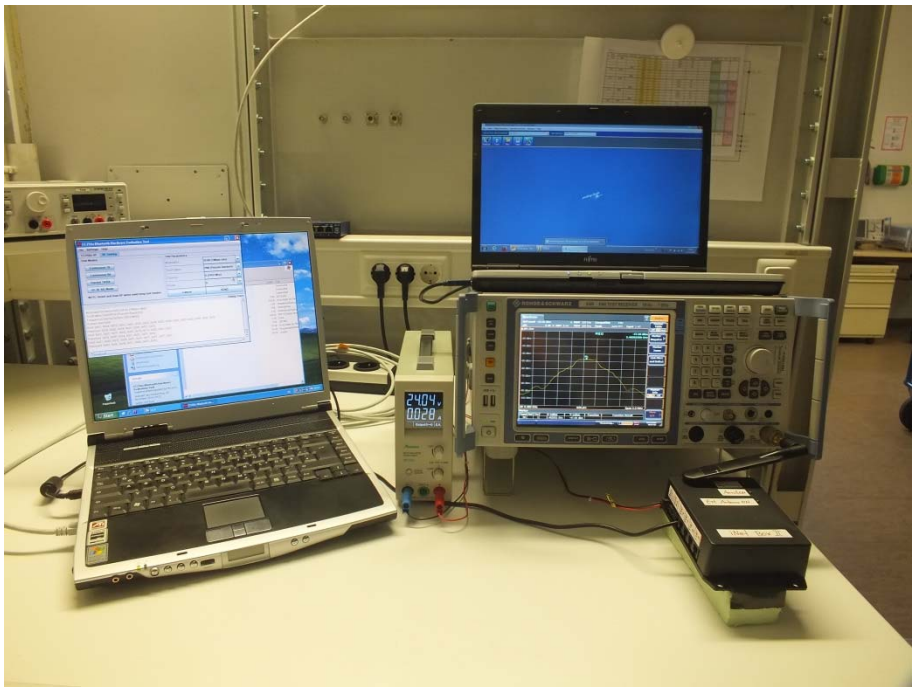
5.8 Correction for pulse operation (duty cycle)

For test instruments and accessories used see section 6 Part **MB**.

5.8.1 Description of the test location

Test location: AREA4

5.8.2 Photo documentation of the test setup



5.8.3 Applicable standard

According to FCC Part 15A, Section 15.35(c):
When the radiated emission limits are expressed in terms of average value and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete puls train, including blanking intervals, as long as the pulse train does not exceed 0.1s. In cases where the puls train exceeds 0.1s, the measured field strength shall be determined from the average absolute voltage during a 0.1s interval during which the field strength is at its maximum. The exact method of calculating the average field strength shall be submitted.
To demonstrate compliance for GFSK and 8DPSK modulation the worst case duty cycle being represented by the longest packet type was selected for test.

5.8.4 Description of Measurement

The duty cycle factor (dB) is calculated applying the following formula:

$$K_E = 20 \log \frac{(t_{iW}/T_B) * t_{iB}}{T_W}$$

Where:

K_E = pulse operation correction factor
t_{iw} = pulse duration for one complete pulse track
t_{iB} = pulse duration for one pulse
T_w = a period of the pulse track
T_B = a period of one pulse

5.8.5 Test result

GFSK

CH	t_{iw} (ms)	T_w (ms)	t_{iB} (ms)	T_B (ms)	K_E (dB)
0	100	100	5.782	100	-24.8

8DPSK

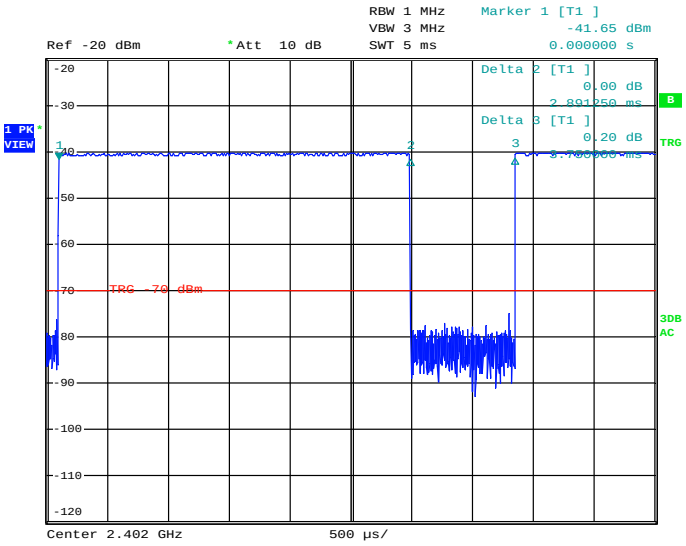
CH	t_{iw} (ms)	T_w (ms)	t_{iB} (ms)	T_B (ms)	K_E (dB)
78	100	100	5.782	100	-24.8

Remarks: The duty cycle has been calculated by averaging the sum of the pulse widths over 100 ms with the highest average value.

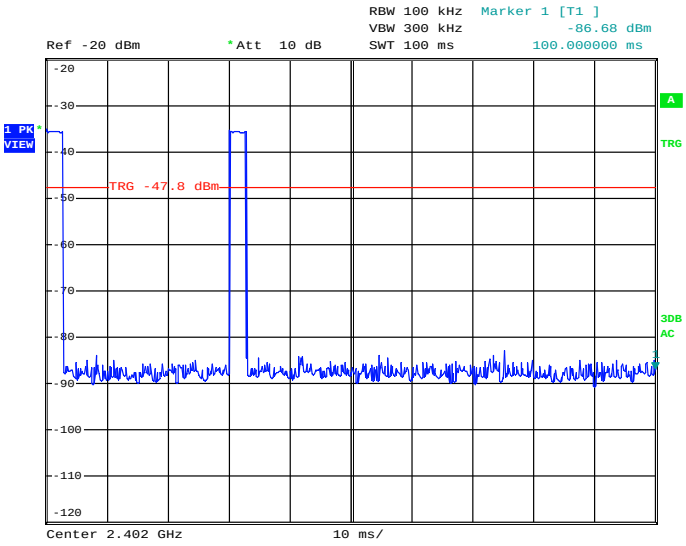
For detailed results, please see the test protocol below.

5.8.6 Test protocol

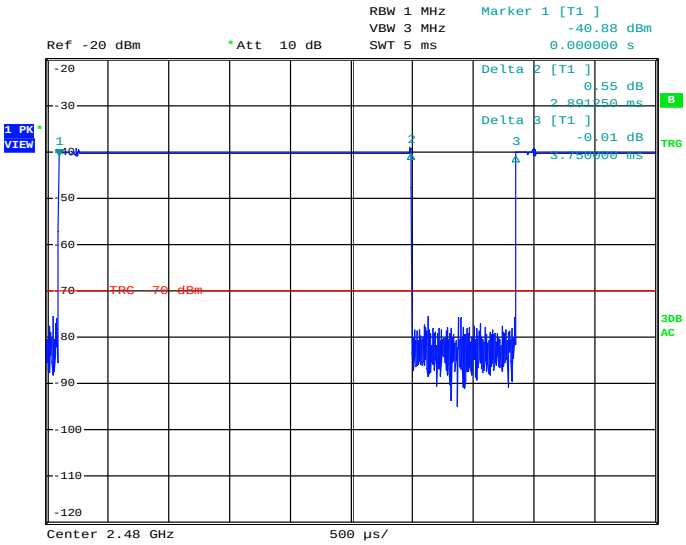
GFSK, DH5 packet



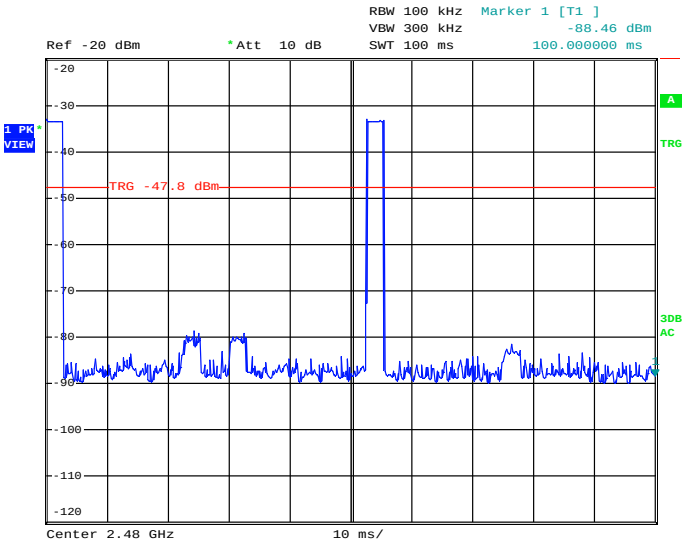
GFSK hopping mode, Emission bursts in 100 ms



8DPSK, 3-DH5 packet



8DPSK hopping mode, Emission bursts in 100 ms



5.9 Pseudorandom frequency hopping sequence

Requirement according to FCC Part 15C, Section 15.247(a):
The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies.

Co-ordination of the hopping sequence in data mode to avoid simultaneous occupancy by multiple transmitters:
Bluetooth units which want to communicate with other units must be organized in a structure called pico net. This consists of maximum 8 Bluetooth units. One unit is the master the other seven are the slaves. The master co-ordinates frequency occupation in this for all units. As the master hop sequence is derived from its BD address which is unique for each Bluetooth device, additional masters intending to establish new Pico nets will always use different hop sequences.
Example of a 79 hopping sequence in data mode:
40, 21, 44, 23, 42, 53, 46, 55, 48, 33, 52, 35, 50, 65, 54, 67, 56, 37, 60, 39, 58, 69, 62, 71, 64, 25, 68, 27, 66, 57, 70, 59, 72, 29, 76, 31, 74, 61, 78, 63, 01, 41, 05, 43, 03, 73, 07, 75, 09, 45, 13, 47, 11, 77, 15, 00, 64, 49, 66, 53, 68, 02, 70, 06, 01, 51, 03, 55, 05, 04

Derivation and examples for a hopping sequence in hybrid mode
For the generation of the inquiry and page hop sequences the same procedures as described for the data mode are used (see chapter 5), but this time with different input vectors:
a. For the inquiry hop sequence, a predefined fixed address is always used. This results in the same 32 frequencies used by all devices doing an inquiry but every time with a different start frequency and phase in this sequence.
b. For the page hop sequence, the device address of the paged unit is used as input vector. This results in the use of a subset of 32 frequencies which is specific for that initial state of the connection establishment between the two units. A page to different devices would result in a different subset of 32 frequencies.
So it is ensured that also in hybrid mode the frequency use equally averaged.
Example of a hopping sequence in inquiry mode:
48, 50, 09, 13, 52, 54, 41, 45, 56, 58, 11, 15, 60, 62, 43, 47, 00, 02, 64, 68, 04, 06, 17, 21, 08, 10, 66, 70, 12, 14, 19, 23
Example of a hopping sequence in paging mode:
08, 57, 68, 70, 51, 02, 42, 40, 04, 61, 44, 46, 63, 14, 50, 48, 16, 65, 52, 54, 67, 18, 58, 56, 20, 53, 60, 62, 55, 06, 66, 64

Remarks: This item is part of the Bluetooth Core Specifications V2.1+EDR compliance and approved.

5.10 Equal hopping frequency use

Requirement according to FCC Part 15C, Section 15.247(a):
Each frequency must be used equally on the average by each transmitter.

The generation of the hopping sequence in connection mode depends essentially on two input values:
1. LAP/UAP of the master of the connection.
2. Internal master clock.
The LAP (lower address part) is the 24 LSB's of the 48 BD_ADDRESS. The BD_ADDRESS is an unambiguous number of every Bluetooth unit. The UAP (upper address part) are the 24 MSB's of the 48 BD_ADDRESS. The internal clock of a Bluetooth unit is derived from a free running clock which is never adjusted and is never turned off. For synchronization with other units only offset are used. It has no relation to the time of the day. Its resolution is at least half the Rx/Tx slot length of 312.5 µs. The clock has a cycle of about one day (23hr30min). In most case, it is implemented as 28 bit counter. For the deriving of the hopping sequence the entire LAP (24 bits), 4 LSB's (4 bits) (Input 1) and the 27 MSB's of the clock (Input 2) are used. With this input values different mathematical procedures (permutations, additions, XOR-operations) are performed to generate the sequence. This will be done at the beginning of every new transmission.
Regarding short transmissions the Bluetooth system has the following behaviour: The first connection between the two devices is established, a hopping sequence was generated. For transmitting the wanted data the complete hopping sequence was not used. The connection ended. The second connection will be established. A new hopping sequence is generated. Due to the fact that the Bluetooth clock has a different value the hopping sequence will always differ from the first one, because the period between the two transmissions is longer and it cannot be shorter than the minimum resolution of the clock is 312.5 µs. This circumstance is always the same therefore the average of the frequency use is the same on all transmitters.

Remarks: This item is part of the Bluetooth Core Specifications V2.1+EDR compliance and approved.

5.11 Receiver input bandwidth

Requirement according to FCC Part1 5C, Section 15.247(a):
The system receivers shall have input bandwidth that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signal.

Receiver input bandwidth and behaviours for repeated single or multiple packets:
The input bandwidth of the receiver is 1 MHz. In every connection one Bluetooth device is the master and the other one is the slave. The master determines the hopping sequence (see chapter 5). The slave follows this sequence. Both devices shift between Rx and Tx time slot according to the clock of the master. Additionally the type of connection (e.g. single or multi-slot packet) is set up at the beginning of the connection. The master adapts its hopping frequency and its Tx/Rx timing according to the packet type of the connection. Also the slave of the connection will use these settings. Repeating of a packet has no influence on the hopping sequence. The hopping sequence generated by the master of the connection will be followed in any case. That means, a repeated packet will not be send on the same frequency, it is send on the next frequency of the hopping sequence.

Remarks: This item is part of the Bluetooth Core Specifications V2.1+EDR compliance and approved.

5.12 Dwell time

5.12.1 Applicable standard

According to FCC Part 15, Section 15.247(a):
In Section 15.247(a)(1i)(1ii) and (1iii) are dwell times defined for the special frequency ranges should not exceed by a frequency hopping system.

Dwell time in data mode:
The dwell time of 0.3797s within a 30 second period in data mode is independent from the packet type (packet length). The calculation for a 30 second period is a follows:

Dwell time = time slot length * hop rate / number of hopping channels * 30s
Example for a DH1 packet (with a maximum length of one time slot)
Dwell time = 625 µs * 1600 * 1/s / 79 * 30s = 0.3797s (in a 30s period)

For multi-slot packet the hopping is reduced according to the length of the packet.
Example for a DH5 packet (with a maximum length of five time slots)
Dwell time = 5 * 625 µs * 1600 * 1/5 * 1/s / 79 * 30s = 0.3797s (in a 30s period)

This is according the Bluetooth Core Specification V 1.0B (+ critical errata) for all Bluetooth devices. There for all Bluetooth devices comply with the FCC dwell time requirement in data mode.
This was checked during the Bluetooth Qualification tests and approved.

The Dwell time in hybrid mode is approximately 2.6 ms (in a 12.8 s period).

5.12.2 Description of Measurement

According to DA 00-705 a spectrum analyser is used to measure EUT´s transmit signal using the assigned frequency. The span of the spectrum analyser was set to zero span and the frequency of the measured hopping channel was centered. Sweep time setting was as long as necessary to capture the entire dwell time per hopping channel. Pre-measurements showed the longest dwell time in 3-DH5 packet type.

Spectrum analyser settings:

RBW: 1 MHz, VBW: 3 MHz, Detector function: Maximum peak, Trace: Maximum hold

5.12.3 Test result

Operation mode:	3-DH5 Packet mode permits maximum 1600 hops per second in each channel, supporting 1 TX- and 1 RX-channel.
Hops per second:	1600
Number of channels:	79
Length of one hop:	$T_{hop} = t_{TX} + t_{RX}$ = 2.891 ms + 0.8554 ms = 3.7464 ms
Spreading factor:	75
Limit for total frequency residence time:	< 0.4 s

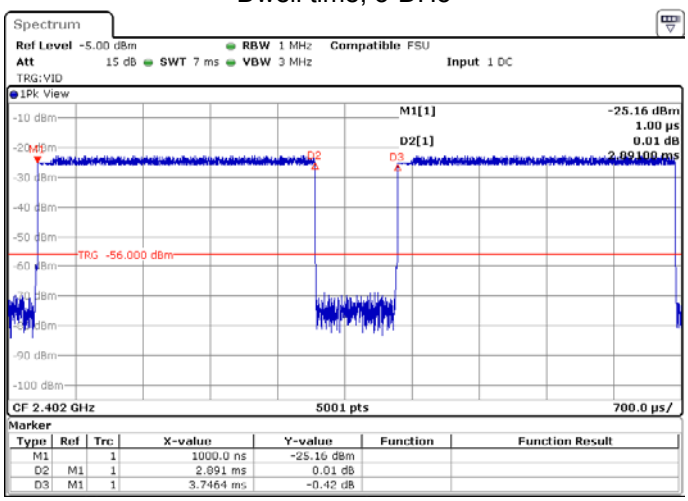
Operating mode	Time of period (s)	Residence time, time of 1 burst (ms)	Number of Bursts (per period)	Total frequency residence time (ms)
Hopping 3-DH5	0.4 s * 75 = 30s	2.891	102	294.88

The requirements are **FULFILLED.**

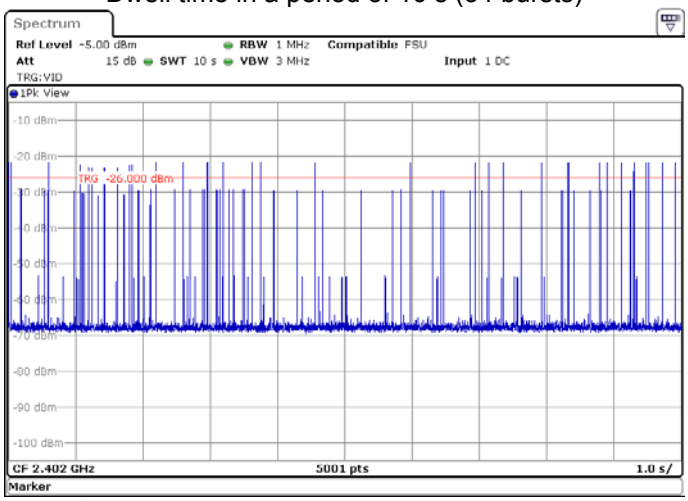
Remarks: This item is part of the Bluetooth Core Specifications V2.1+EDR compliance and approved.

For detailed test results please refer to following test protocol.

Dwell time, 3-DH5



Dwell time in a period of 10 s (34 bursts)



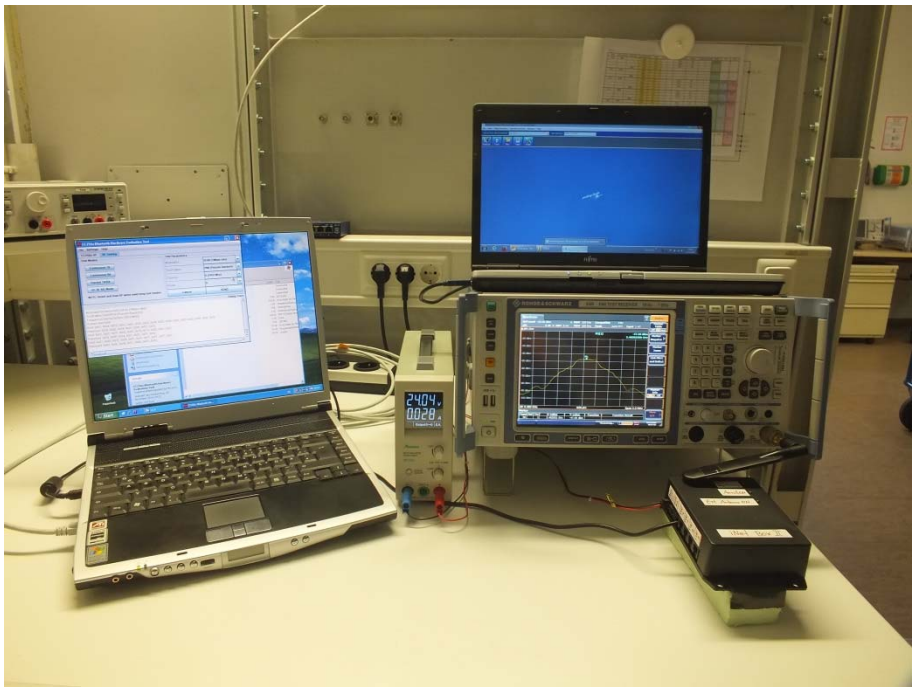
5.13 Carrier frequency separation

For test instruments and accessories used see section 6 Part **MB**.

5.13.1 Description of the test location

Test location: AREA4

5.13.2 Photo documentation of the test set-up



5.13.3 Applicable standard

According to FCC Part 15, Section 15.247(a):
Frequency hopping systems operating in the frequency band of 2400 MHz – 2483.5 MHz may have hopping channel carrier frequencies that are separated by 25 kHz or 2/3 of the 20 dB bandwidth of the hopping channel.

5.13.4 Description of Measurement

The measurement is performed using a spectrum analyser in single sweep mode. A part of the operating frequency is used for better resolution. In normal application mode all the channels of the part of operating frequency are displayed and the separation is measured. The 20 dB OBW has to be measured before to compare whether the OBW requirement is fulfilled.

5.13.5 Test result

Channel separation in hybrid mode:
The nominal channel spacing of the Bluetooth system is 1MHz independent of the operating mode. The maximum “initial carrier frequency tolerance” which is allowed for Bluetooth is c_{centre} = 75 kHz.
This was checked during the Bluetooth Qualification tests (Test Case: TRM/CA/07-E) for three frequencies (2402 MHz, 2441 MHz, and 2480 MHz) and approved.

Additionally an example for the channel separation is given below:

Channel number	Channel frequency (MHz)	Peak frequency (MHz)	Separation (kHz)	Limit 2/3*EBW (kHz)
39	2440	2440.146	-	> 903
40	2441	2441.144	998	> 903

Limit according to FCC Part 15C, Section 15.247(a):

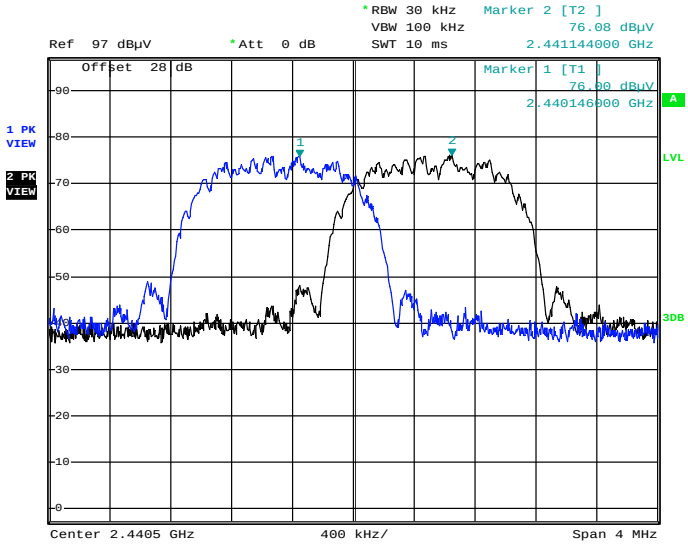
Frequency (MHz)	Hopping channels	Limit channel separation
All systems		> 25 kHz or 20 dB bandwidth, whichever is greater
2400 - 2483.5	≥ 15	> 25 kHz or 2/3 of 20 dB bandwidth, whichever is greater

The requirements are **FULFILLED.**

Remarks: For detailed test result please see to following test protocol.

5.13.6 Test protocol

Channel separation, CH39 to CH40



5.14 Number of hopping channels

For test instruments and accessories used see section 6 Part **MB**.

5.14.1 Description of the test location

Test location: AREA4

5.14.2 Test result

Hopping channel frequency range	Number of all available hopping channels
2402 - 2480	79

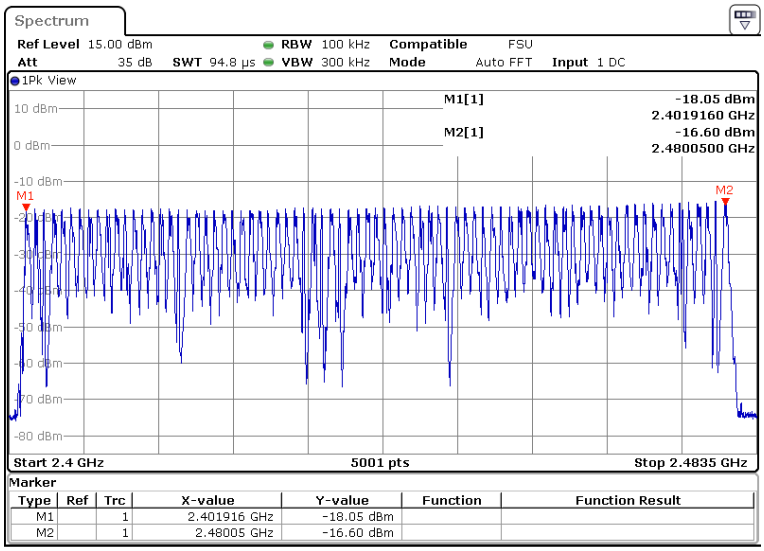
Limit according to FCC Part 15C, Section 15.247(1):

Frequency range (MHz)	LIMIT (Number of Hopping Channels)			
	20dB Bandwidth < 250kHz	20dB Bandwidth > 250kHz	20dB Bandwidth < 1 MHz	20dB Bandwidth > 1MHz
2400 – 2483.5	15	15	15	15

The requirements are **FULFILLED.**

Remarks: For detailed test result please see to following test protocol.

5.14.3 Test protocol



5.15 Antenna application

For test instruments and accessories used see section 6 Part **CPR3** .

5.15.1 Applicable standard

According to FCC Part 15C, Section 15.203:
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that broken antennas can be replaced by the user, but the use of a standard antenna jack is prohibited.

Remarks: No power reduction results from the defacto limit, because the antenna gain is lower than 6 dBi.

Antenna application can be viewed in Attachment A.

6 USED TEST EQUIPMENT AND ACCESSORIES

All test instruments used are calibrated and verified regularly. The calibration history is available on request.

Test ID	Model Type	Equipment No.	Next Calib.	Last Calib.	Next Verif.	Last Verif.
CPR 3	FSP 30	02-02/11-05-001	20/10/2015	20/10/2014		
	AFS5-12001800-18-10P-6	02-02/17-06-002				
	AFS4-01000400-10-10P-4	02-02/17-13-002				
	AMF-4F-04001200-15-10P	02-02/17-13-003				
	3117	02-02/24-05-009	07/05/2015	07/05/2014		
	Sucoflex N-2000-SMA	02-02/50-05-075				
	SF104/11N/11N/1500MM	02-02/50-13-015				
	NSP 3630	02-02/50-14-015				
MB	ESR 7	02-02/03-13-001	03/06/2015	03/06/2014		
	FSP 30	02-02/11-05-001	20/10/2015	20/10/2014		
	NSP 3630	02-02/50-14-015				
SER 2	ESVS 30	02-02/03-05-006	03/07/2015	03/07/2014		
	VULB 9168	02-02/24-05-005	08/04/2015	08/04/2014	12/09/2015	12/03/2015
	S10162-B	02-02/50-05-032				
	NW-2000-NB	02-02/50-05-113				
	KK-EF393/U-16N-21N20 m	02-02/50-12-018				
SER 3	FSP 30	02-02/11-05-001	20/10/2015	20/10/2014		
	JS4-18004000-30-5A	02-02/17-05-017				
	AFS5-12001800-18-10P-6	02-02/17-06-002				
	AFS4-01000400-10-10P-4	02-02/17-13-002				
	AMF-4F-04001200-15-10P	02-02/17-13-003				
	3117	02-02/24-05-009	07/05/2015	07/05/2014		
	BBHA 9170	02-02/24-05-014				
	Sucoflex N-2000-SMA	02-02/50-05-075				
	KMS102-0.2 m	02-02/50-11-020				
	SF104/11N/11N/1500MM	02-02/50-13-015				
	NSP 3630	02-02/50-14-015				