

EMI – TEST REPORT

- FCC Part 15.249, RSS210 -

Type / Model Name : Type 2779_rLeaf

Product Description : Remote control with Bluetooth 4.0 Low Energy

Applicant : ruwido austria gmbh

Address : Köstendorfer Strasse 8

5202 NEUMARKT, AUSTRIA

Manufacturer : ruwido austria gmbh

Address : Köstendorfer Strasse 8

5202 NEUMARKT, AUSTRIA

Licence holder : ruwido austria gmbh

Address : Köstendorfer Strasse 8

5202 NEUMARKT, AUSTRIA

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

POSITIVE

Test Report No. : **T40947-00-02GK**

21. June 2016

Date of issue



DAkkS

Deutsche
Akkreditierungsstelle
D-PL-12030-01-01
D-PL-12030-01-02

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test results
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Attachment B as separate supplement

1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 15, Subpart A - General (September, 2015)

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, 2015)

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 15.249	Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz, 5725 - 5875 MHz, and 24.0 - 24.25 GHz

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.
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ANSI C63.10: 2013	Testing Unlicensed Wireless Devices
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ANSI C95.1:2005	IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz
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CISPR 16-4-2: 2013	Uncertainty in EMC measurement
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CISPR 22: 2008 EN 55022: 2010	Information technology equipment
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2 EQUIPMENT UNDER TEST

2.1 Photo documentation of the EUT

Detailed photos see Attachment B

2.2 Equipment category

Bluetooth Low Energy device, portable equipment.

2.3 Short description of the equipment under test (EUT)

The EUT is a Bluetooth Low Energy wireless remote control system. The EUT is compatible with the standard 802.15.1. It supports the 2.4 GHz frequency band. A single PCB antenna is used within the system. The modulation used by the EUT is GFSK with a data rate of 1 Mbits which means worst case for testing. The EUT has only one integrated antenna, no temporary connector and no external antenna can be connected.

Number of tested samples	:	1 (emission test)	1 (CPC measurement)
Serial number	:	Pre-production sample	Pre-production sample
Firmware version	:	V 1.0.1	V 1.0.1

Items	Description
BT type	4.0 Low Energy
BT chipset type	Texas Instruments CC2541
Modulation	GFSK
Frequency range	2400 MHz to 2483.5 MHz
Channel numbers	40
Data rate (kbps)	1000
Antenna type	PCB

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:

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
37	2402	9	2422	18	2442	28	2462
0	2404	10	2424	19	2444	29	2464
1	2406	38	2426	20	2446	30	2466
2	2408	11	2428	21	2448	31	2468
3	2410	12	2430	22	2450	32	2470
4	2412	13	2432	23	2452	33	2472
5	2414	14	2434	24	2454	34	2474
6	2416	15	2436	25	2456	35	2476
7	2418	16	2438	26	2458	36	2478
8	2420	17	2440	27	2460	39	2480

Note: the marked frequencies are determined for final testing.

2.6 Transmit operating modes

The EUT uses GFSK and provide following data rate:

1000 kbps (kbps = kilobits per second)

2.7 Antenna

The following antenna shall be used with the EUT:

Number	Characteristic	Certification name	Plug	Frequency range (GHz)	Gain (dBi)
1	Omni	PCB antenna	none	2.4 - 2.4835	n/a

2.8 Power supply system utilised

Power supply voltage, V_{nom} : 3.7 VDC (battery powered)

2.9 Peripheral devices and interface cables

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

- _____ Model : _____
- _____ Model : _____
- _____ Model : _____

2.10 Determination of worst case conditions for final measurement

Measurements have been made in all three orthogonal axes and the settings of the EUT were 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 with the following settings:

BT 4.0 LE	Available channels	Tested channels	Power setting	Modulation	Data rate
802.15.1	00 to 39	37, 18, 39	0 dBm	GFSK	1000 kbps

1000 kbps, GFSK with TX continuous modulated.

2.10.1 Test jig

No Test jig was used for test.

2.10.2 Test software

The device for emission test uses a special firmware that allows enabling a continuous modulated output signal.

3 TEST RESULT SUMMERY

Operating in the 2400 MHz – 2483.5 MHz band:

FCC Rule Part	RSS Rule Part	Description	Result
15.35(c)	RSS-Gen, 6.10	Pulsed operation	passed
15.203	RSS Gen, 8.3	Antenna requirement	passed
15.204	RSS Gen, 8.2	External radio frequency power amplifiers	passed
15.205(a)	RSS Gen, 8.1	Emissions in restricted bands	passed
15.207(a)	RSS Gen, 8.8	AC power line conducted emissions	not applicable
15.215(c)	-	EBW	passed
-	RSS-Gen, 6.6	OBW	passed
15.249(a)	RSS-210, A2.9(a)	Field strength of fundamental	passed
15.249(d)	RSS-210, A2.9(b)	Out-of-band emission, radiated	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

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 : 13 April 2016

Testing concluded on : 13 June 2016

Checked by:

Tested by:

Klaus Gegenfurtner
Teamleader Radio

Konrad Graßl
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 referenced 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.

Measurement uncertainty	
Test	Uncertainty
Conducted emissions mains	± 3.1 dB
Power spectral density	± 2.7 dB
bandwidth measurement	± 100 kHz (depends on the used RBW)
Maximum output power	± 1.0 dB
Spurious emissions radiated below 30 MHz	± 3 dB
Spurious emissions radiated 30 MHz to 1 GHz	± 4.4 dB
Spurious emissions radiated 1 GHz to 12.75 GHz	± 3.7 dB
Spurious emissions radiated above 12.75 GHz	± 5.0 dB

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-01

The anechoic chamber site is a listed chamber under the Canadian Test-Sites File-No:

IC 3009A-02

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 AC power line 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: Not applicable, the EUT is battery powered and has no externally connectable cables.

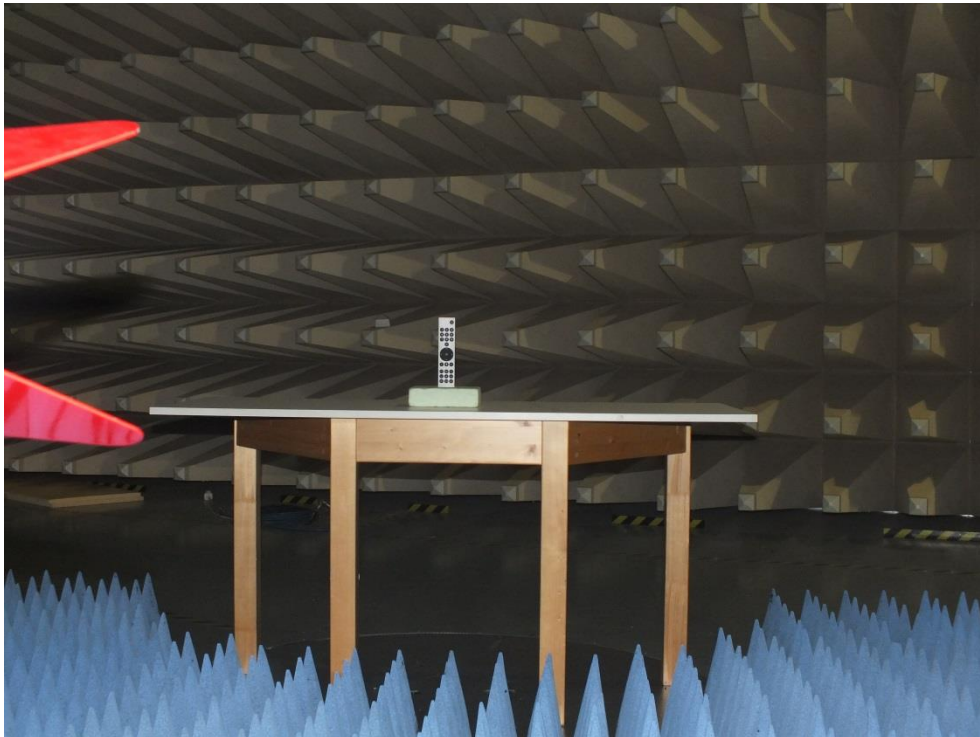
5.2 Field strength of fundamental

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

5.2.1 Description of the test location

Test location: Anechoic chamber 1
Test distance: 3 m

5.2.2 Photo documentation of the test set-up



5.2.1 Applicable standard

According to FCC Part 15C, Section 15.249(a):

The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the effective limits.

5.2.2 Description of Measurement

The radiated emission of the fundamental wave from the EUT is measured using a spectrum analyser and appropriate linear polarized antennas. The set up of the EUT and the measurement procedure is in accordance to ANSI C63.10, Item 6.5. The EUT is measured in TX continuous mode modulated under normal conditions.

Analyser settings:

Peak measurement: RBW: 3 MHz

VBW: 10 MHz

Detector: Max peak

5.2.3 Test result

Frequency (MHz)	Level PK dB(μV/m)	Limit PK dB(μV/m)	Margin PK (dB)	Level AV dB(μV/m)	Limit AV dB(μV/m)	Margin AV (dB)
2402	87.7	114.0	-26.3	51.3	94.0	-42.7
2442	87.6	114.0	-26.4	51.2	94.0	-42.8
2480	84.7	114.0	-29.3	48.3	94.0	-45.7

Note: The correction factor includes cable loss and antenna factor.
Additional the peak values are corrected with the duty cycle of -36.4 dB to get the average value.

Average-Limit according to FCC Part 15C, Section 15.249(a):

Frequency (MHz)	Field strength of fundamental	
	(mV/m)	dB(μV/m)
902 - 928	50	94
2400 - 2483.5	50	94
5725-5875	50	94
24000 - 24250	250	108

Peak-Limit according to FCC Part 15C, Section 15.249(e):
However the peak fieldstrength shall not exceed the maximum permitted average limit by more than 20 dB.

The requirements are **FULFILLED**.

Remarks:

5.3 Out-of-band emission, radiated

For test instruments and accessories used see section 6 Part **SER1**, **SER 2**, **SER 3**.

5.3.1 Description of the test location

Test location: OATS 1
Test location: Anechoic chamber 1
Test distance: 3 m

5.3.2 Photo documentation of the test set-up

Test setup 30 MHz – 1000 MHz:



Test setup 1 GHz – 18 GHz:



5.3.3 Applicable standard

According to FCC Part 15C, Section 15.249 (d):

Emission radiated outside of the specified frequency bands, except harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated limit in FCC Part 15C, Section 15.209, whichever is the lesser attenuation.

5.3.4 Description of Measurement

The radiated emissions from the EUT are measured in the frequency range of 9 kHz to 1000 MHz using a tuned receiver and appropriate broadband linearly polarized antennas. The setup of the EUT and the measurement procedure is in accordance to ANSI C63.10, Item 6.3. In the frequency range above 1 GHz a spectrum analyser is used with appropriate linear polarized antennas. If the emission level in peak mode complies with the average limit testing is stopped and peak values will be reported, otherwise, the emission is measured in average mode again and reported. The EUT is measured in TX continuous mode modulated under normal conditions.

Instrument settings:

9 kHz – 150 kHz	RBW:	200 Hz
150 kHz - 30 MHz	RBW:	9 kHz
30 MHz – 1000 MHz:	RBW:	120 kHz
1000 MHz – 25 GHz	RBW:	1 MHz

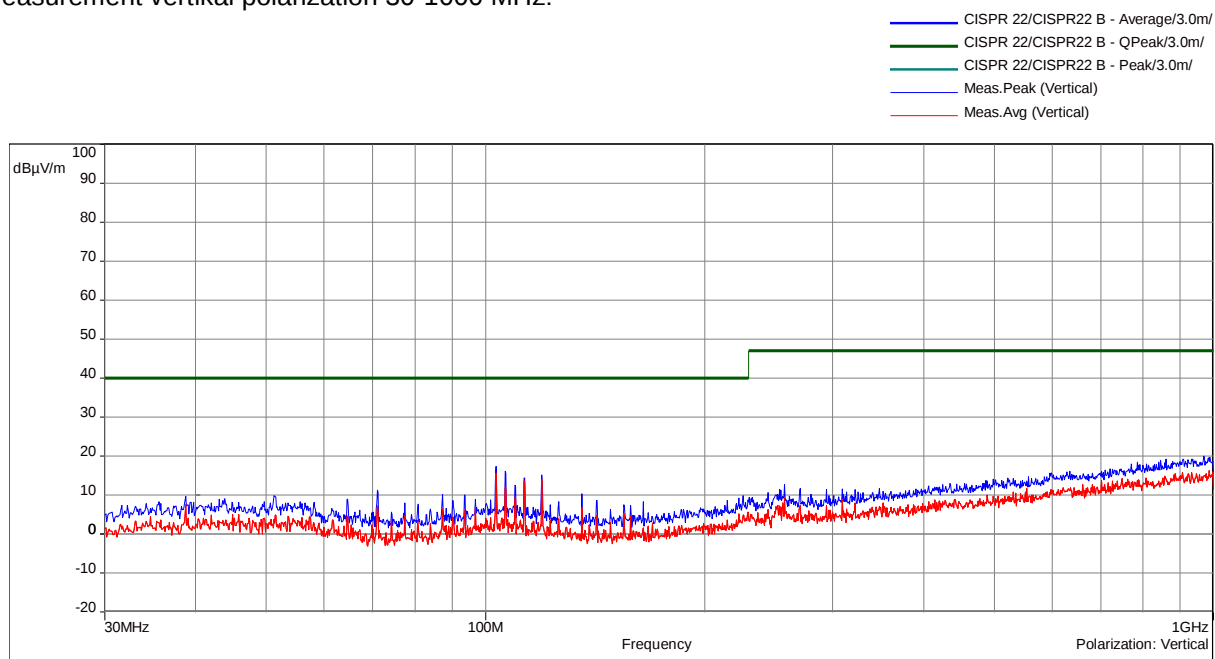
5.3.1 Test result

Note:

Pre-measurements were performed in the frequency range 9 kHz to 30 MHz, 30 MHz to 1000 MHz and 18 GHz to 25 GHz. The EUT showed no detectable suspects.

Only for reference the plots of the pre-measurement in TX mode at 2402 MHz

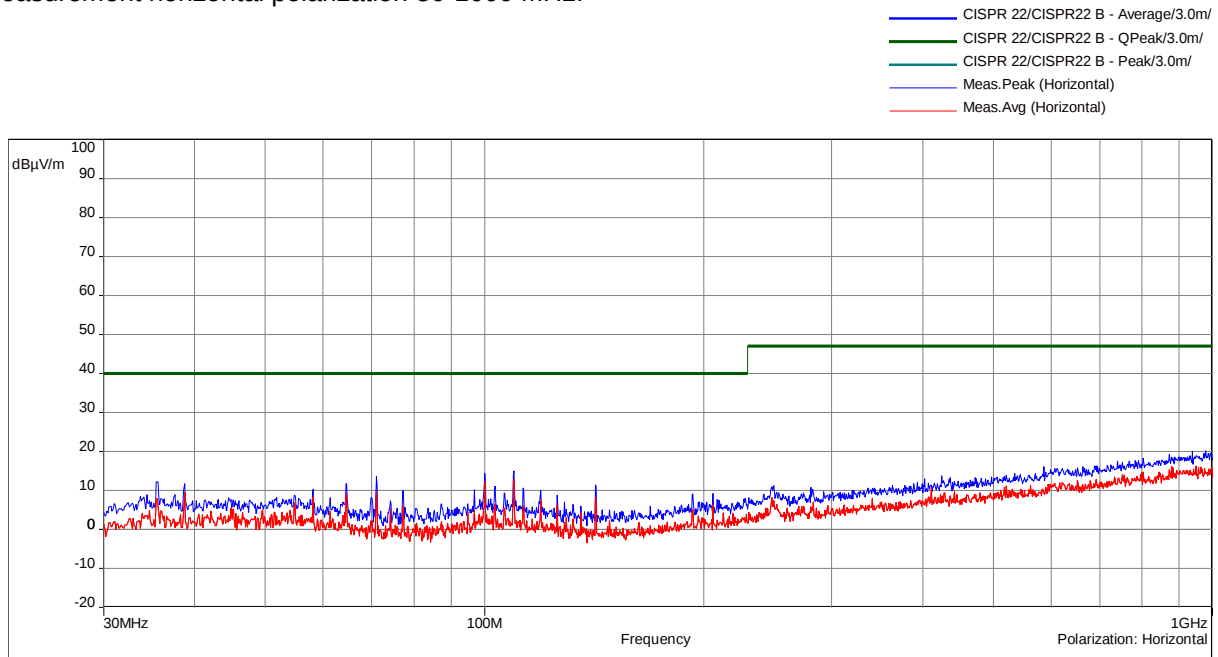
Pre-measurement vertical polarization 30-1000 MHz:



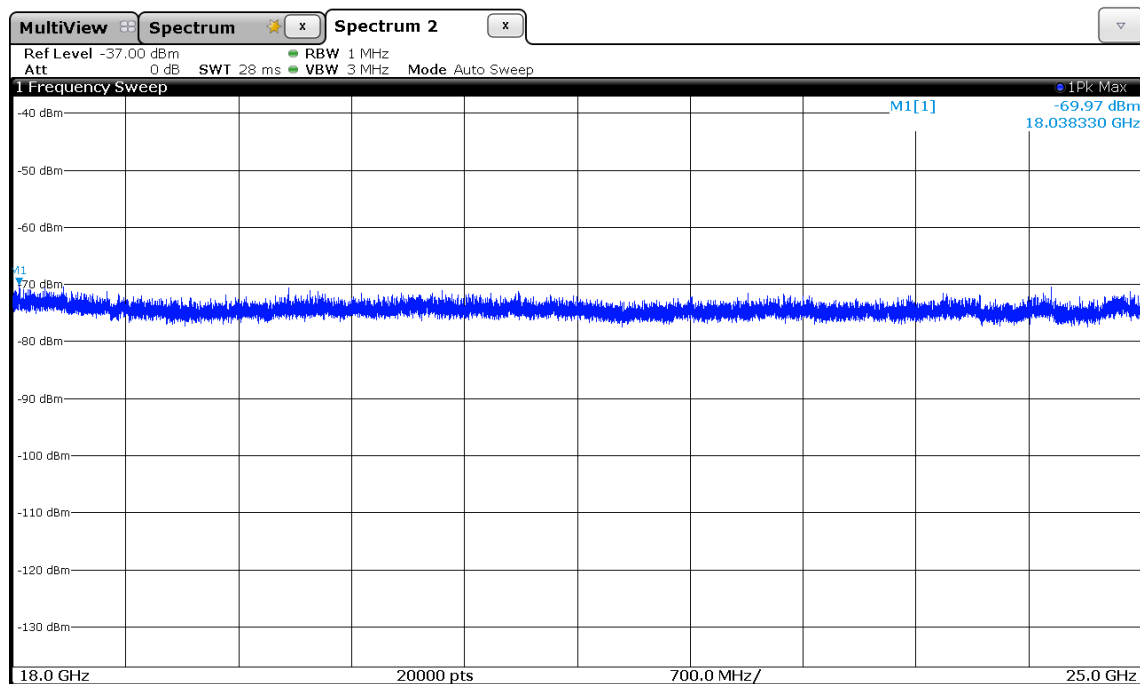
FCC ID: XYN779B

IC: 8748A-779B

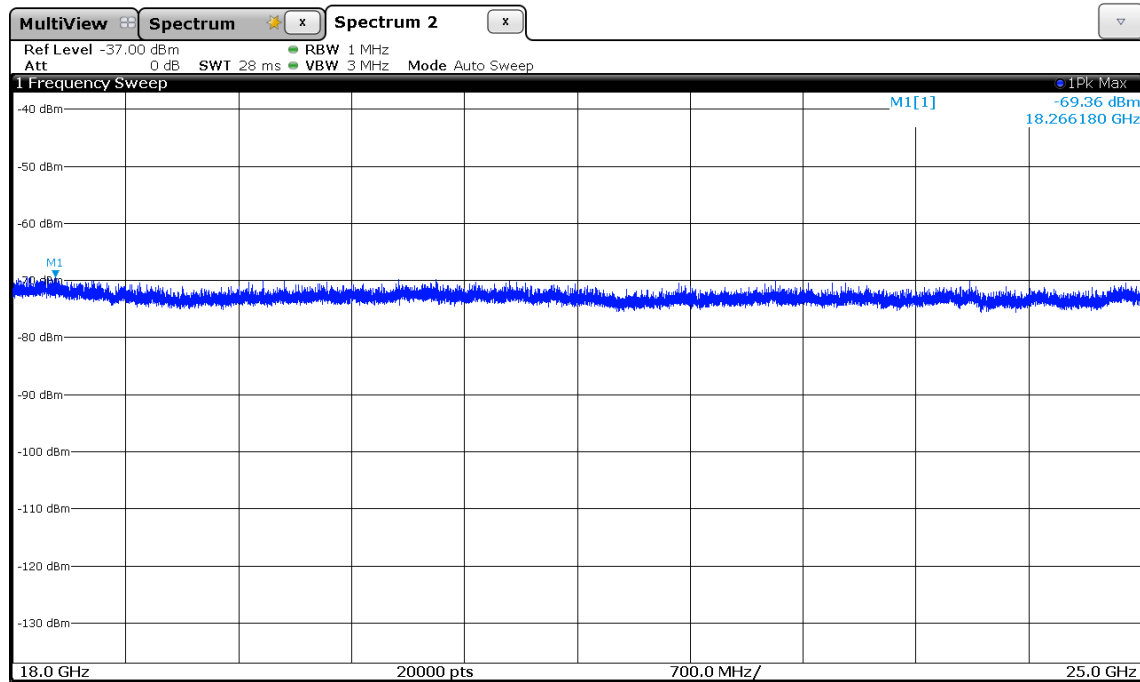
Pre-measurement horizontal polarization 30-1000 MHz:



Pre-measurement vertical polarization 18 GHz to 25 GHz



Pre-measurement horizontal polarization



5.3.2 Test result 30 MHz - 1000 MHz

Frequency (MHz)	Reading Vert. (dBμV)	Reading Hor. (dBμV)	Correct. Vert. (dB)	Correct. Hor. (dB)	Level Vert. (dBμV/m)	Level Hor. (dBμV/m)	Limit (dBμV/m)	Dlimit (dB)
33.80	6.8	4.2	13.9	12.7	20.7	16.9	40.0	-19.3
68.60	6.4	5.4	14.1	13.4	20.5	18.8	40.0	-19.5
111.90	7.0	8.7	11.0	11.8	18.0	20.5	43.5	-23.0
207.70	5.6	11.5	11.6	12.3	17.2	23.8	43.5	-19.7
315.10	7.5	13.0	17.3	16.9	24.8	29.9	46.0	-16.1
455.00	6.8	6.0	21.3	21.0	28.1	27.0	46.0	-17.9
540.60	9.2	10.5	23.7	23.5	32.9	34.0	46.0	-12.0
614.00	5.9	5.9	25.7	25.5	31.6	31.4	46.0	-14.4
715.40	5.6	5.6	27.4	26.9	33.0	32.5	46.0	-13.0
826.30	7.4	7.5	29.9	29.4	37.3	36.9	46.0	-8.7
964.80	7.6	7.6	32.0	31.5	39.6	39.1	54.0	-14.4

Note:

The correction factor includes cable loss and antenna factor. No emission difference could be detected for the intentional radiated frequencies 2402 MHz, 2450 MHz and 2480 MHz within the frequency range from 30 MHz to 1000 MHz. The values show only the noise floor of the OATS 1, but there were no values measurable belonging to the EUT.

5.3.3 Test result f > 1 GHz

2402 MHz

Peak limit:

		Frequency (MHz)	Reading Vert. (dBµV)	Reading Hor. (dBµV)	Correct. Vert. (dB)	Correct. Hor. (dB)	Level Vert. (dBµV/m)	Level Hor. (dBµV/m)	Limit (dBµV/m)	Dlimit (dB)
EUT	Detector									
Y	Peak	2400.00		76.6		-14.6		62.0	74.0	-12.0
Z	Peak	4804.00	43.1	44.1	2.3	2.3	45.4	46.4	74.0	-27.6
Y	Peak	16581.00	47.8		5.4		53.2		74.0	-20.8

Average limit:

		Frequency (MHz)	Reading Vert. (dBµV)	Reading Hor. (dBµV)	Correct. Vert. (dB)	Correct. Hor. (dB)	Level Vert. (dBµV/m)	Level Hor. (dBµV/m)	Limit (dBµV/m)	Dlimit (dB)
EUT	Detector									
Z	Peak	4804.00	43.1	44.1	2.3	2.3	45.4	46.4	54.0	-7.6
Y	Peak	16581.00	47.8		5.4		53.2		54.0	-0.8

Apart of the value at 2400 MHz all peak values fulfil the average limit, therefore an average measurement is not required.

Calculation of the average value at 2400 MHz: peak value – DC = average value

62 dBµV/m – 36.4 dB = 25.6 dBµV/m

Frequency	Reading PK	D factor	Level AV	Limit AV	Delta
(MHz)	dB(µV)	dB(µV/m)	dB(µV/m)	dB(µV/m)	(dB)
2400	62.0	-36.4	25.6	54.0	-28.4

2442 MHz

		Frequency (MHz)	Reading Vert. (dBµV)	Reading Hor. (dBµV)	Correct. Vert. (dB)	Correct. Hor. (dB)	Level Vert. (dBµV/m)	Level Hor. (dBµV/m)	Limit (dBµV/m)	Dlimit (dB)
EUT	Detector									
Y	Peak	2400.00	53.9	53.7	-14.6	-14.6	39.2	39.1	54.0	-14.8
Y	Peak	1328.65	59.5		-19.6		39.9		54.0	-14.1
Y	Peak	2483.50	53.2	53.8	-14.0	-14.0	39.3	39.8	54.0	-14.2
Z	Peak	4883.40		44.2		2.3		46.5	54.0	-7.5
Z	Peak	12920.20	48.0		2.1		50.1		54.0	-3.9
Z	Peak	15769.80		48.4		3.9		52.3	54.0	-1.7
Z	Peak	16581.40	44.6		5.4		50.0		54.0	-4.0

Note: All peak values fulfil the average limit, therefore an average measurement is not required.

2480 MHz

		Frequency (MHz)	Reading Vert. (dBµV)	Reading Hor. (dBµV)	Correct. Vert. (dB)	Correct. Hor. (dB)	Level Vert. (dBµV/m)	Level Hor. (dBµV/m)	Limit (dBµV/m)	Dlimit (dB)
EUT	Detector									
Y	Peak	2483.50	60.0	64.7	-14.0	-14.0	46.0	50.7	54.0	-3.3
Y	Peak	4959.40	43.7		2.7		46.4		54.0	-7.6
Z	Peak	4959.40		42.9		2.7		45.6	54.0	-8.4
Z	Peak	13491.00		47.9		1.3		49.2	54.0	-4.8
Z	Peak	15714.20	48.0		3.6		51.6		54.0	-2.4

Note: All peak values fulfil the average limit, therefore an average measurement is not required.

Note: Average values were calculated from the subtraction of peak values minus correction duty cycle factor.

Limit according to FCC Part 15C, Section 15.209:

Frequency (MHz)	15.209 Limits ($\mu\text{V/m}$)	Measurement distance (m)
0.009 - -0.49	$2400/f(\text{kHz})$	300
0.49 – 1.705	$24000/f(\text{kHz})$	30
1.705 – 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

Average limit according to FCC Part 15C, Section 15.249(a):

Fundamental frequency (MHz)	Field strength of harmonics	
	($\mu\text{V/m}$)	dB($\mu\text{V/m}$)
902 - 928	500	54
2400 - 2483.5	500	54
5725 - 5875	500	54
24000 - 24250	2500	68

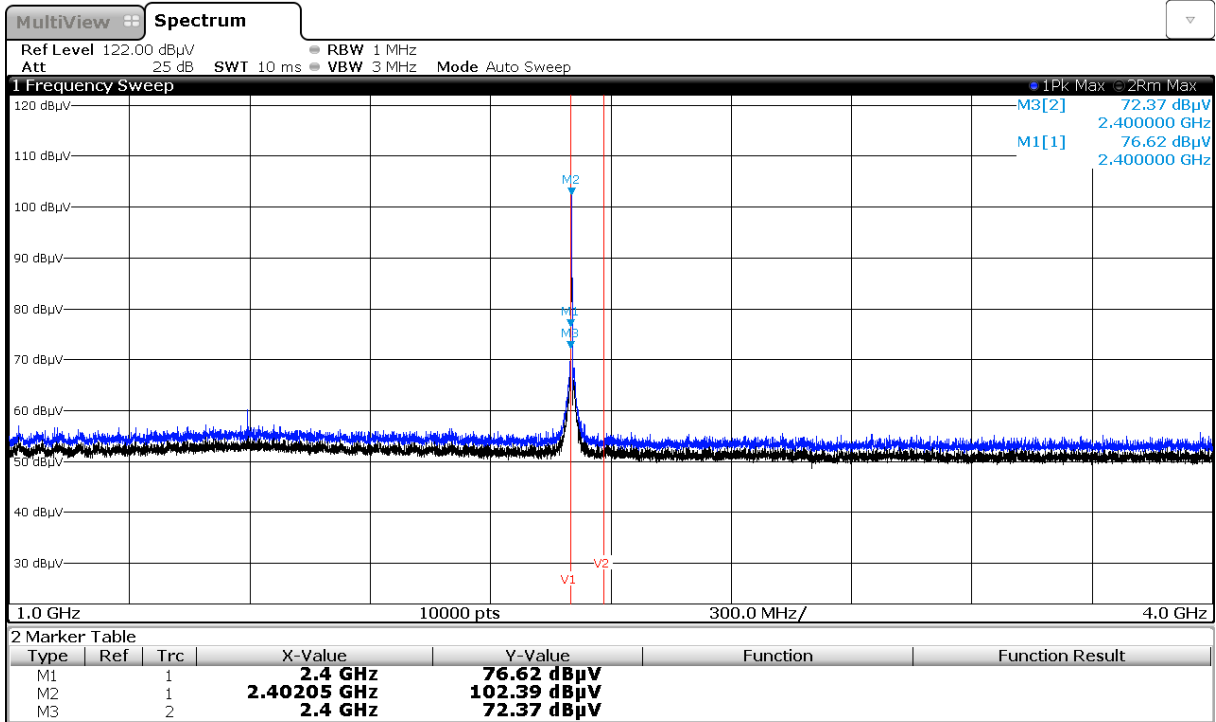
The requirements are **FULFILLED**.

Remarks: The measurement was performed up to the 10th harmonic (25000 MHz). For detailed test result
please refer to following test protocols.

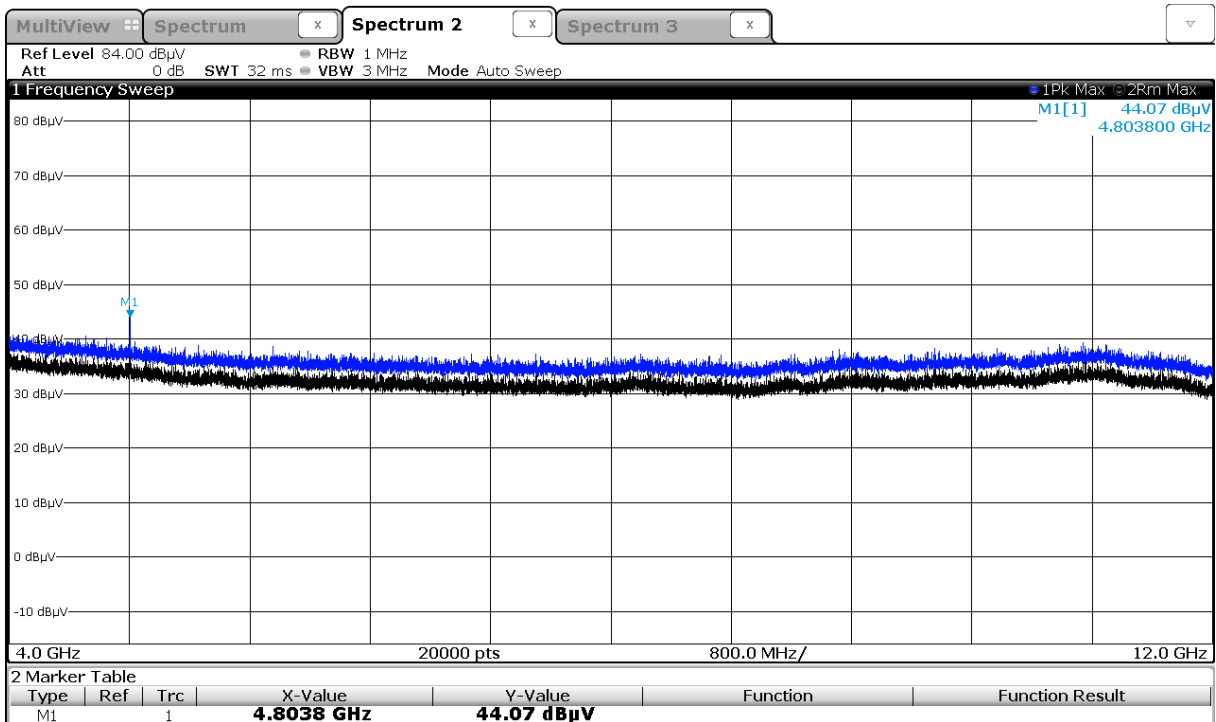
5.3.4 Test protocols

For reference the plots from 1 GHz up to 18 GHz (only raw data) at TX 2402 MHz

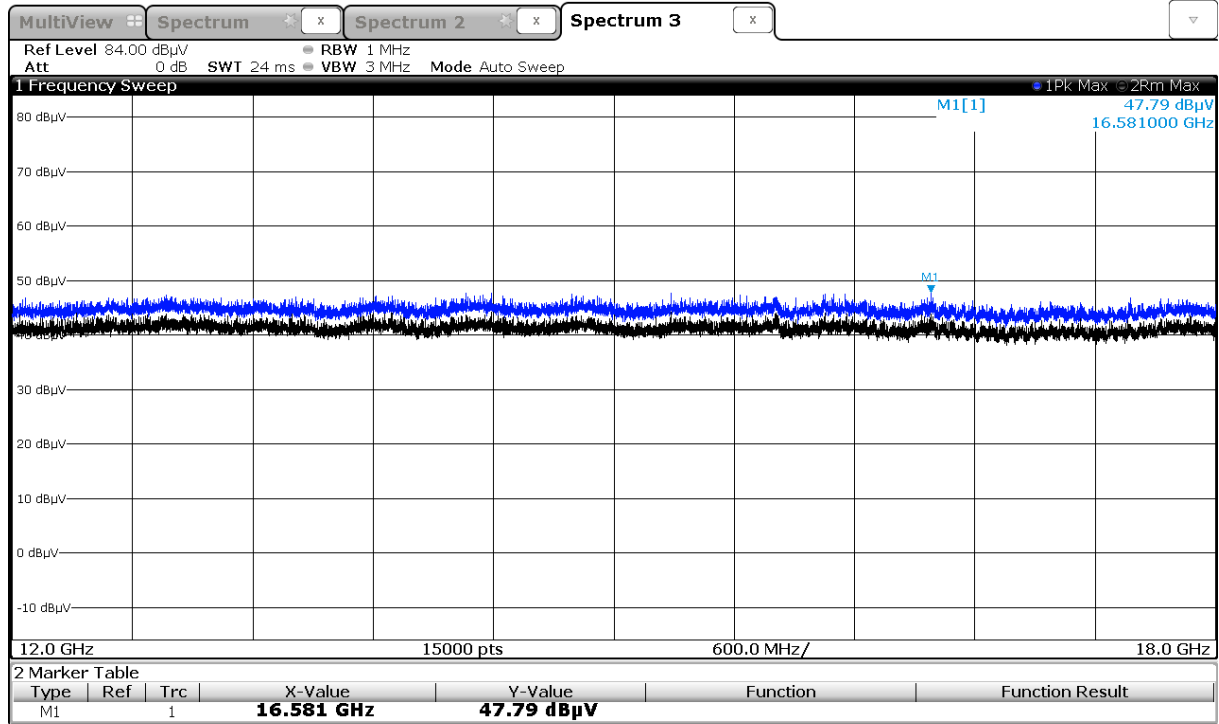
1-4 GHz



4-12 GHz



12-18 GHz



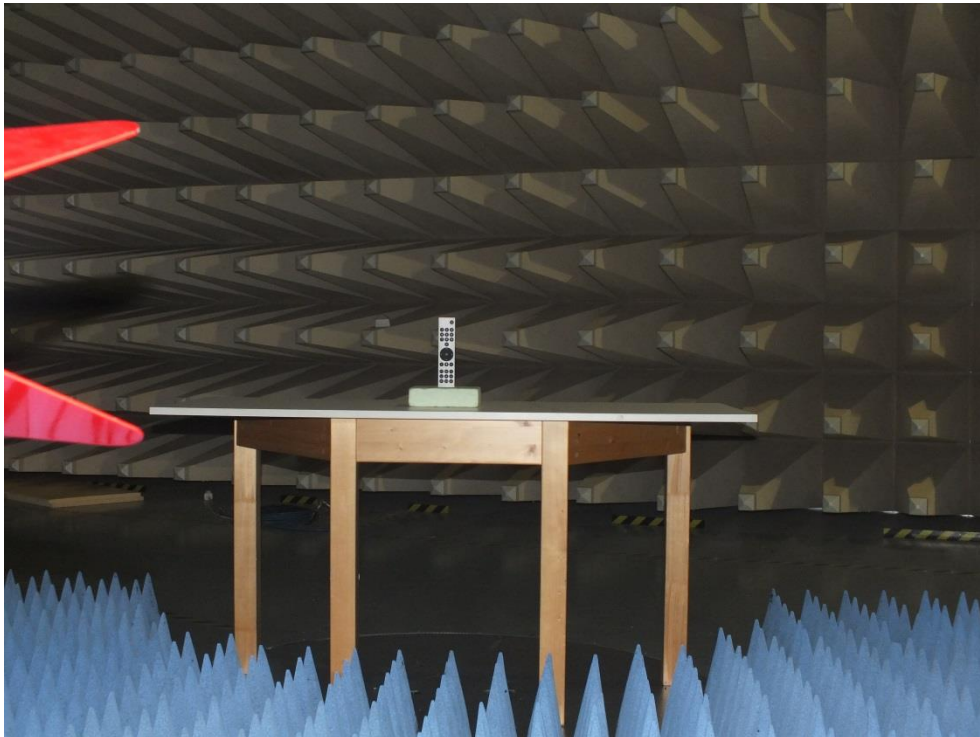
5.4 EBW and OBW

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

5.4.1 Description of the test location

Test location: AREA4

5.4.2 Photo documentation of the test set-up



5.4.3 Applicable standard

According to FCC Part 15, Section 15.215(c):

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in Section 15.217 through Section 15.257, must be designed to ensure that the 20 dB bandwidth of the emission is contained within the frequency band designated in the rule section under which the equipment is operated.

5.4.4 Description of Measurement

The bandwidth is measured at an amplitude level reduced from the reference level by a specified ratio of -20 dB (99%). The x-dB-down (OBW) function of the analyser is used. The measurement is performed with normal modulation in TX continuous mode.

Spectrum analyser settings:

RBW: 30 kHz, VBW: 100 kHz, Span: 3 MHz, Trace mode: max. hold, Detector: max. peak;

5.4.5 Test result

Centre f (MHz)	20dB bandwidth f_1	20dB bandwidth f_2	Measured EBW (MHz)
2401.97230	2401.36480	2402.57980	1.21500
2441.96780	2441.36930	2442.56630	1.19700
2480.25280	2479.93930	2480.56630	0.62700

Centre f (MHz)	99% bandwidth f_1	99% bandwidth f_2	Measured OBW (MHz)
2401.973000	2401.43525	2402.510750	1.075500
2441.958750	2441.42475	2442.492750	1.068000
2479.962500	2479.42775	2480.497250	1.069500

Operating frequency band (MHz)	20 dB Bandwidth (MHz)
$f_{\text{low}} > 2400$	$f_{\text{low}} = 2401.36480$
$f_{\text{high}} < 2483.5$	$f_{\text{high}} = 2480.56630$
Operating Band occupancy	79.20

Operating Band occupancy percentage	94.85 %
Operating channel occupancy percentage	60.75 %

Limit according to FCC Part 15C, Section 15.215(c):

If frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within the central 80% of the permitted band in order to minimize the possibility of out-of-band operation. Due to the channelising of the operating band into 39 channels with 20 dB channel bandwidth of 1.22 MHz within a channel pattern of 2 MHz the limit central 80% of the permitted band can not be applied. Therefore the stability of the EUT will be shown staying within the central 80% of the operating channel.

The requirements are **FULFILLED**.

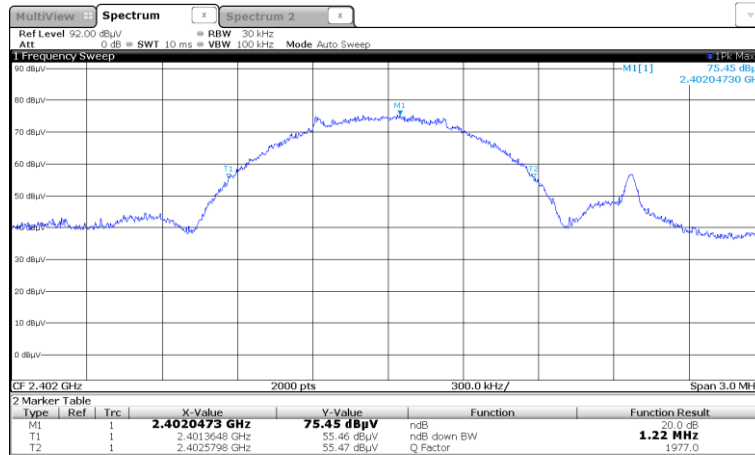
Remarks: For detailed test result please refer to following test protocols.

The OBW99 is measured for RSS only.

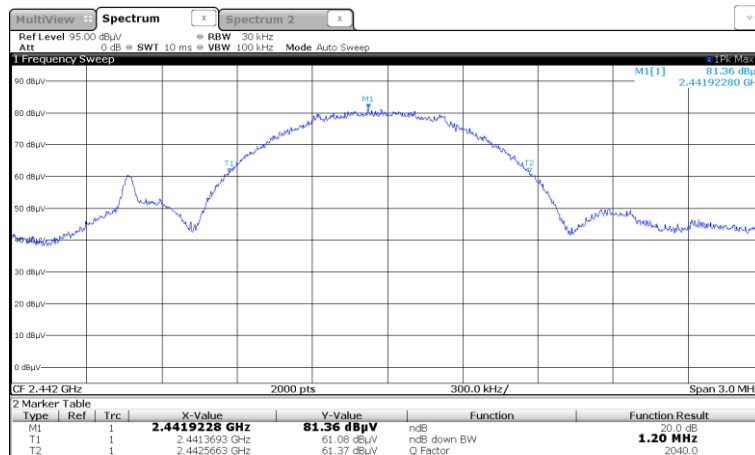
5.4.6 Test protocols

EBW

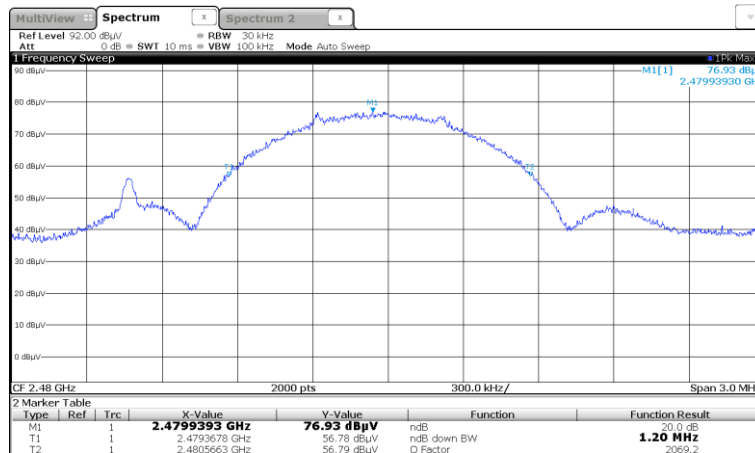
2402 MHz



2442 MHz



2480 MHz

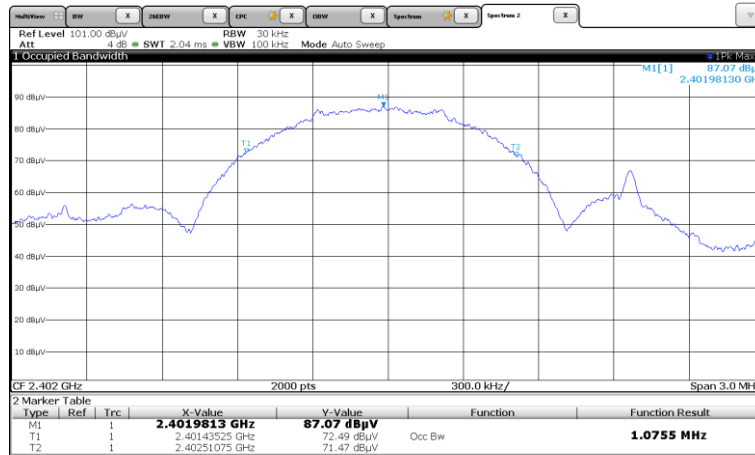


FCC ID: XYN779B

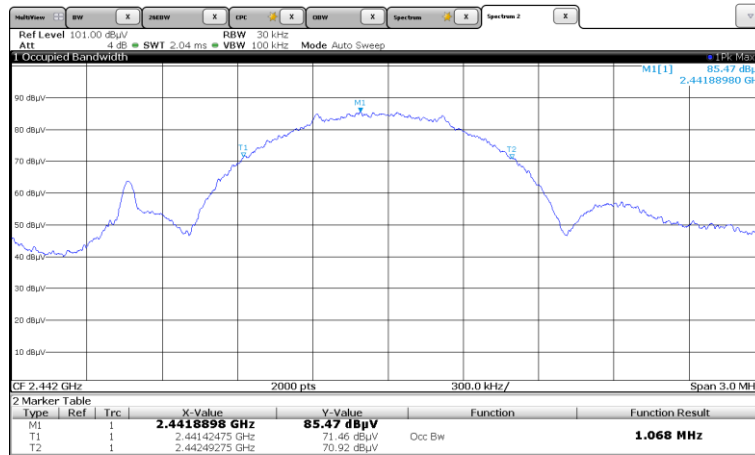
IC: 8748A-779B

OBW

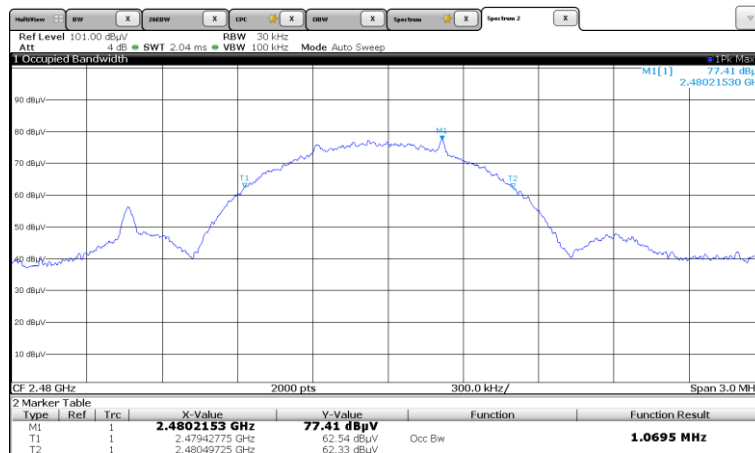
2402 MHz



2442 MHz



2480 MHz



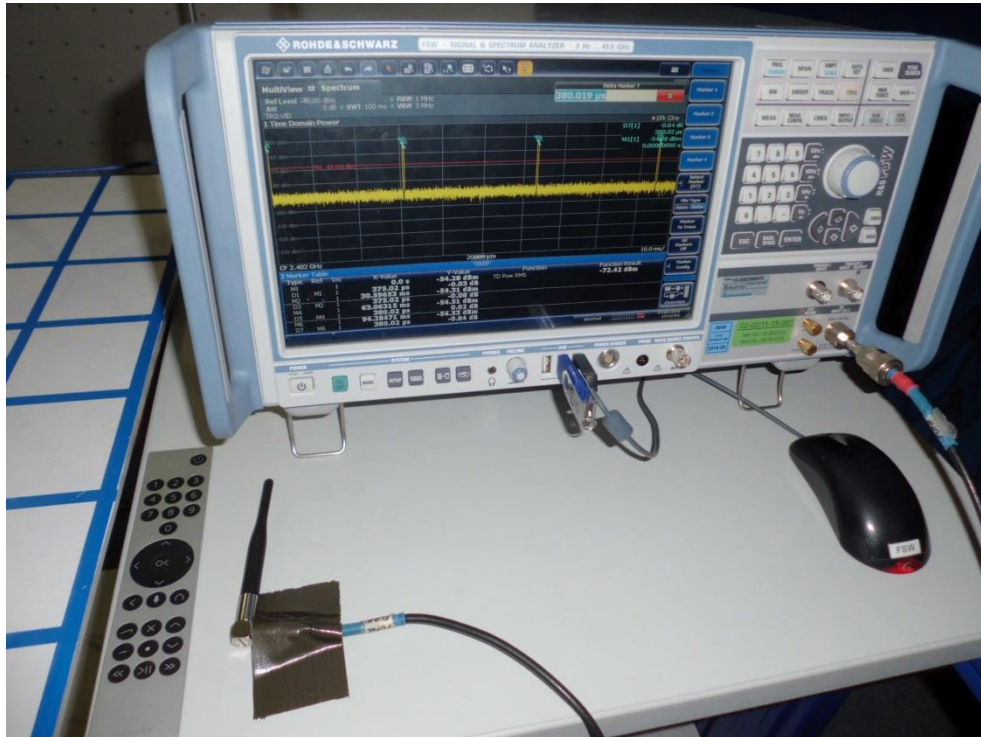
5.5 Correction for pulse operation (duty cycle)

For test instruments and accessories used see section 6 Part DC.

5.5.1 Description of the test location

Test location: Anechoic chamber 2

5.5.2 Photo documentation of the test set-up



5.5.3 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.

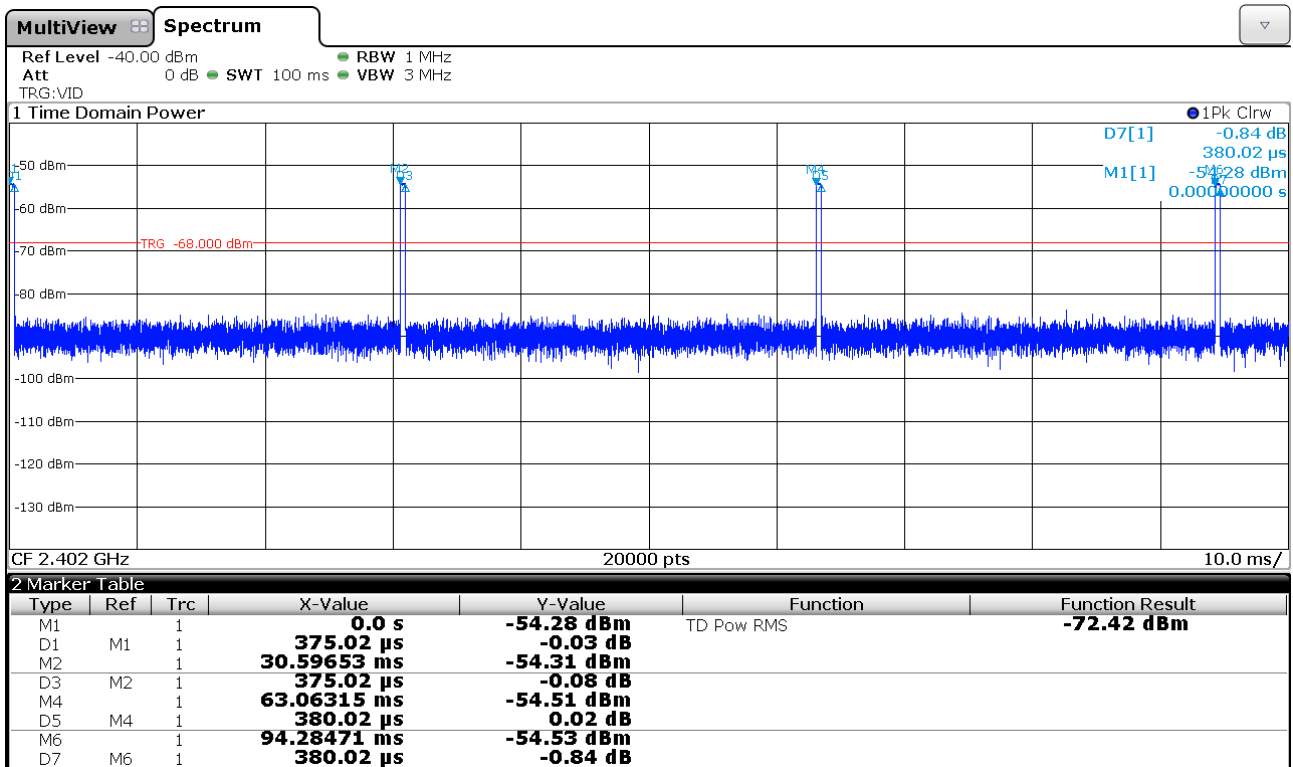
5.5.4 Description of Measurement

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

$$KE = 20 \log (t_{iw}/0.1 \text{ s})$$

KE: pulse operation correction factor

t_{iw} pulse duration for the complete pulse track

5.5.5 Test result


Note: The worst case regarding duty cycle of a BLE device is in advertising mode. Channel 37 was chosen for measurement.

Complete burst duration (4 bursts): $375.02 \mu s + 375.02 \mu s + 380.02 \mu s + 380.02 \mu s = 1510.08 \mu s$

$KE = 20 \log (1510.08 \mu s / 0.1 s) = -36.4 \text{ dB}$

Remarks:

5.6 Antenna application

5.6.1 Applicable standard

According to FCC Part 15C, Section 15.203(a):

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.

5.6.2 Result

The EUT uses an integrated PCB antenna. No other antenna than the furnished by the responsible party or external power amplifier can be applied by a customer.

The antenna of the EUT meets the requirement of FCC Part 15C, Section 15.203 and 15.204.

The requirements are **FULFILLED**.

Remarks:

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	FSW43	02-02/11-15-001	05/08/2016	05/08/2015		
	AFS4-01000400-10-10P-4	02-02/17-13-002				
	BBHA 9120 E 251	02-02/24-05-006	19/04/2017	19/04/2016	19/10/2016	19/04/2016
	Sucoflex N-2000-SMA	02-02/50-05-075				
	SF104/11N/11N/1500MM	02-02/50-13-015				
	SF104/11SMA/11N/1500MM	02-02/50-13-016				
DC	FSW43	02-02/11-15-001	05/08/2016	05/08/2015		
	RF Antenna	02-02/24-05-032				
MB	FSW43	02-02/11-15-001	05/08/2016	05/08/2015		
	AFS4-01000400-10-10P-4	02-02/17-13-002				
	BBHA 9120 E 251	02-02/24-05-006	19/04/2017	19/04/2016	19/10/2016	19/04/2016
	Sucoflex N-2000-SMA	02-02/50-05-075				
	SF104/11N/11N/1500MM	02-02/50-13-015				
	SF104/11SMA/11N/1500MM	02-02/50-13-016				
SER 2	ESVS 30	02-02/03-05-003	09/07/2016	09/07/2015		
	VULB 9168	02-02/24-05-005	20/04/2017	20/04/2016	20/10/2016	20/04/2016
	NW-2000-NB	02-02/50-05-113				
	KK-EF393/U-16N-21N20 m	02-02/50-12-018				
	KK-SD_7/8-2X21N-33,0M	02-02/50-15-028				
SER 3	FSW43	02-02/11-15-001	05/08/2016	05/08/2015		
	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				
	BBHA 9120 E 251	02-02/24-05-006	19/04/2017	19/04/2016	19/10/2016	19/04/2016
	WBH2-18NHG	02-02/24-08-002	19/04/2017	19/04/2016	19/10/2016	19/04/2016
	Sucoflex N-2000-SMA	02-02/50-05-075				
	SF104/11N/11N/1500MM	02-02/50-13-015				
	SF104/11SMA/11N/1500MM	02-02/50-13-016				
	SF104/11SMA/11N/1500MM	02-02/50-13-017				