



RF - TEST REPORT

- FCC Part 15.247, RSS-247 -

Type / Model Name : 2855-001 - Model: 827A01

Product Description : BLE5/IR remote control

Applicant : ruwido austria gmbh

Address : Koestendorferstr. 8

5202 NEUMARKT, AUSTRIA

Manufacturer : ruwido austria gmbh

Address : Koestendorferstr. 8

5202 NEUMARKT, AUSTRIA

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

POSITIVE

Test Report No. : T46773-00-00HS

11. January 2021

Date of issue



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

Contents

1	TEST STANDARDS	3
2	EQUIPMENT UNDER TEST	4
2.1	Information provided by the Client	4
2.2	Sampling	4
2.3	General remarks	4
2.4	Photo documentation of the EUT – Detailed photos see ATTACHMENT A	4
2.5	Equipment type	4
2.6	Short description of the equipment under test (EUT)	4
2.7	Variants of the EUT	4
2.8	Operation frequency and channel plan	4
2.9	Transmit operating modes	5
2.10	Antenna	5
2.11	Power supply system utilised	5
2.12	Peripheral devices and interface cables	5
2.13	Determination of worst-case conditions for final measurement	6
3	TEST RESULT SUMMARY	7
3.1	Final assessment	7
4	TEST ENVIRONMENT	8
4.1	Address of the test laboratory	8
4.2	Environmental conditions	8
4.3	Statement of the measurement uncertainty	8
4.1	Conformity Decision Rule	8
4.2	Measurement protocol for FCC and ISED	9
5	TEST CONDITIONS AND RESULTS	12
5.1	AC power line conducted emissions	12
5.2	EBW and OBW	13
5.3	Maximum peak output power	19
5.4	Power spectral density	21
5.5	Radiated emissions in restricted bands	25
5.6	Spurious emissions radiated	36
5.7	Antenna application	40
5.8	Antenna requirements	40
6	USED TEST EQUIPMENT AND ACCESSORIES	41

Attachment A as separate supplement

1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 15, Subpart A - General (September 2020)

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 2020)

Part 15, Subpart C, Section 15.203	Antenna requirement
Part 15, Subpart C, Section 15.204 modifications	External radio frequency power amplifiers and antenna
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

ANSI C63.10: 2013	Testing Unlicensed Wireless Devices
-------------------	-------------------------------------

ETSI TR 100 028 V1.3.1: 2001-03,	Electromagnetic Compatibility and Radio Spectrum Matters (ERM); Uncertainties in the Measurement of Mobile Radio Equipment Characteristics—Part 1 and Part 2
----------------------------------	--

KDB 558074 D01 v05r02	Guidance for compliance measurements on DTS; FHSS and hybrid system devices operating under Section 15.247 of the FCC rules, April 2, 2019.
-----------------------	---

2 EQUIPMENT UNDER TEST

2.1 Information provided by the Client

Please note, we do not take any responsibility for information provided by the client or his representative which may have an influence on the validity of the test results.

2.2 Sampling

The customer is responsible for the choice of sample. Sample configuration, start-up and operation is carried out by the customer or according his/her instructions.

2.3 General remarks

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

2.5 Equipment type

BLE device

2.6 Short description of the equipment under test (EUT)

The EUT is a BLE5/IR remote control. The EUT is compatible with the standard 802.15.1. It supports the 2.4 GHz frequency band.

Number of tested samples:	1 pc radiated sample	1 pc conducted sample
Serial number:	16888206	Prototype
Firmware version:	0x00270101	0x00270101

EUT configuration:

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

2.7 Variants of the EUT

There are no variants.

2.8 Operation frequency and channel plan

The operating frequency is 2400 MHz to 2483.5 MHz.

Channel plan:

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

Note: the marked frequencies are determined for final testing.

2.9 Transmit operating modes

The EUT uses GFSK modulation and may provide following data rates:

- 1000 kbps
- 2000 kbps

(kbps = *kilobits per second*)
(kbps = *kilobits per second*)

Other data rates are not supported.

2.10 Antenna

The following antennas shall be used with the EUT:
Integrated PCB antenna gain 0 dBi.

2.11 Power supply system utilised

Power supply voltage, V_{nom} : 3 Vdc (2xAAA batteries per 1.5 V)

2.12 Peripheral devices and interface cables

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

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

2.13 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 side right up position.

The tests are carried out in the following frequency band:

2400 MHz – 2483.5 MHz

Preliminary tests are performed to find the worst-case mode from all possible combinations between available modulations and data rates. The maximum output power depends on used data rate.

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

Wireless system	Available channel	Tested channels	Power setting	Modulation	Modulation type	Data rate
BLE	0 -39	37, 18, 39	max	DSSS	GFSK	1 Mbps 2 Mbps

2.13.1 Test jig

No test jig was used.

2.13.2 Test software

The EUT is programmed with test software for TX continuous modulated. The channels and the modulation can be set by pressing a button.

3 TEST RESULT SUMMARY

BLE device using digital modulation:

Operating in the 2400 MHz – 2483.5 MHz:

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)(2)	RSS-247, 6.2.4(1)	-6 dB EBW	passed
15.247(b)(3)	RSS-247, 6.2.4(1)	Maximum peak conducted output power	passed
15.247(b)(4)	-	Defacto limit	passed
15.247(d)	RSS-247, 6.2.4(2)	Out-of-band emission, radiated	passed
15.247(d)	RSS-Gen, 8.9	Emissions in restricted bands	passed
15.247(e)	RSS-247, 6.2.4(1)	PSD	passed
15.35(c)	RSS-Gen, 6.10	Pulsed operation	not applicable
15.203	RSS-Gen, 6.6	Antenna requirement	passed
-	RSS-Gen, 6.11	Transmitter frequency stability	passed
-	RSS-Gen, 6.6	99 % Bandwidth	passed

The mentioned new RSS Rule Parts in the above table are related to:

RSS-Gen, Issue 5, March 2019

RSS-247, Issue 2, February 2017

3.1 Final assessment

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

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

Testing commenced on : 15 December 2020

Testing concluded on : 17 December 2020

Checked by:

Tested by:

Klaus Gegenfurtner
Teamleader Radio

Hermann Smetana
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 / 2011 + A1 / 2014 „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 Type	Range	Confidence Level (%)	Calculated Uncertainty
AC Conducted Spurious Emissions	0.15 MHz to 30 MHz	95%	± 3.29 dB
20 dB Bandwidth	Center frequency of EUT	95%	$\pm 2.5 \times 10^{-7}$
99% Occupied Bandwidth	Center frequency of EUT	95%	$\pm 2.5 \times 10^{-7}$
Radiated Spurious Emissions	9 kHz to 30 MHz	95%	± 3.53 dB
Radiated Spurious Emissions	30 MHz to 1000 MHz	95%	± 3.71 dB
Radiated Spurious Emissions	1000 MHz to 10000 MHz	95%	± 2.34 dB
Peak conducted output power	902 MHz to 928 MHz	95%	± 0.35 dB
Conducted Spurious Emissions	9 kHz to 10000 MHz	95%	± 2.15 dB

4.1 Conformity Decision Rule

The conformity decision rule is based on the ILAC G8 published at the time of reporting.

4.2 Measurement protocol for FCC and ISED

4.2.1 General information

CSA Group Bayern GmbH is recognized as wireless testing laboratory under the CAB identifier:

FCC: DE 0011
ISED: DE0009

4.2.2 General Standard information

The test methods used comply with ANSI C63.10 - "Testing Unlicensed Wireless Devices".

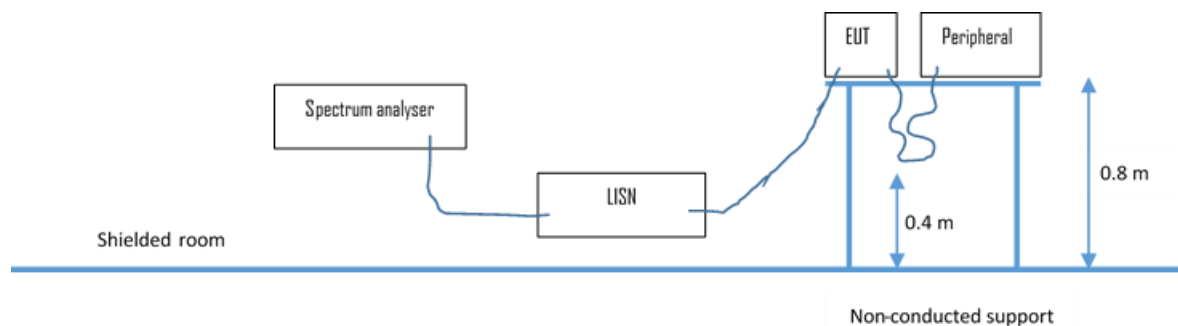
4.2.2.1 Justification

The equipment under test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions.

4.2.3 Details of test procedures

4.2.3.1 Conducted emission

Test setup according ANSI C63.10



The final level, expressed in dB μ V, is arrived at by taking the reading directly from the Spectrum analyser. This level is compared to the limit.

To convert between dB μ V and μ V, the following conversions apply:

$$\text{dB}\mu\text{V} = 20(\log \mu\text{V})$$

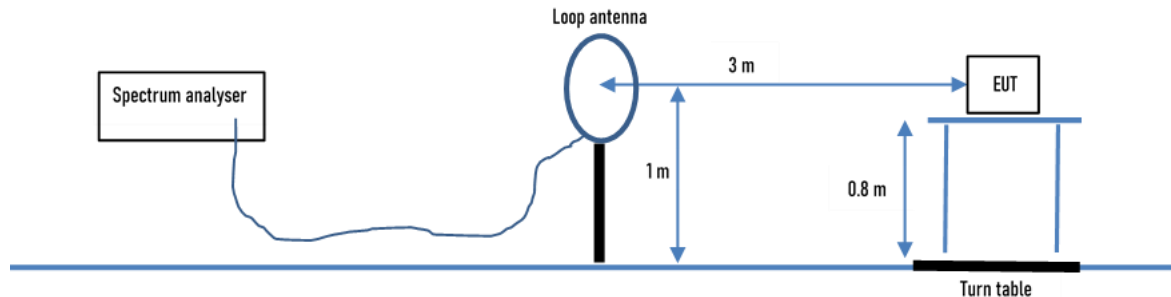
$$\mu\text{V} = \text{Inverse log}(\text{dB}\mu\text{V}/20)$$

Conducted emissions on the 50 Hz and/or 60 Hz power interface of the EUT are measured in the frequency range of 150 kHz to 30 MHz. The measurements are performed using a receiver, which has CISPR characteristic bandwidth and quasi-peak detection and a Line Impedance Stabilization Network (LISN) with 50 Ω / 50 μ H (CISPR 16) characteristics. The receiver is protected by means of an impedance matched pulse limiter connected directly to the RF input. Table top equipment is placed on a non-conducting table 80 centimetres above the floor and is positioned 40 centimetres from the vertical ground plane (wall) of the screen room. If the minimum limit margin appears to be less than 20 dB with a peak mode measurement, the emission is re-measured using a tuned receiver with quasi-peak and average detection and recorded on the data sheets.

4.2.3.2 Radiated emission

4.2.3.2.1 OATS1 test site (9 kHz - 30 MHz):

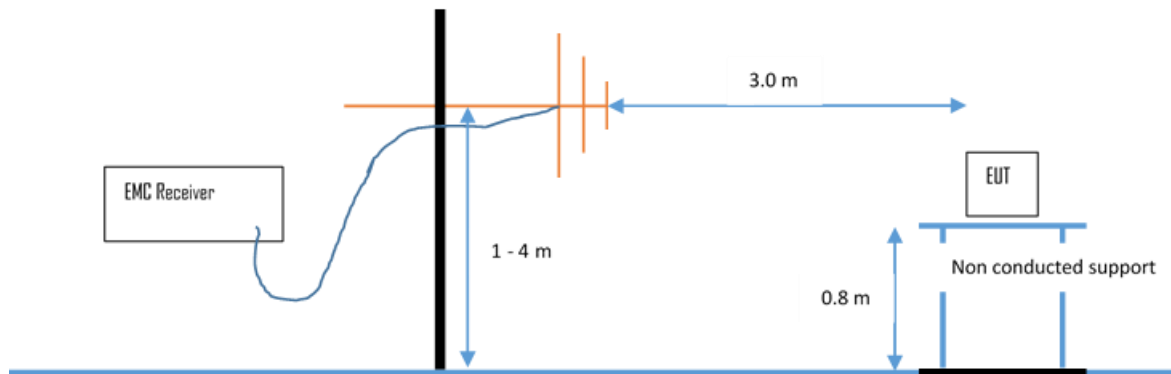
Test setup according ANSI C63.10



Emissions from the EUT are measured in the frequency range of 9 MHz to 30 MHz using a tuned receiver and a calibrated loop antenna. Table top equipment is placed on a 1.0 X 1.5 m non-conducting table 80 centimetres above the ground plane. Cables to simulators/testers (if used in this test) are routed through the center of the table and to a screened room located outside the test area. The antenna is positioned 3, 10 or 30 metres horizontally from the EUT and is repeated vertically. To locate maximum emissions from the test sample the antenna is varied along the site axis and the EUT is rotated 360 degrees.

4.2.3.2.2 OATS1 test site (30 MHz - 1 GHz):

Test setup according ANSI C63.10.



Spurious emissions from the EUT are measured in the frequency range of 30 MHz to 1000 MHz using a tuned receiver and appropriate broadband linearly polarised antennas. Measurements between 30 MHz and 1000 MHz are made with 120 kHz/6 dB bandwidth and quasi-peak detection. Table top equipment is placed on a 1.0 X 1.5 m non-conducting table 80 centimetres above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. Cables to simulators/testers (if used in this test) are routed through the center of the table and to a screened room located outside the test area. To locate maximum emissions from the test sample the antenna is varied in height from 1 to 4 metres and the EUT is rotated 360 degrees. The final level in dB μ V/m is calculated by taking the reading from the EMI receiver (Level dB μ V) and adding the correction factors and cable loss factor (dB). The FCC limit is subtracted from this result in order to provide the limit margin listed in the measurement protocol.

The resolution bandwidth setting:

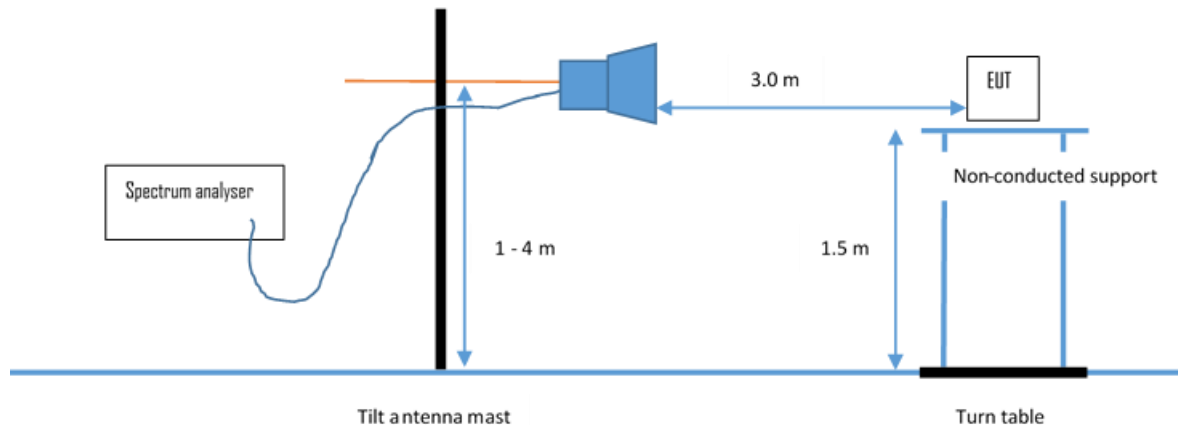
30 MHz – 1000 MHz: RBW: 120 kHz

Example:

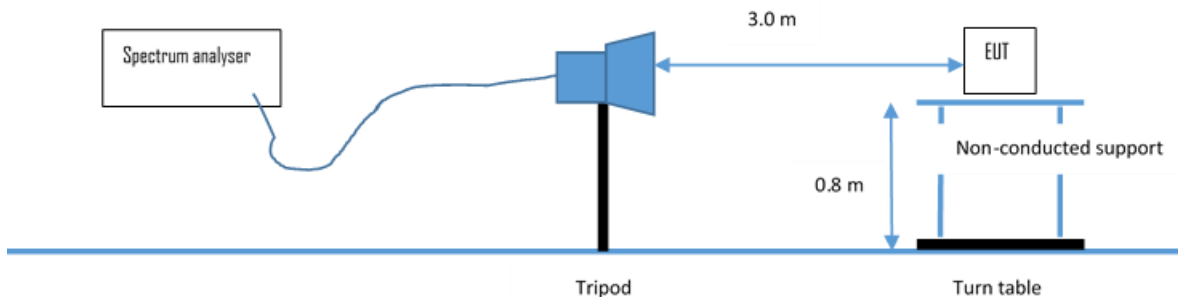
Frequency (MHz)	Level (dB μ V)	+	Factor (dB)	=	Level (dB μ V/m)	-	Limit (dB μ V/m)	=	Delta (dB)
719.0	75.0	+	32.6	=	107.6	-	110.0	=	-2.4

4.2.3.2.3 Anechoic chamber 1 (1000 MHz – 18000 MHz)

Test setup according ANSI C63.10.



Radiated emissions from the EUT are measured in the frequency range 1 GHz up to 18 GHz as specified in 47 CFR Part 15, Subpart A, Section 15.33, using a spectrum analyser and appropriate linearly polarized antennas. Table top equipment is placed on a non-conducting table, 1.5 metre above the ground plane. The turntable is fully covered with the appropriate absorber (Type VHP-12). Any controlling device is positioned such that it does not significantly influence the measurement results. Interconnecting cables that hang closer than 40 cm to the ground plane are folded back and forth in the center, forming a bundle 30 cm to 40 cm long. Measurements are made in three orientations of the EUT and the horizontal and vertical polarization planes of measurement antenna in a fully anechoic room. The measurement antenna is adjusted and the EUT orientated to permit the measurement of the maximum emission from the EUT. The conditions determined as worst-case will then be used for the final measurements.

4.2.3.2.4 Anechoic chamber 1 (18 GHz – 40 GHz)

Emissions from the EUT are measured in the frequency range 18 GHz up to 40 GHz as specified in 47 CFR Part 15, Subpart A, Section 15.33, using a spectrum analyser and appropriate linearly polarized antennas. Table top equipment is placed on a non-conducting table, 0.8 metre above the ground plane. The turntable is fully covered with the appropriate absorber (Type VHP-12). Any controlling device is positioned such that it does not significantly influence the measurement results. Interconnecting cables that hang closer than 40 cm to the ground plane are folded back and forth in the centre, forming a bundle 30 cm to 40 cm long. Measurements are made in three orientations of the EUT and the horizontal and vertical polarization planes of measurement antenna in a fully anechoic room. The measurement antenna is adjusted and the EUT orientated to permit the measurement of the maximum emission from the EUT. The conditions determined as worst-case will then be used for the final measurements. Where appropriate, the test distance may be reduced in order to detect emissions under better uncertainty. The limit is adopted.

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.

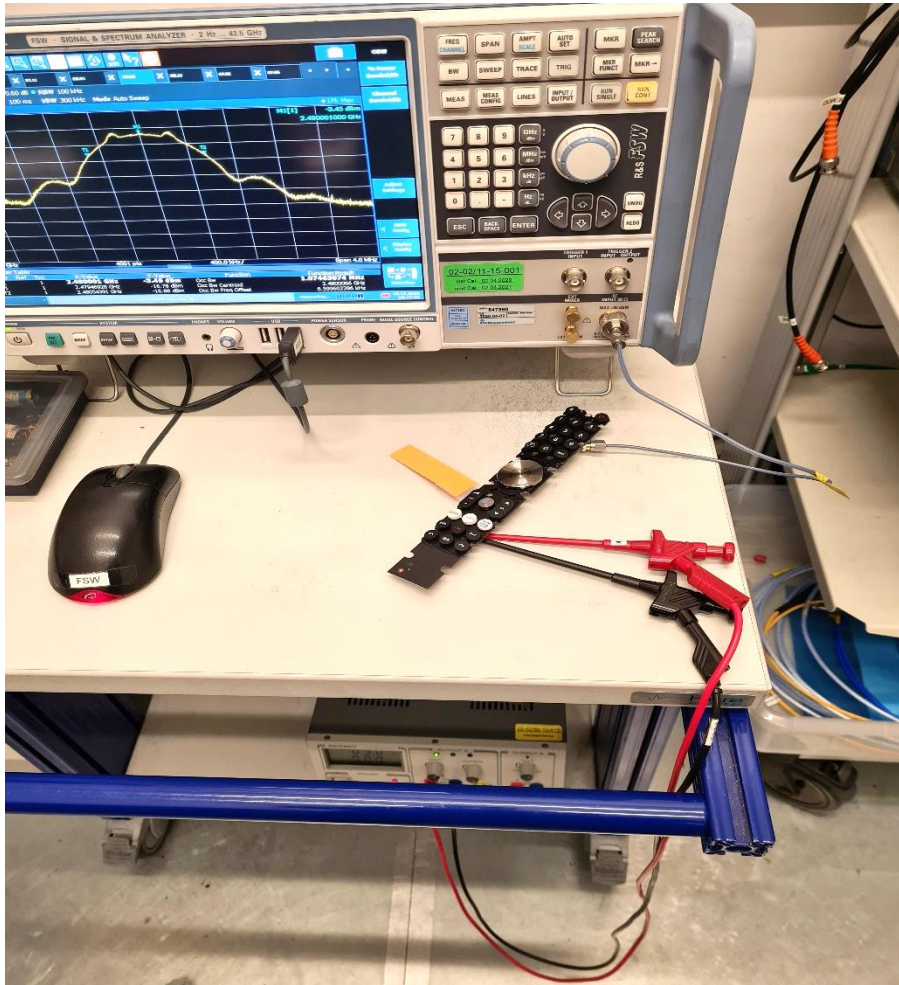
5.2 EBW and OBW

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

5.2.1 Description of the test location

Test location: Shielded Room S6

5.2.2 Photo documentation of the test set-up



5.2.3 Applicable standard

According to FCC Part 15, Section 15.247(a)(2):

Systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 – 2483.5 MHz and 5725 – 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

5.2.4 Description of Measurement

The bandwidth was measured at an amplitude level reduced from the reference level of a modulated channel by a ratio of -6 dB. The reference level is the level of the highest signal amplitude observed at 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. An alternative is to use the bandwidth measurement of the analyser.

FCC ID: XYN827A**IC ID: 8748A-827A**

Spectrum analyser settings for EBW:

RBW: 100 kHz, VBW: 300 kHz, Detector: Max peak, Sweep time: 5 s, Span: 2 EBW;

Spectrum analyser settings for OBW:

RBW: 1-5% OBW, VBW: 3 RBW, Detector: Max peak, Sweep time: 5 s, Span: 2 OBW;

5.2.5 Test result**EBW:**

1 Mbps:

Channel	Centre frequency (MHz)	6 dB bandwidth (MHz)	Minimum limit (MHz)
CH37	2402	0.711	0.5
CH18	2442	0.711	0.5
CH39	2480	0.711	0.5

2 Mbps:

Channel	Centre frequency (MHz)	6 dB bandwidth (MHz)	Minimum limit (MHz)
CH37	2402	1.421	0.5
CH18	2442	1.417	0.5
CH39	2480	1.396	0.5

OBW99:

1 Mbps:

Channel	Centre frequency (MHz)	99 % bandwidth (MHz)
CH37	2402	1.063
CH18	2442	1.047
CH39	2480	1.054

2 Mbps:

Channel	Centre frequency (MHz)	99 % bandwidth (MHz)
CH37	2402	2.061
CH18	2442	2.067
CH39	2480	2.076

Limit according to FCC Part 15, Section 15.247(a)(2):

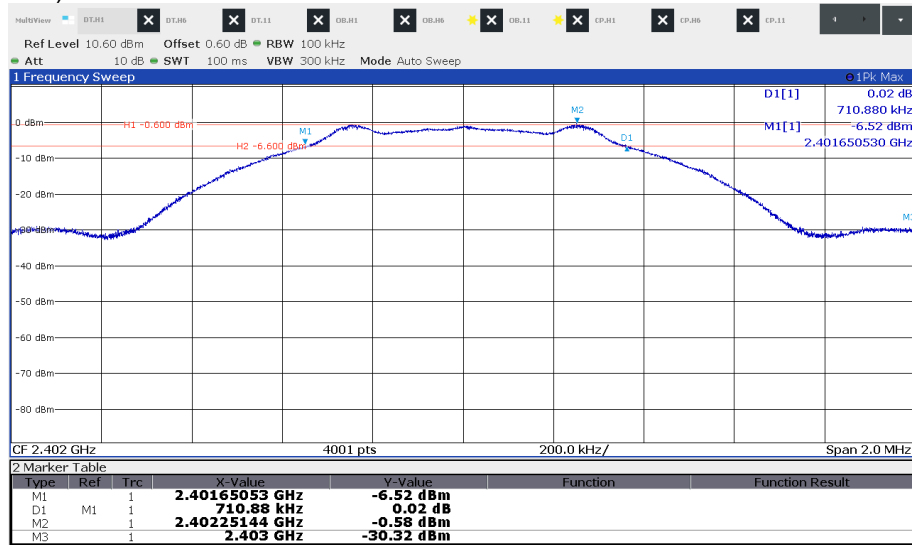
Systems using digital modulation techniques may operate in the 2400 – 2483.5 MHz band. The minimum 6 dB bandwidth shall be at least 500 kHz.

The requirements are **FULFILLED**.**Remarks:** For detailed test result please see the following test protocols

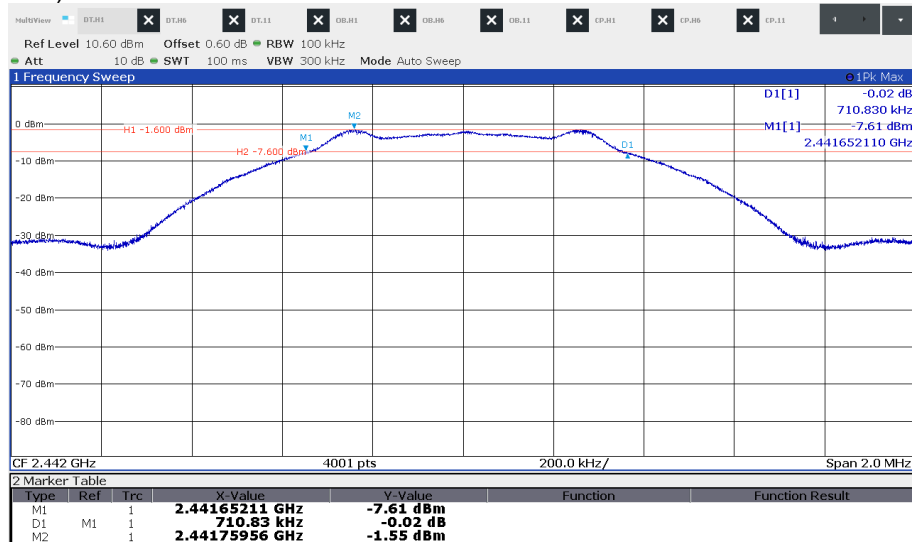
5.2.6 Test protocols EBW

1 Mbps:

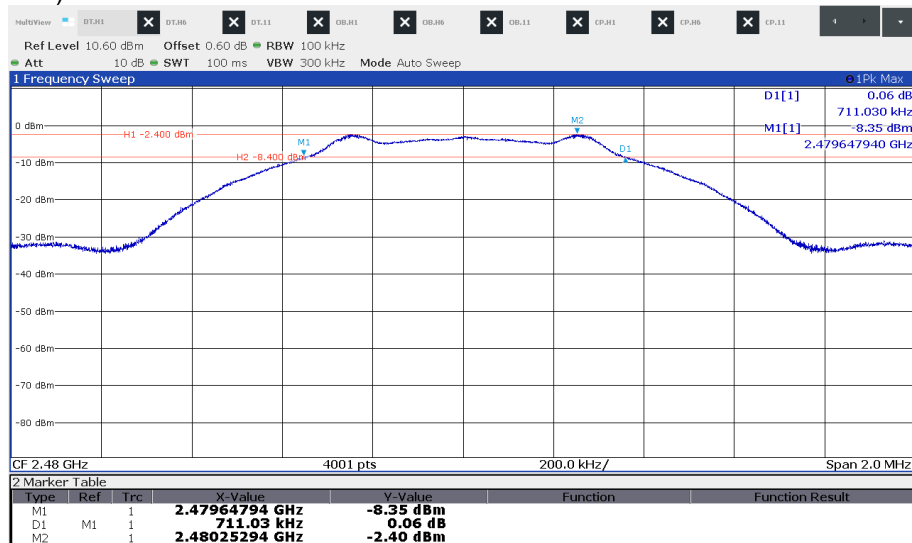
Channel 37 (2402 MHz)



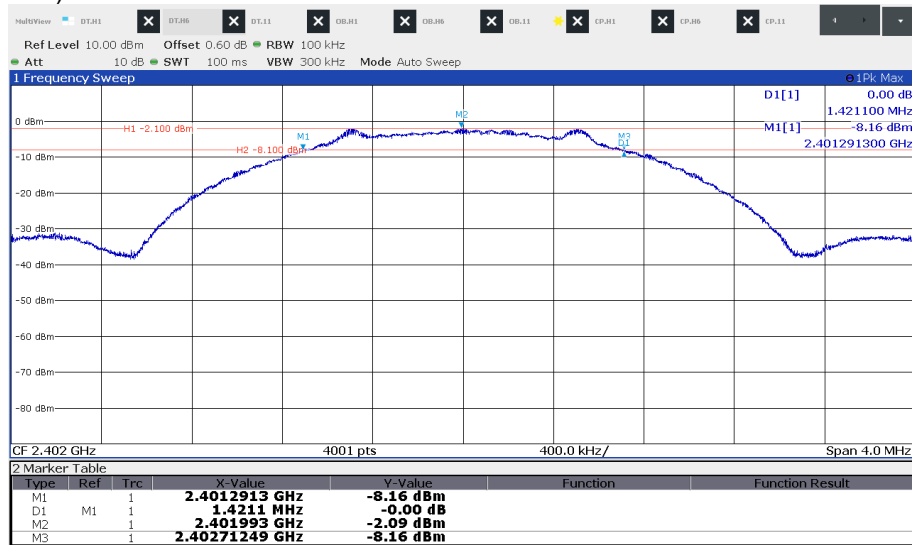
Channel 18 (2442 MHz)



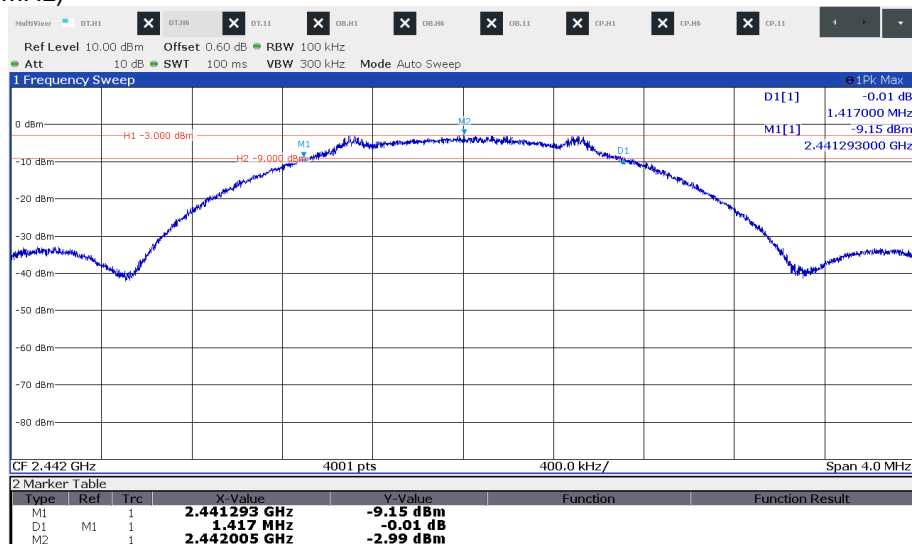
Channel 39 (2480 MHz)



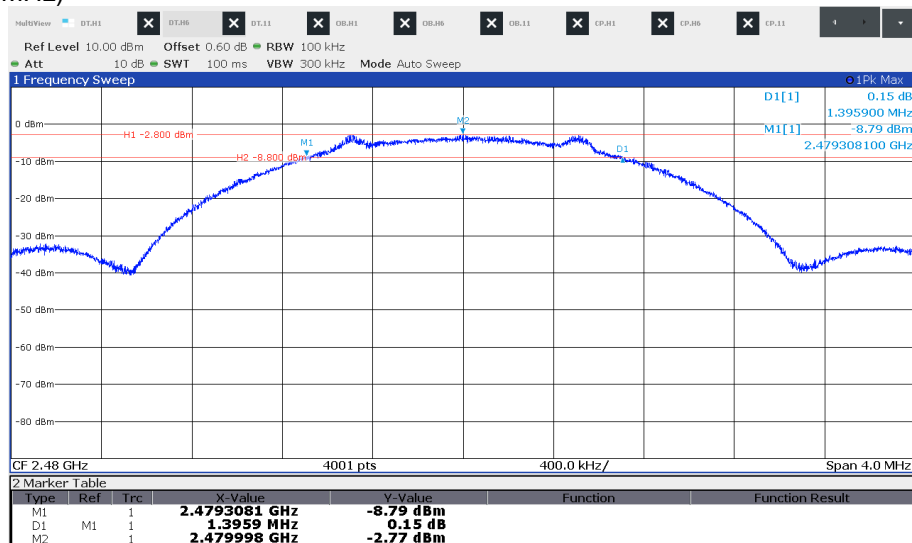
2 Mbps:
Channel 37 (2402 MHz)



Channel 18 (2442 MHz)



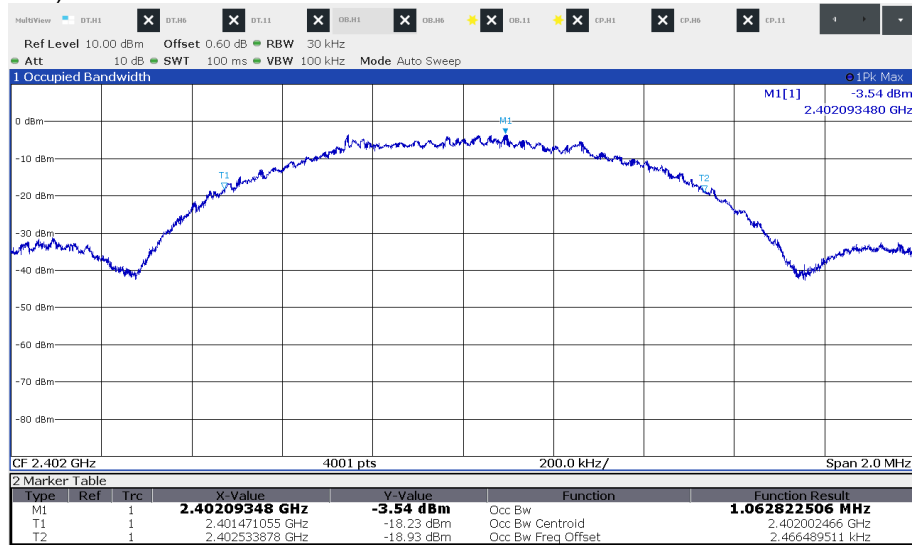
Channel 39 (2480 MHz)



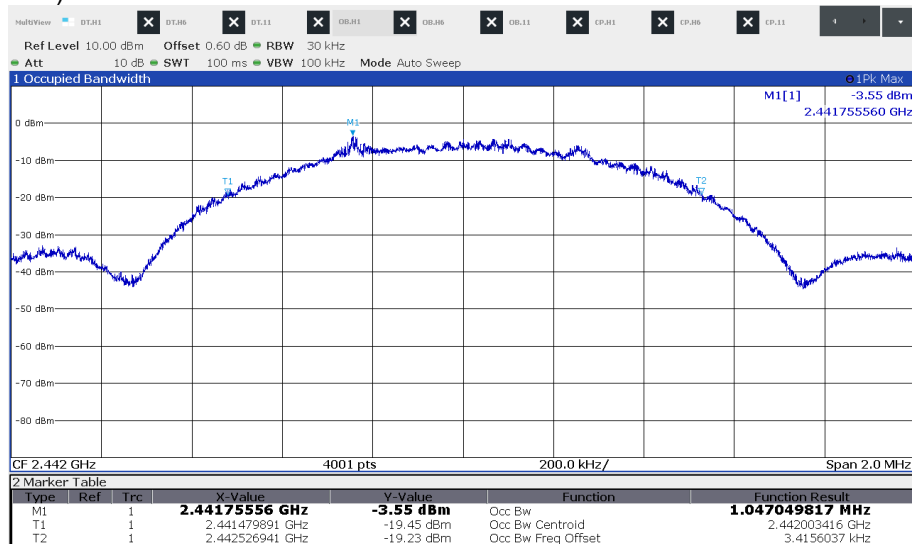
5.2.7 Test protocols OBW

1 Mbps:

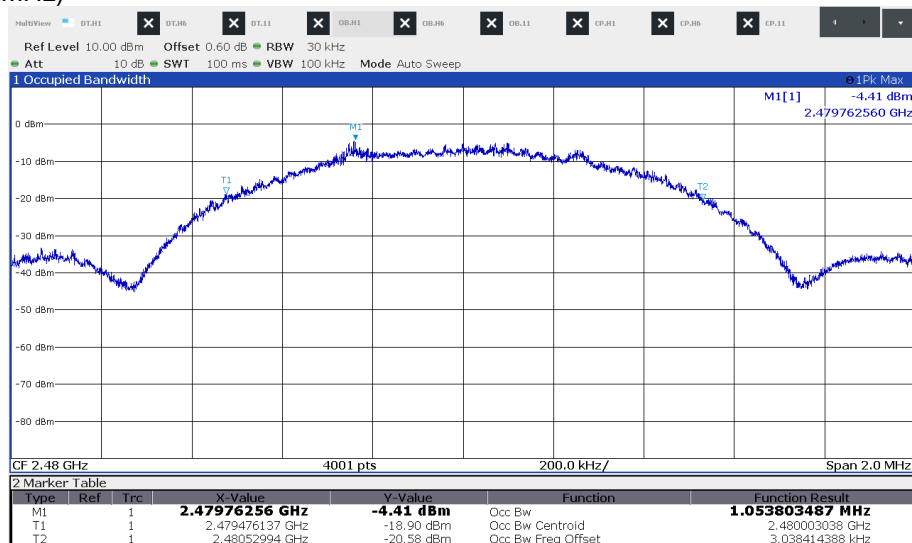
Channel 37 (2402 MHz)



Channel 18 (2442 MHz)

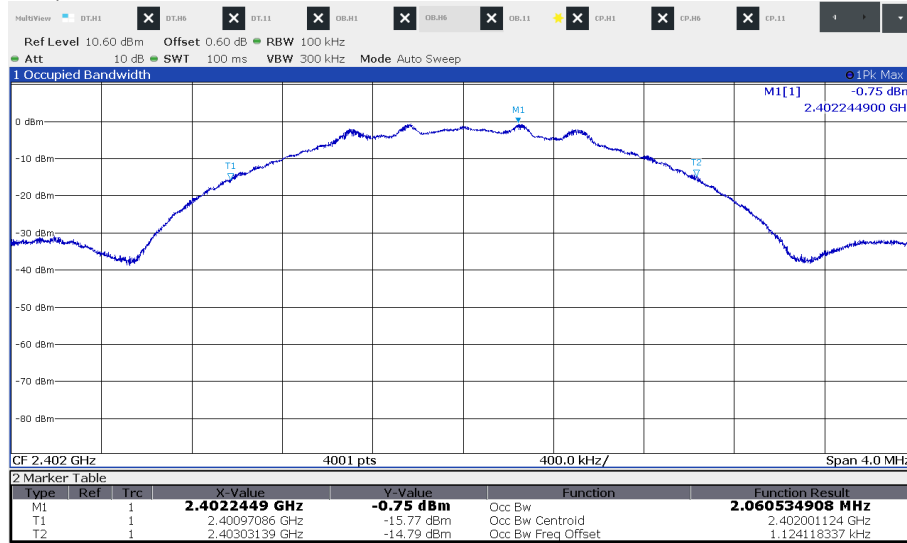


Channel 39 (2480 MHz)

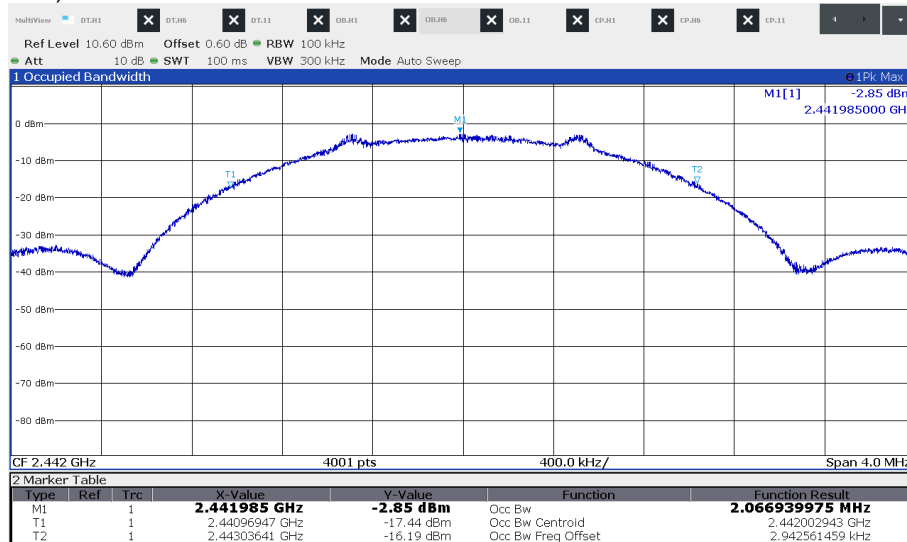


FCC ID: XYN827A

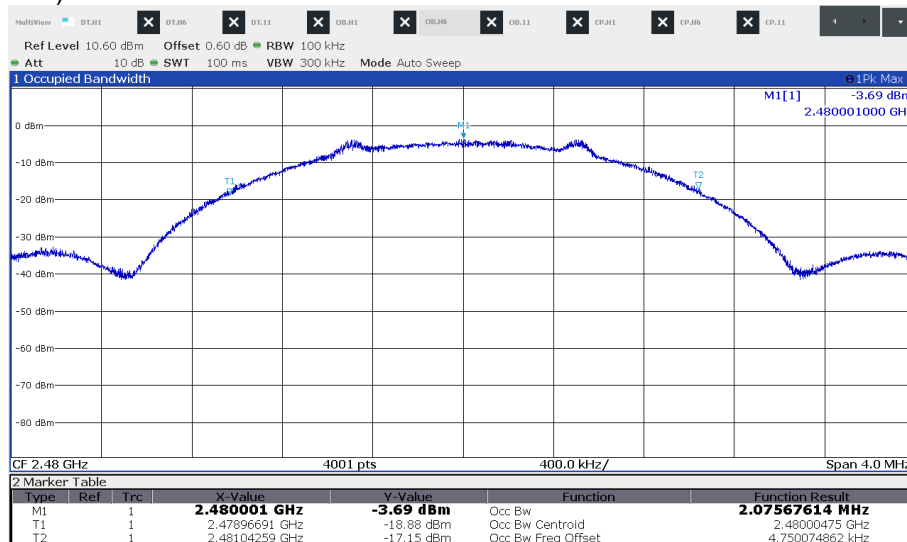
IC ID: 8748A-827A

2 Mbps:
Channel 37 (2402 MHz)

Channel 18 (2442 MHz)



Channel 39 (2480 MHz)



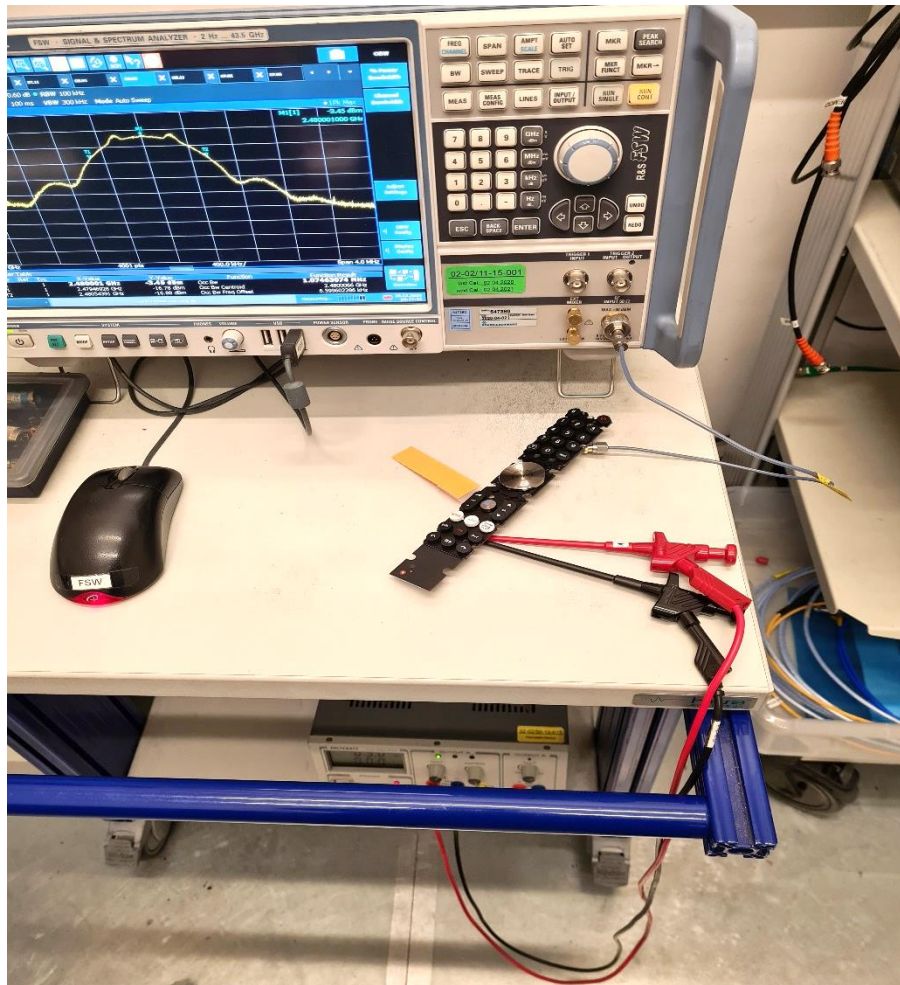
5.3 Maximum peak output power

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

5.3.1 Description of the test location

Test location: Shielded Room S6

5.3.2 Photo documentation of the test set-up



5.3.3 Applicable standard

According to FCC Part 15, Section 15.247(b)(3):

For systems using digital modulation in the 2400-2483.5 MHz band, the maximum peak output power of the transmitter shall not exceed 1 Watt. The limit is based on transmitting antennas of directional gain that do not exceed 6 dBi.

5.3.4 Description of Measurement

The maximum peak output power is measured using a spectrum analyser following the procedure set out in ANSI C63.10, item 11.9.1.1. The EUT is set in TX continuous mode while measuring.

5.3.5 Test result

1 Mbps		Test results			
		P (dBm)	Gain (dBm)	Limit (dBm)	Margin (dB)
Lowest frequency: CH37					
T_{nom}	V_{nom}	-0.5	0.0	30.0	-30.5
Middle frequency: CH18					
T_{nom}	V_{nom}	-1.3	0.0	30.0	-31.3
Highest frequency: CH39					
T_{nom}	V_{nom}	-2.2	0.0	30.0	-32.2

2 Mbps		Test results			
		P (dBm)	Gain (dBm)	Limit (dBm)	Margin (dB)
Lowest frequency: CH37					
T_{nom}	V_{nom}	-0.5	0.0	30.0	-30.5
Middle frequency: CH18					
T_{nom}	V_{nom}	-1.3	0.0	30.0	-31.3
Highest frequency: CH39					
T_{nom}	V_{nom}	-2.2	0.0	30.0	-32.2

Peak Power Limit according to FCC Part 15, Section 15.247(b)(3):

Frequency (MHz)	Peak Power Limit	
	(dBm)	(W)
2400-2483.5	30	4.0

The requirements are **FULFILLED**.

Remarks:

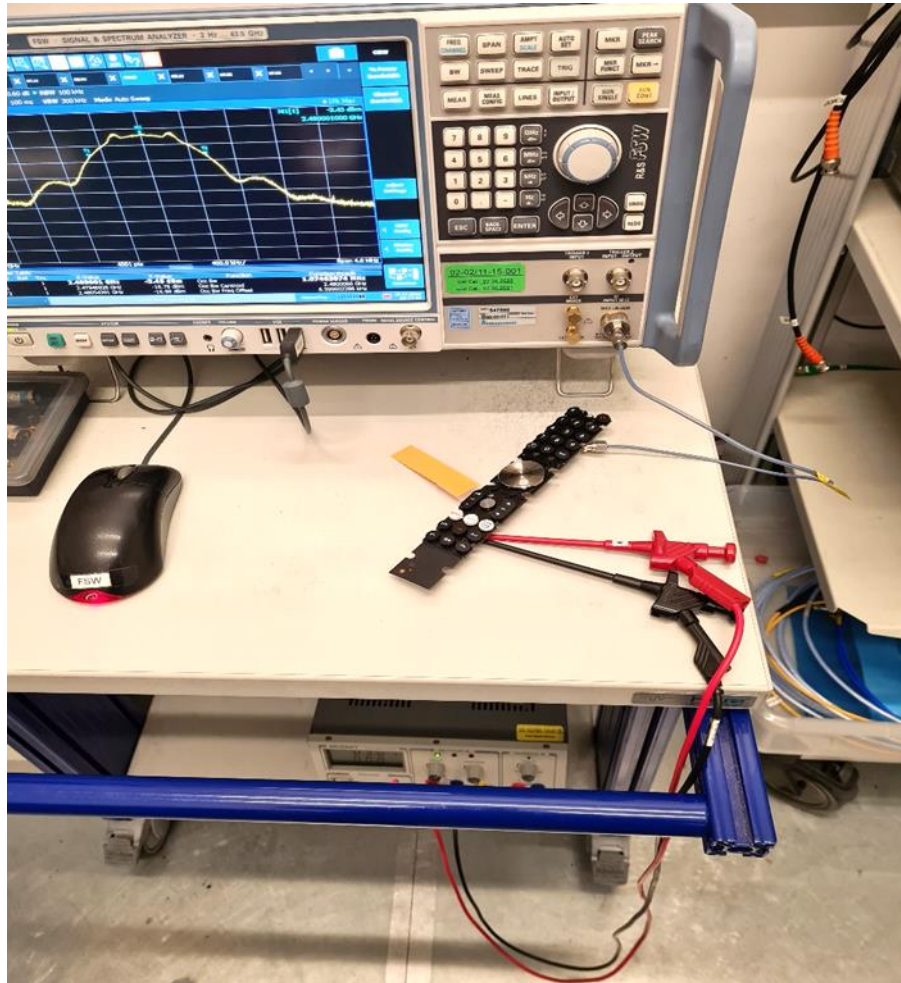
5.4 Power spectral density

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

5.4.1 Description of the test location

Test location: Shielded Room S6

5.4.2 Photo documentation of the test set-up



5.4.3 Applicable standard

According to FCC Part 15, Section 15.247(e):

For digitally modulated systems, the power spectral density radiated from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the radiated output power shall be used to determine the power spectral density.

5.4.4 Description of Measurement

The measurement is performed using the procedure set out in ANSI C63.10, item 11.10.3. Therefore, the PKPSD is measured conducted. The max peak was located and measured with the spectrum analyser and the marker set to peak. An offset of 0.6 dB was set to compensate the cable attenuation. The maximum antenna gain is used to calculate the maximum peak power spectral density.

Spectrum analyser settings:

RBW: 3 kHz, VBW: 10 kHz, Detector: Peak, Sweep time: Auto

5.4.5 Test result

1 Mbps		Test results conducted				
		PD [Pmax] (dBm/3kHz)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm/3kHz)	Margin (dB)
Lowest frequency: 2402 MHz						
T_{nom}	V_{nom}	-11.2	0.0	-11.2	14.0	-25.2
Middle frequency: 2426 MHz						
T_{nom}	V_{nom}	-11.3	0.0	-11.3	14.0	-25.3
Highest frequency: 2480 MHz						
T_{nom}	V_{nom}	-12.2	0.0	-12.2	14.0	-26.2

2 Mbps		Test results conducted				
		PD [Pmax] (dBm/3kHz)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm/3kHz)	Margin (dB)
Lowest frequency: 2402 MHz						
T_{nom}	V_{nom}	-14.1	0.0	-14.1	14.0	-28.1
Middle frequency: 2426 MHz						
T_{nom}	V_{nom}	-15.3	0.0	-15.3	14.0	-29.3
Highest frequency: 2480 MHz						
T_{nom}	V_{nom}	-16.6	0.0	-16.6	14.0	-30.6

Power spectral density limit according to FCC Part 15, Section 15.247(e):

Frequency (MHz)	Power spectral density limit (EIRP)
	(dBm/3 kHz)
2400 - 2483.5	14

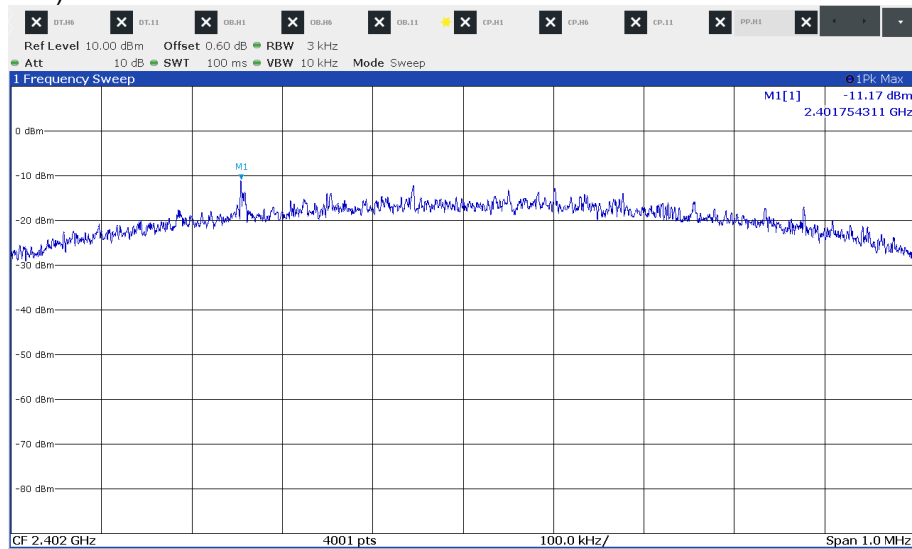
The requirements are **FULFILLED**.

Remarks: For detailed test result please see the following test protocols

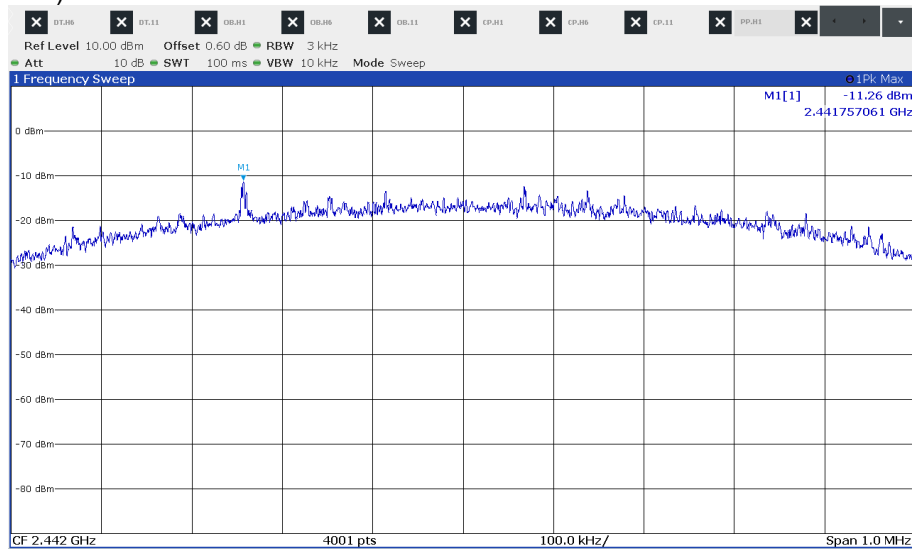
5.4.6 Test protocols

1 Mbps:

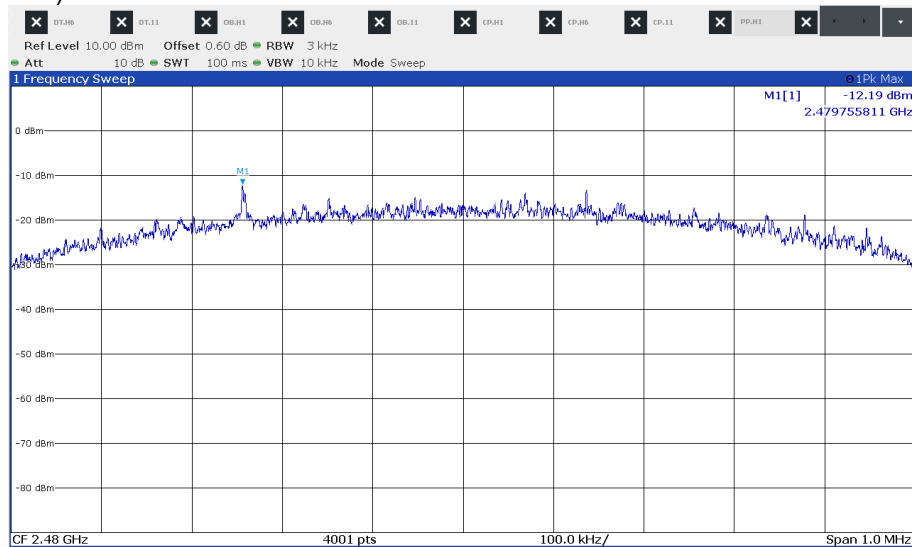
Channel 37 (2402 MHz)

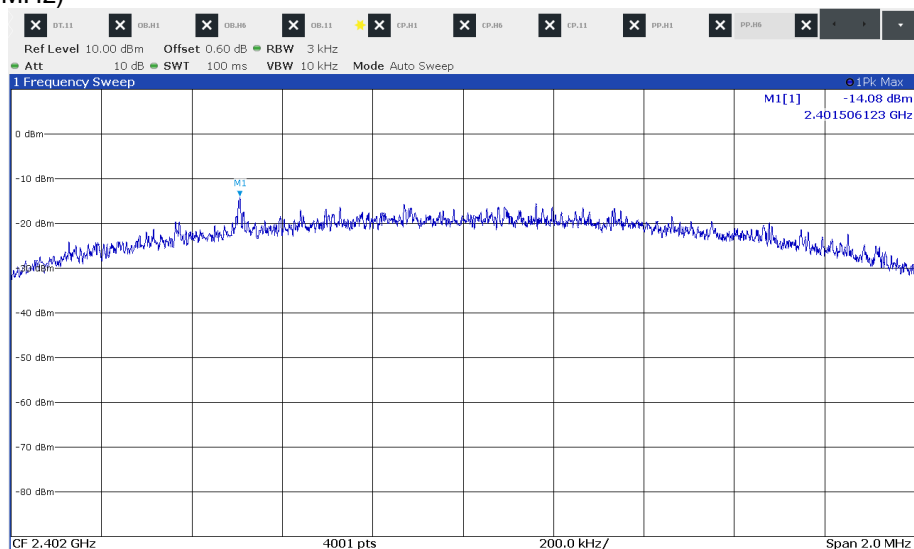


Channel 18 (2442 MHz)

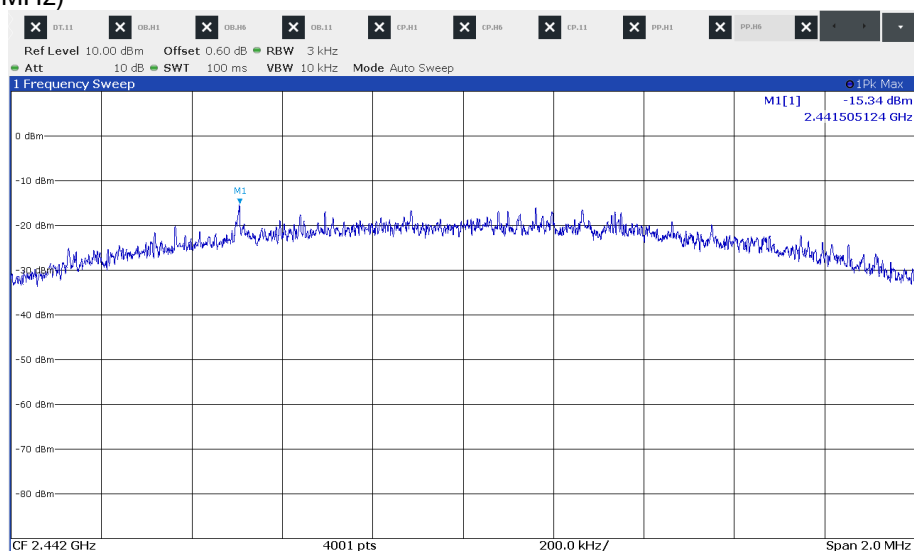


Channel 39 (2480 MHz)

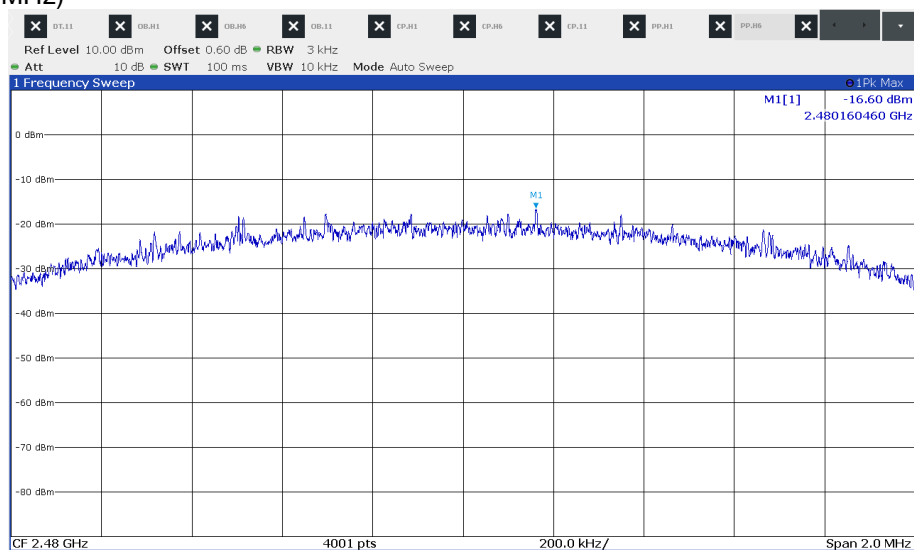


2 Mbps:
Channel 37 (2402 MHz)

Channel 18 (2442 MHz)



Channel 39 (2480 MHz)



5.5 Radiated emissions in restricted bands

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

5.5.1 Description of the test location

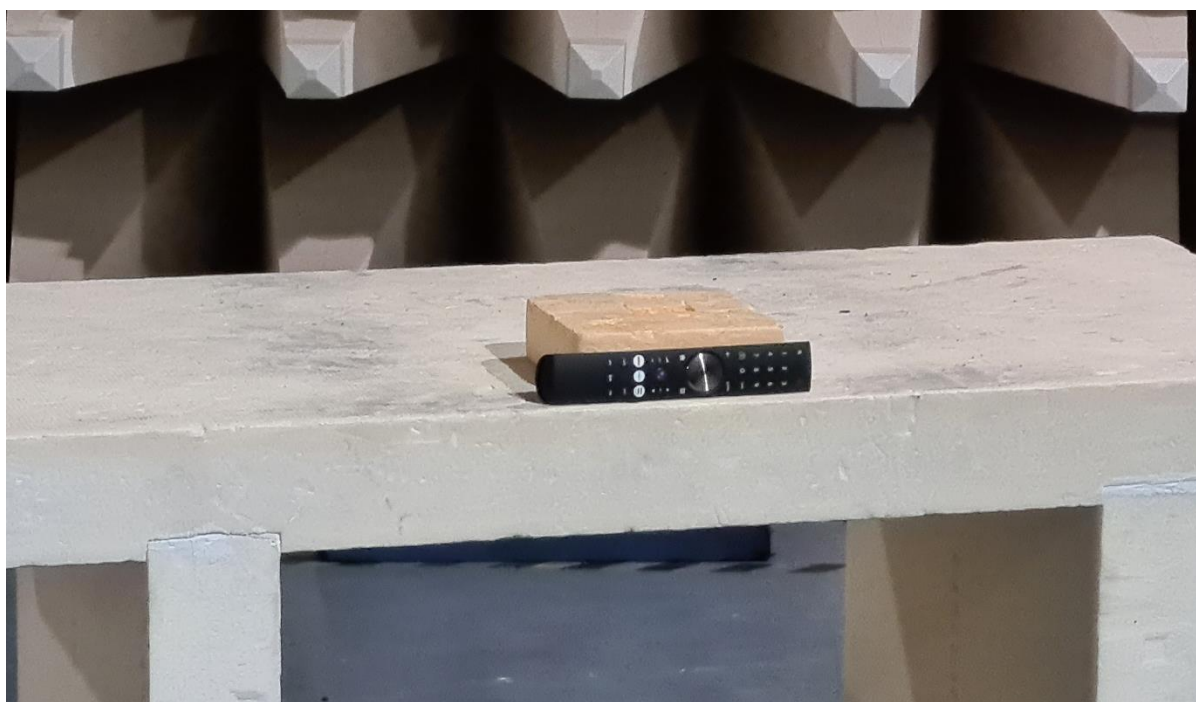
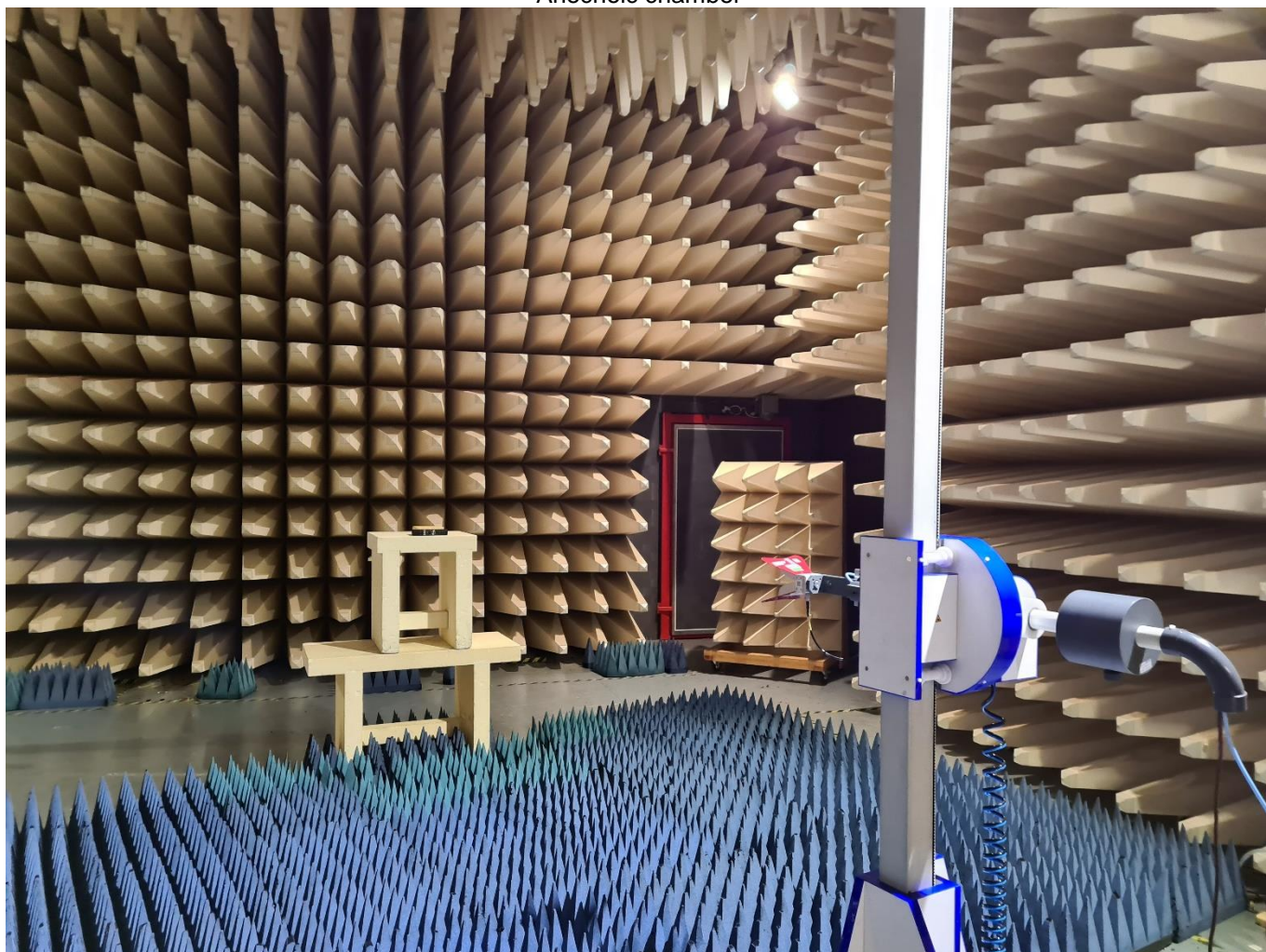
Test location: OATS 1
Test location: Anechoic chamber 1
Test distance: 3 m

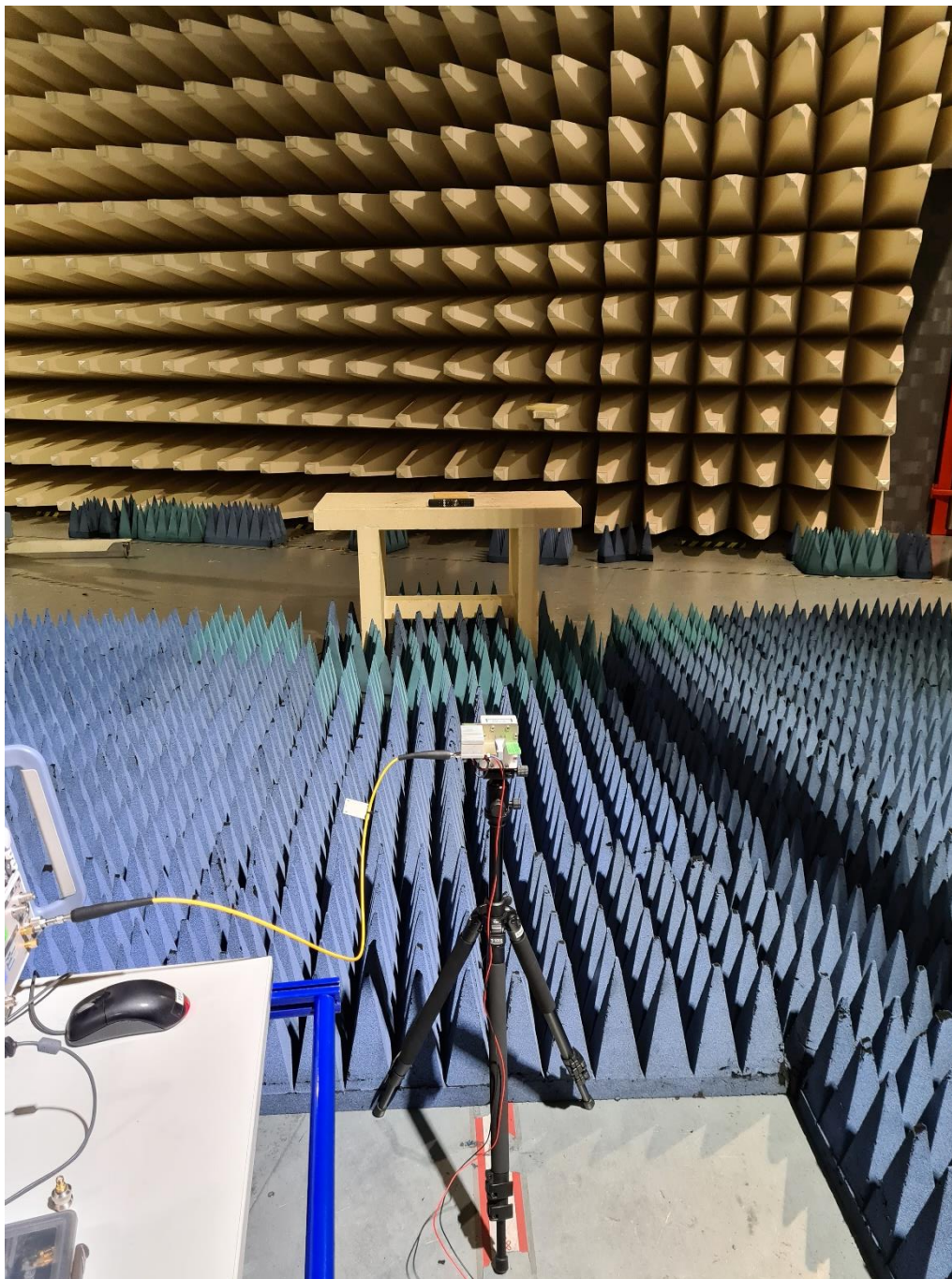
5.5.2 Photo documentation of the test set-up

Open area test site



Anechoic chamber





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).

5.5.3 Description of Measurement

The restricted bands are measured radiated. The span of the spectrum analyser is 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. The restricted bands are measured falling emissions into it and the nearest restricted band are checked for emissions also the restricted band for the harmonics of the carrier.

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 time: 100 ms

5.5.4 Test result

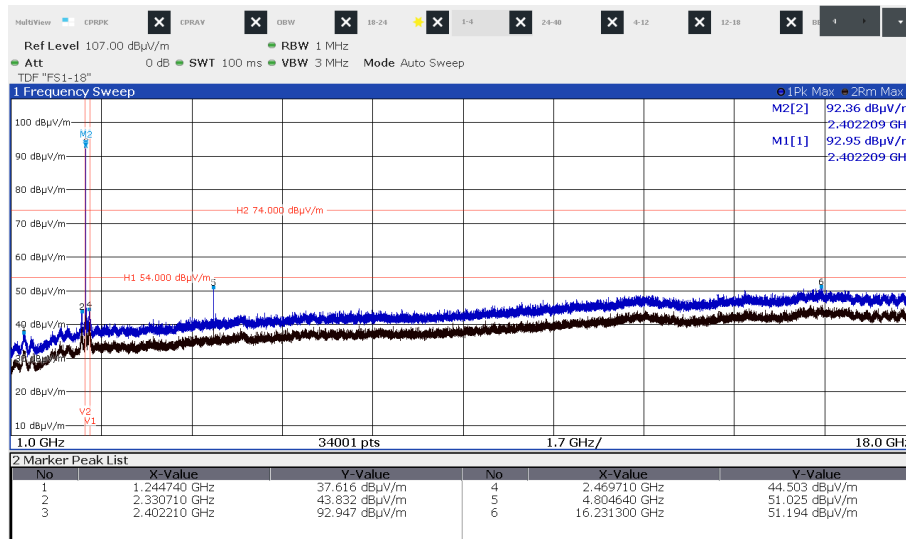
Emissions 30 MHz – 1000 MHz, SER2

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)
35.80	9.4	0.5	13.3	14.5	22.7	15.0	40.0	-17.3
81.40	4.6	1.6	11.4	11.4	16.0	13.0	40.0	-24.0
110.60	2.1	2.8	13.4	12.6	15.5	15.4	43.5	-28.0
469.30	3.1	2.6	21.9	22.1	25.0	24.7	46.0	-21.0
986.30	4.1	4.0	30.3	30.9	34.4	34.9	54.0	-19.1

Emissions 1 GHz – 26 GHz, SER3

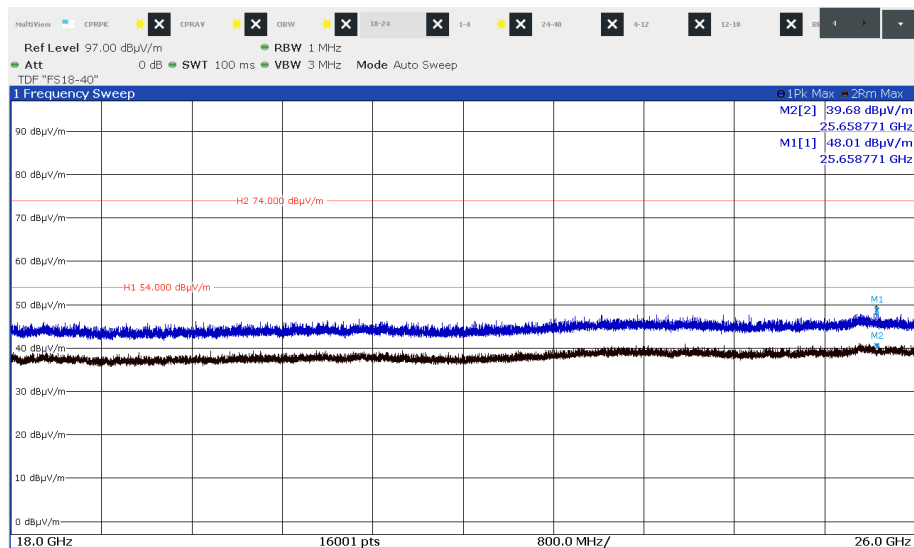
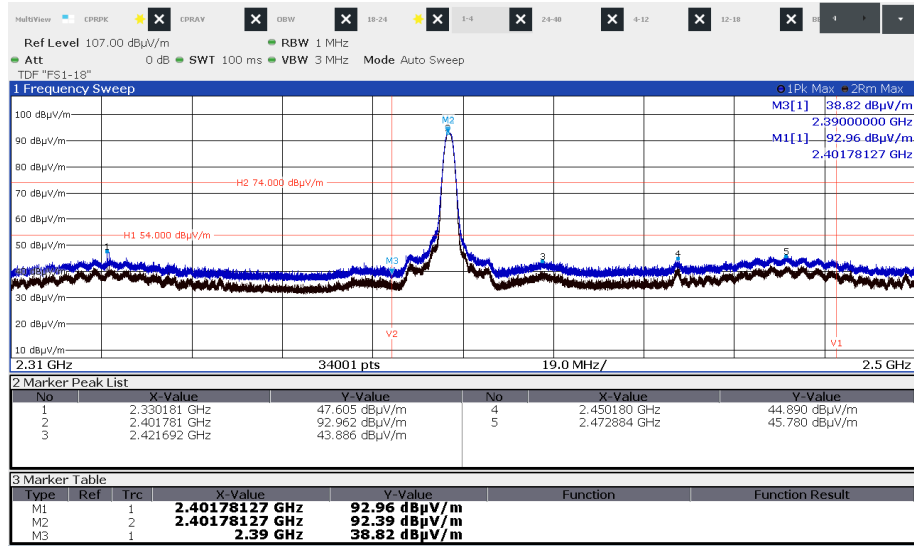
1 Mbps:

CH37

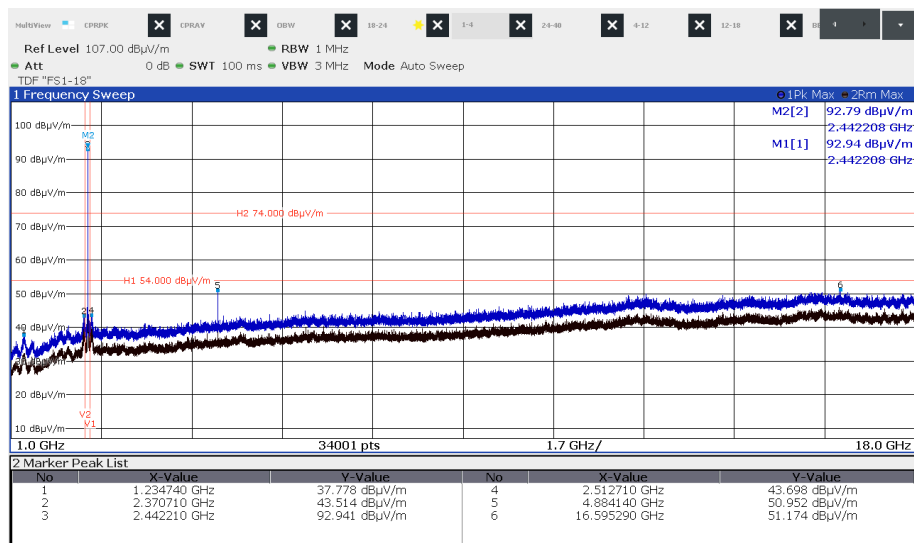


FCC ID: XYN827A

IC ID: 8748A-827A

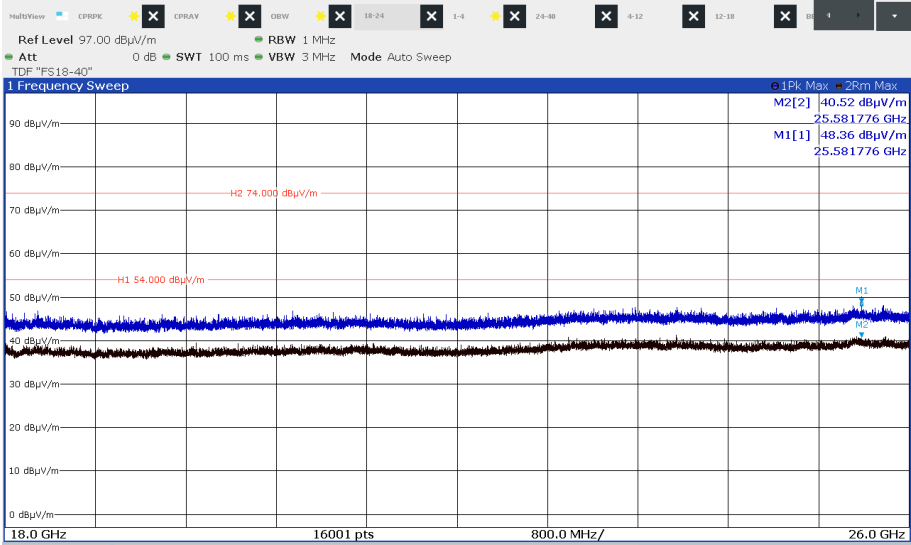


CH18

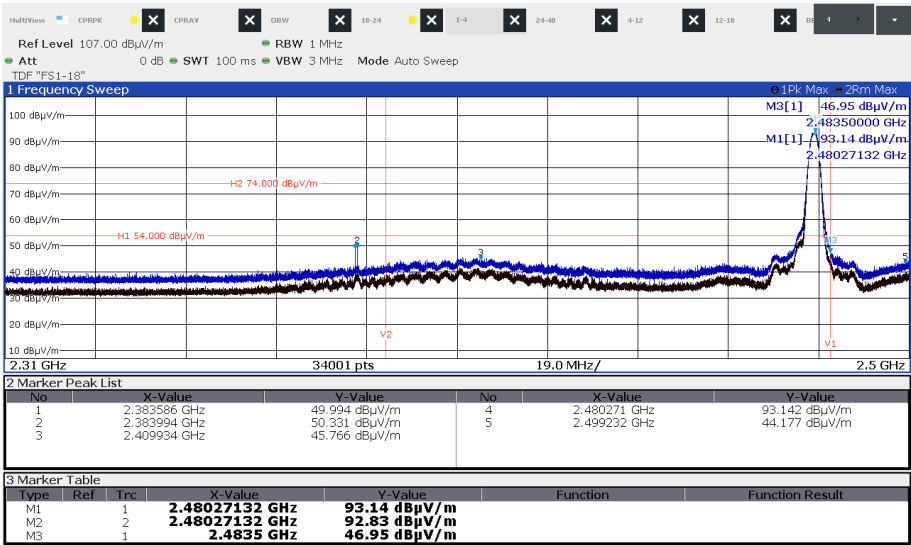
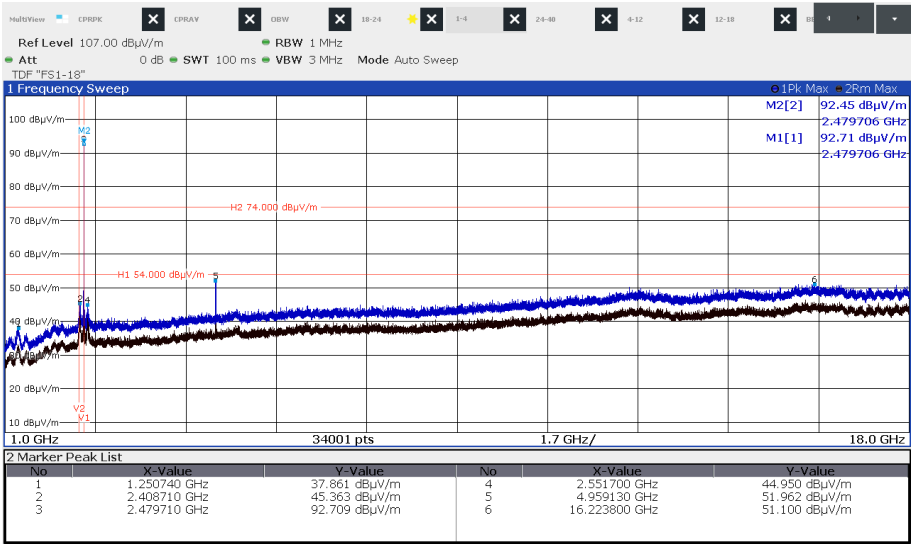


FCC ID: XYN827A

IC ID: 8748A-827A

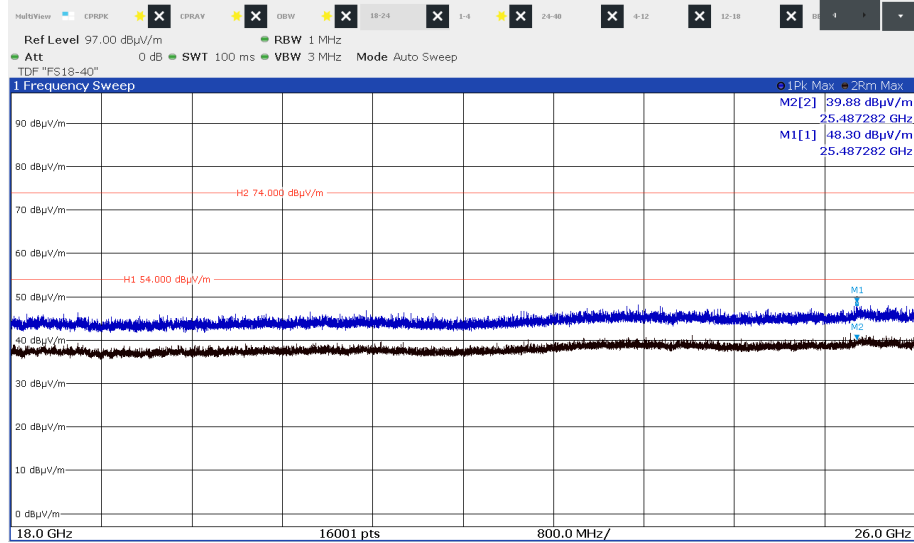
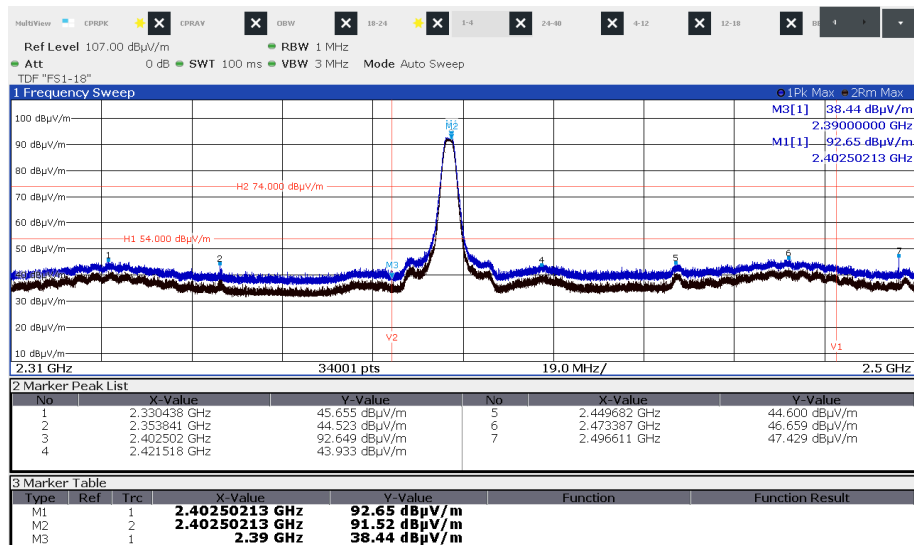
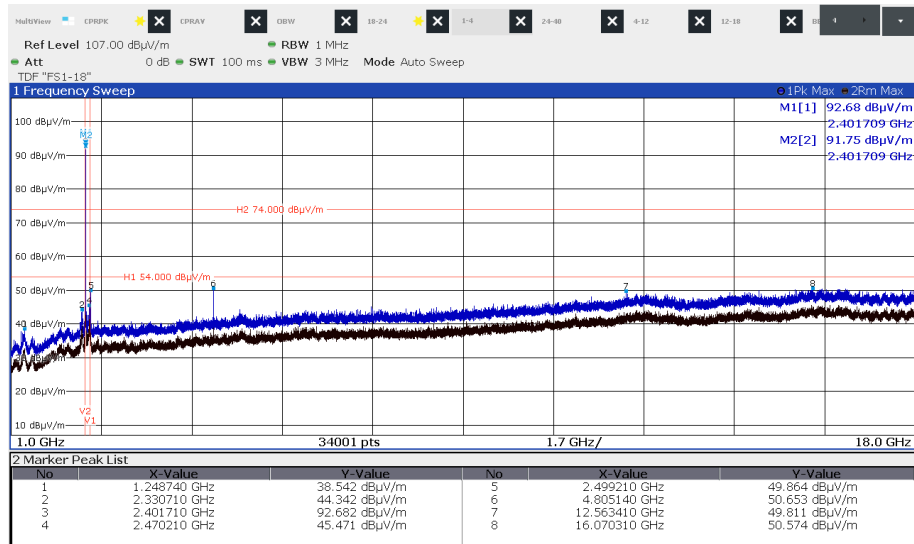


CH39



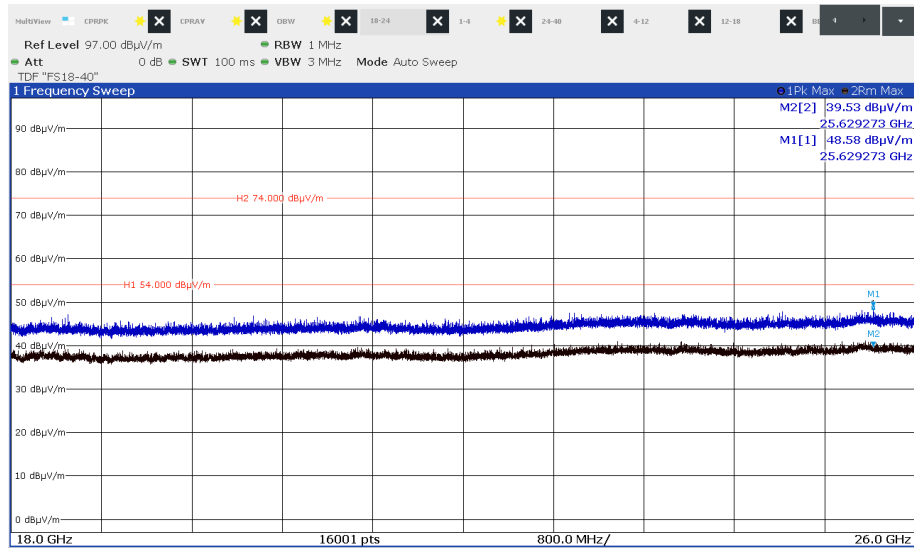
FCC ID: XYN827A

IC ID: 8748A-827A

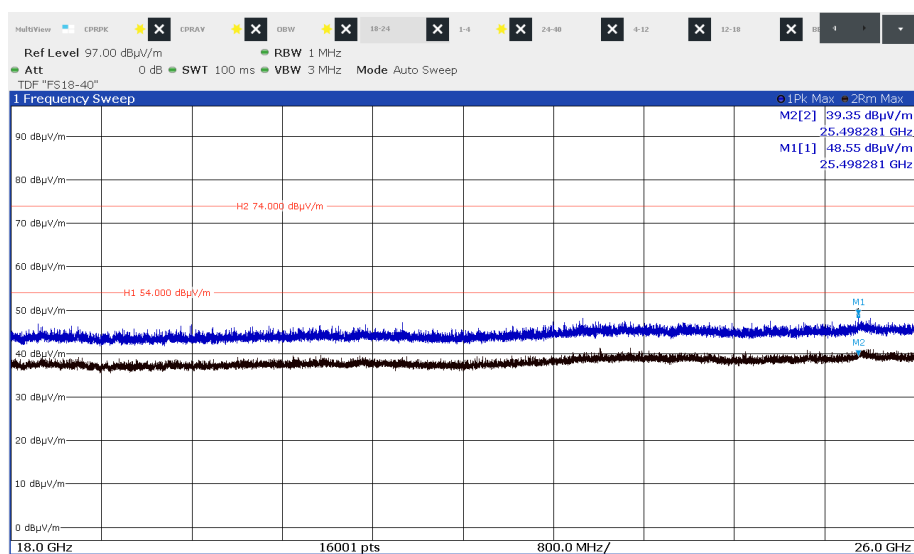
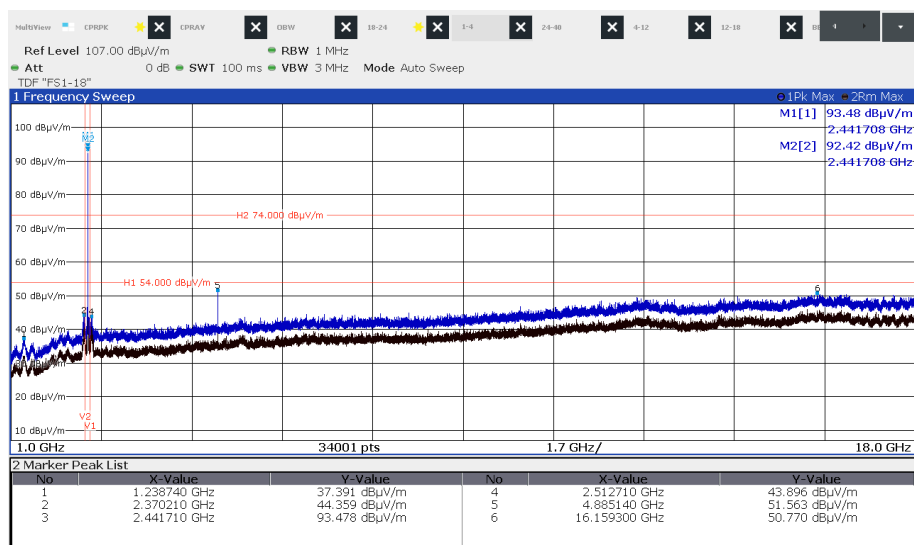
2 Mbps:
CH37

FCC ID: XYN827A

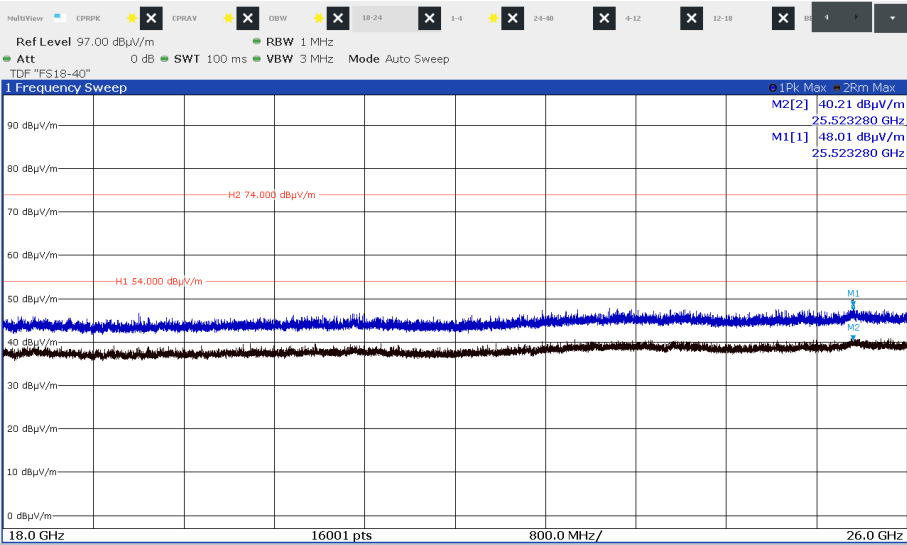
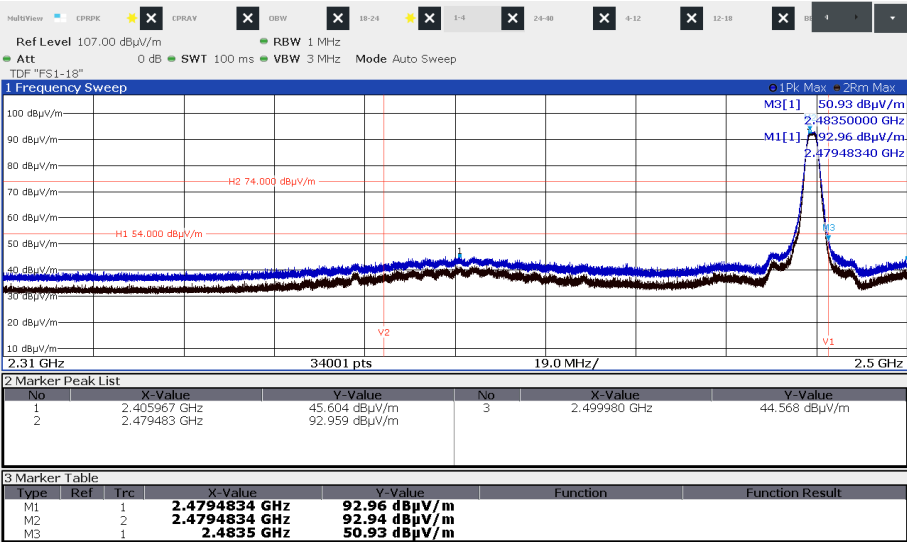
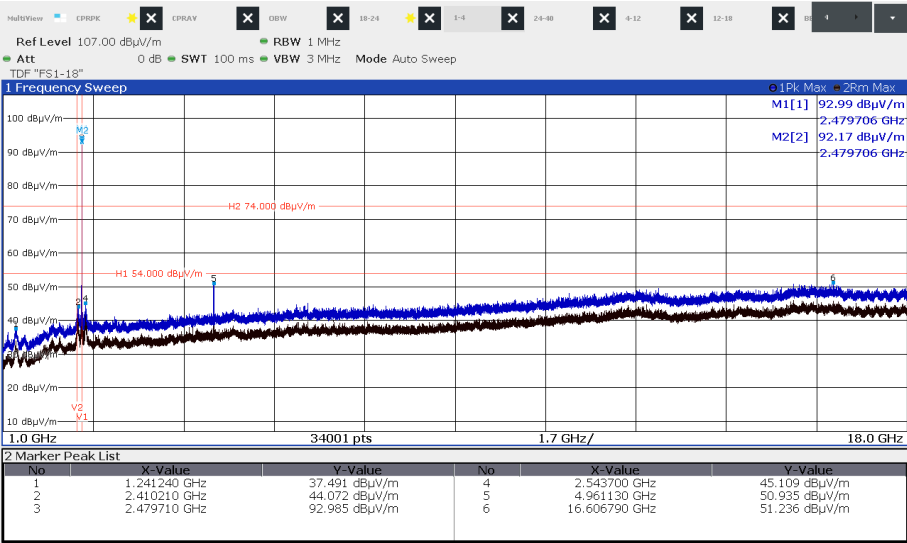
IC ID: 8748A-827A



CH18



CH39



Radiated limits according to FCC Part 15 Section 15.209(a) for spurious emissions which fall in restricted bands:

Frequency (MHz)	Field strength of spurious emissions		Measurement distance (metres)
	($\mu\text{V/m}$)	dB($\mu\text{V/m}$)	
0.009-0.490	2400/F (kHz)		300
0.490-1.705	24000/F (kHz)		30
1.705-30	30	29.5	30
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	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

RSS-Gen, Table 6 – Restricted Frequency Bands

MHz	MHz	MHz	GHz
0.090 - 0.110	12.57675 - 12.57725	399.9 - 410	7.250 - 7.750
0.495 - 0.505	13.36 - 13.41	608 - 614	8.025 - 8.500
2.1735 - 2.1905	16.42 - 16.423	960 - 1427	9.0 - 9.2
3.020 - 3.026	16.69475 - 16.69525	1435 - 1626.5	9.3 - 9.5
4.125 - 4.128	16.80425 - 16.80475	1645.5 - 1646.5	10.6 - 12.7
4.17725 - 4.17775	25.5 - 25.67	1660 - 1710	13.25 - 13.4
4.20725 - 4.20775	37.5 - 38.25	1718.8 - 1722.2	14.47 - 14.5
5.677 - 5.683	73 - 74.6	2200 - 2300	15.35 - 16.2
6.215 - 6.218	74.8 - 75.2	2310 - 2390	17.7 - 21.4
6.26775 - 6.26825	108 - 138	2483.5 - 2500	22.01 - 23.12
6.31175 - 6.31225	149.9 - 150.05	2655 - 2900	23.6 - 24.0
8.291 - 8.294	156.52475 - 156.52525	3260 - 3267	31.2 - 31.8
8.362 - 8.366	156.7 - 156.9	3332 - 3339	36.43 - 36.5
8.37625 - 8.38675	162.0125 - 167.17	3345.8 - 3358	Above 38.6
8.41425 - 8.41475	167.72 - 173.2	3500 - 4400	
12.29 - 12.293	240 - 285	4500 - 5150	
12.51975 - 12.52025	322 - 335.4	5350 - 5460	

The requirements are **FULFILLED**.

Remarks: The measurement was performed up to the 10th harmonic. For detailed test results please see the following test protocols.

5.6 Spurious emissions

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

5.6.1 Description of the test location

Test location: Shielded Room S6

5.6.2 Applicable standard

According to FCC Part 15, Section 15.247(d):

In any 100 kHz bandwidth outside the frequency bands 2400 – 2483.50 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 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) (see Section 15.205(c)).

5.6.3 Description of Measurement

The radiated power of the spurious emission from the EUT is measured in a test setup following the procedures set out in ANSI C63.10. If the emission level of the EUT in peak mode complies with the average limit is 20 dB lower, then testing will be stopped and peak values of the EUT will be reported, otherwise the emission will be measured in average mode again and reported.

Test receiver settings for SER2:

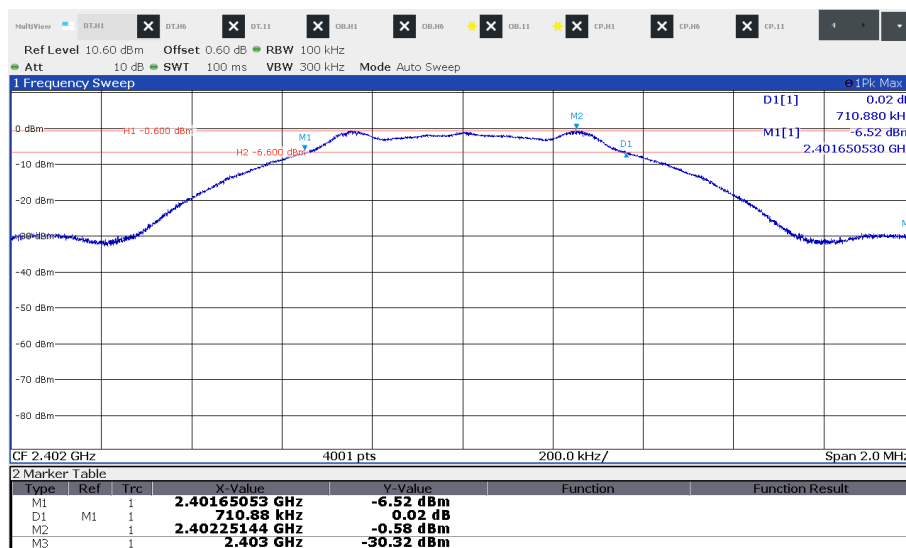
RBW: 120 MHz, Detector: Quasi peak, Mes. Time: 1 s,

Spectrum analyser settings for SER3:

RBW: 100 kHz, VBW: 300 kHz, Detector: Max. peak, Trace: Max. hold, Sweep: Auto

Determination of the limit:

CH37, 1 Mbps:



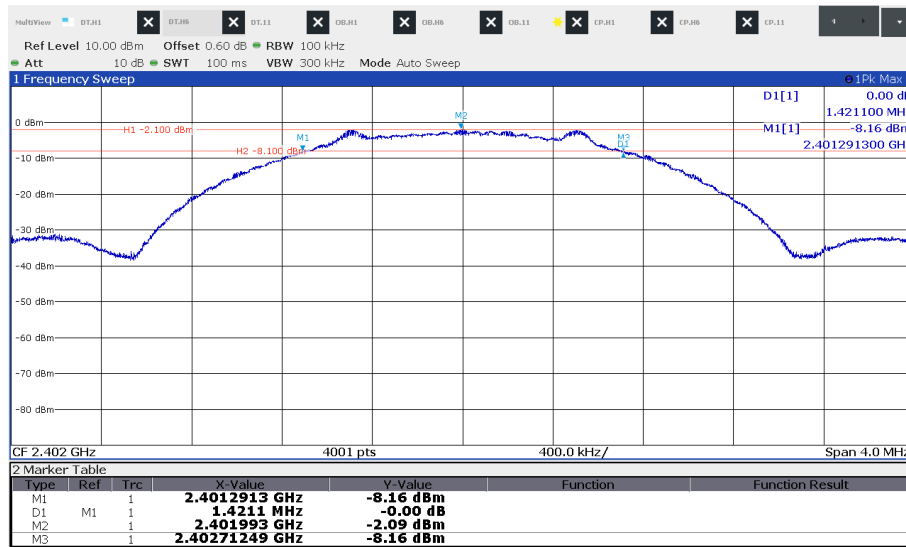
Max. level -0.6 dBm

Limit -20.6 dBm

FCC ID: XYN827A

IC ID: 8748A-827A

CH37, 2 Mbps:



Max. level -2.1 dBm

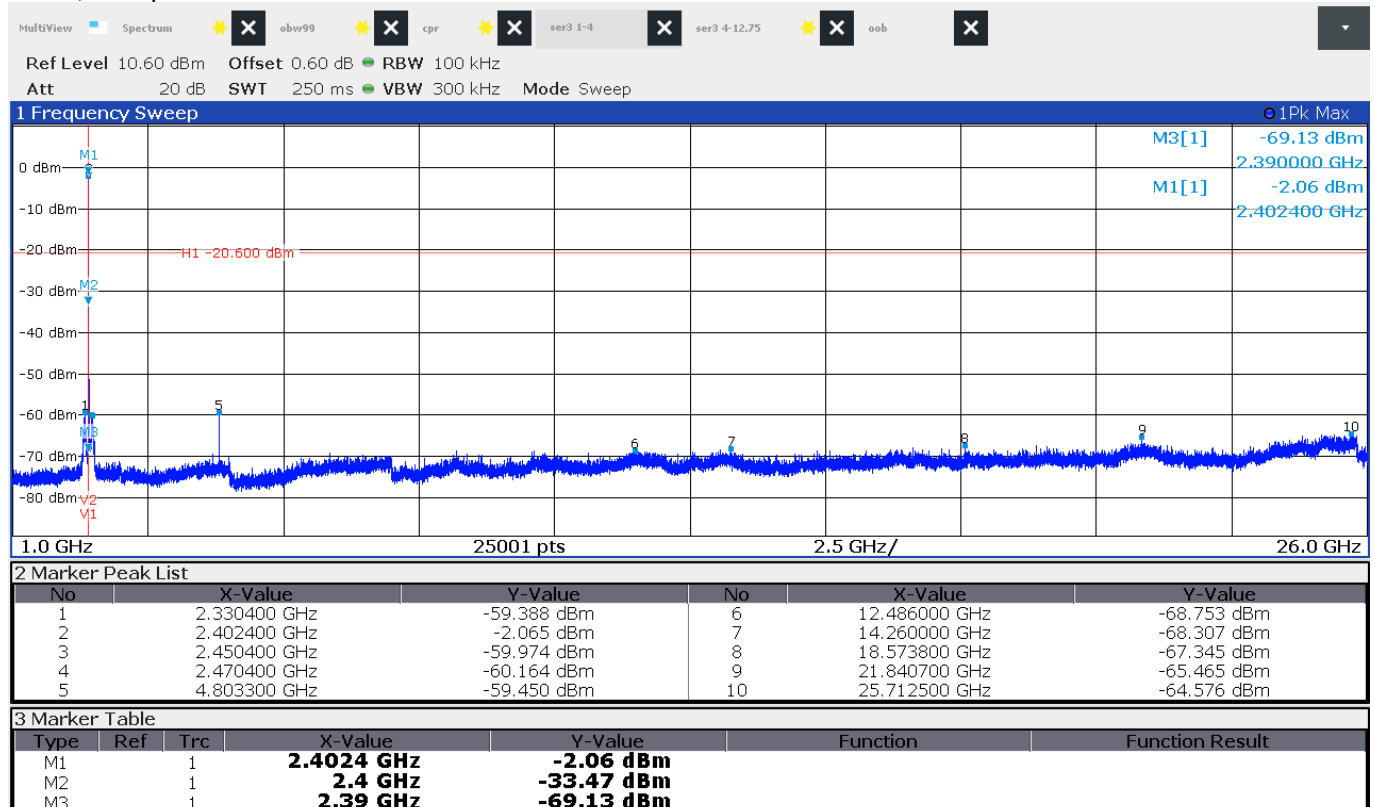
Limit -22.1 dBm

5.6.4 Test result

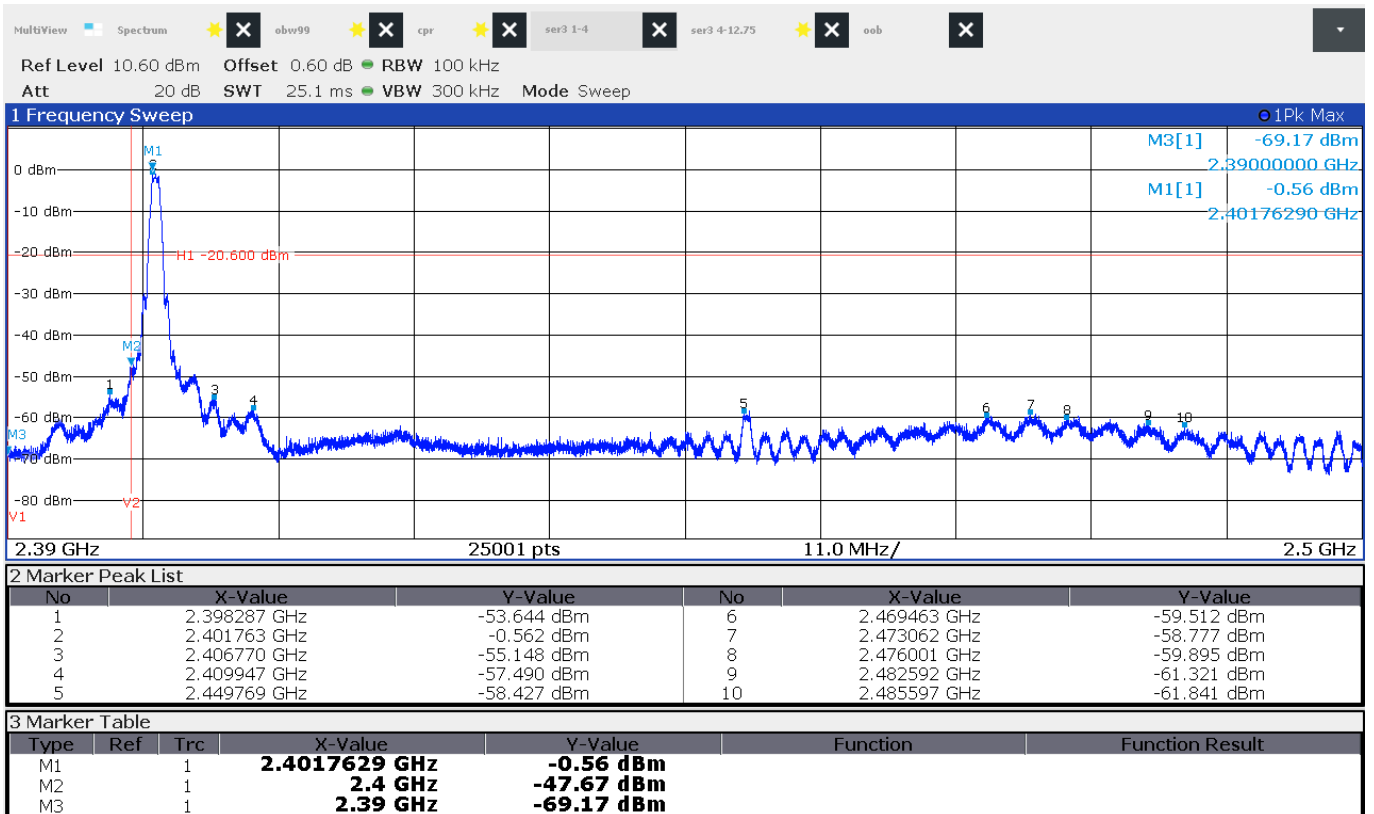
Note:

Measurements were performed in the frequency range from 1 GHz up to 26 GHz with the analyser settings for restricted band measurements to show compliance for emissions falling into restricted bands, else the band edge compliance is fulfilled. In the frequency ranges from 9 kHz up to 1000 MHz no emission can be detected.

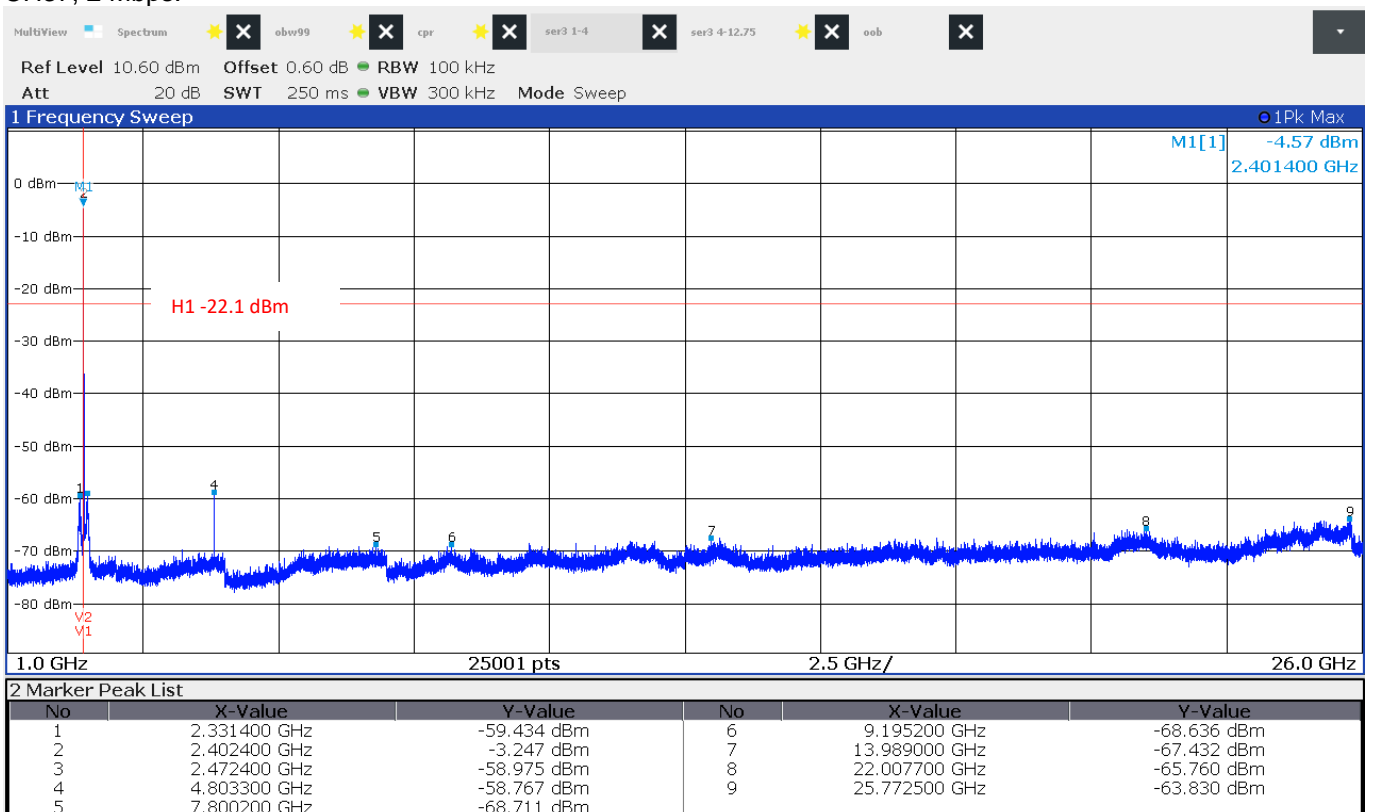
CH37, 1 Mbps:



IC ID: 8748A-827A

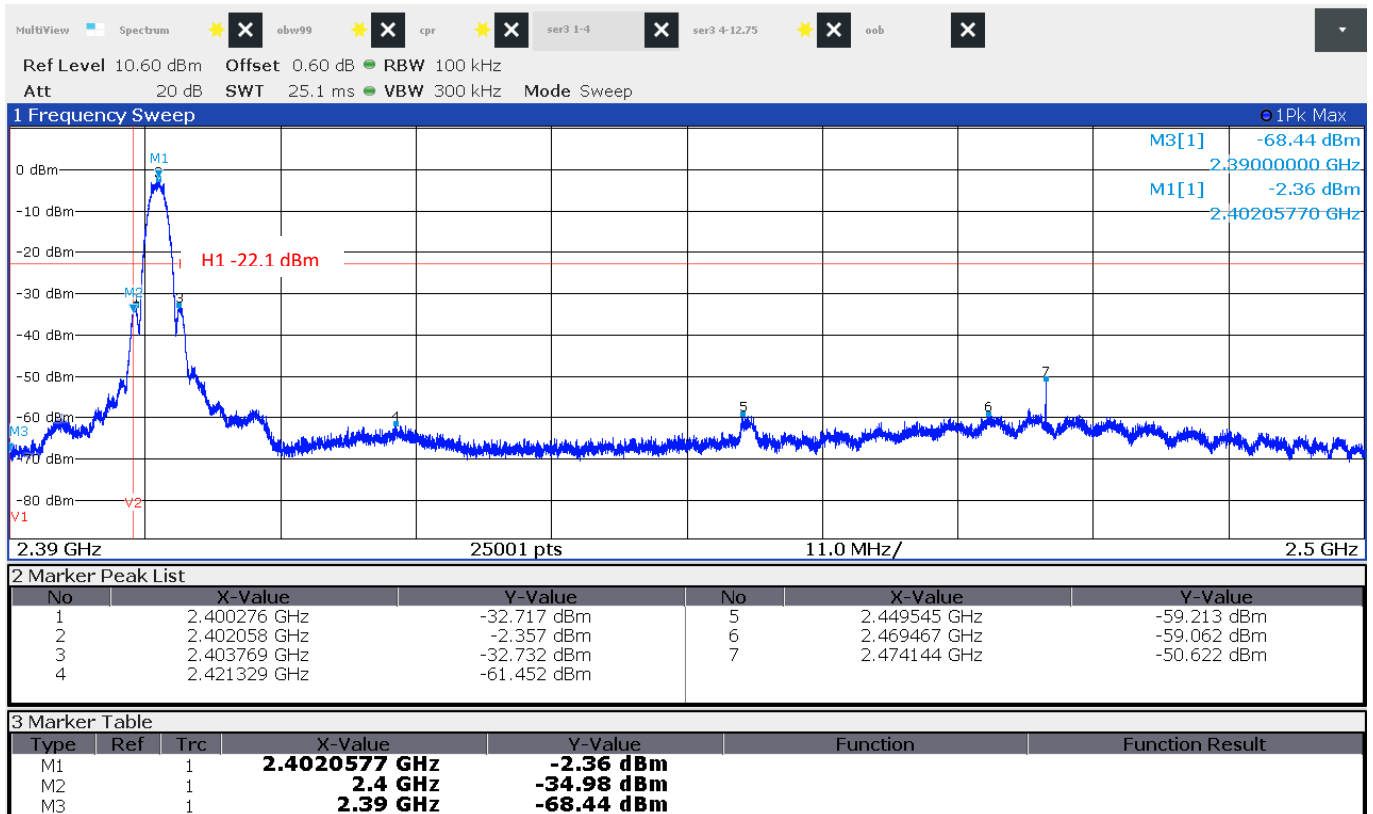


CH37, 2 Mbps:



FCC ID: XYN827A

IC ID: 8748A-827A



Limit according to FCC Part 15, Section 15.247(d) for emissions falling not in restricted bands:

In any 100 kHz bandwidth outside the frequency bands 2400 – 2483.50 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 a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required.

Frequency (MHz)	Spurious emission limit
Below 1000	20 dB below the highest level of the desired power
Above 1000	20 dB below the highest level of the desired power

The requirements are **FULFILLED**.

Remarks:

5.7 Antenna application

5.7.1 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 that broken antennas can be replaced by the user, but the use of a standard antenna jack is prohibited.

The EUT has an integrated antenna. No other antenna can be used with the device.

Remarks: The antenna meets the requirements of part 15.203 and 15.204.

5.8 Antenna requirements

According to FCC Part 15C, Section 15.247(b)(4):

The conducted output power limit specified in paragraph (b) of 15.247 is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from intentional radiator shall be reduced below the stated values in paragraph (b)(1), (b)(2) and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The gain of used antenna is smaller 6 dB. No defacto limit results.

Remarks: The output power has not to be reduced.

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.
CPC 3	FSW43	02-02/11-15-001	02/04/2021	02/04/2020		
	VLP-1602 PRO	02-02/50-10-015				
	minibend KR-16	02-02/50-16-017				
MB	FSW43	02-02/11-15-001	02/04/2021	02/04/2020		
	VLP-1602 PRO	02-02/50-10-015				
	minibend KR-16	02-02/50-16-017				
PSD	FSW43	02-02/11-15-001	02/04/2021	02/04/2020		
	VLP-1602 PRO	02-02/50-10-015				
	minibend KR-16	02-02/50-16-017				
SER 2	ESVS 30	02-02/03-05-006	15/07/2021	15/07/2020		
	VULB 9168	02-02/24-05-005	19/09/2020	19/07/2019		
	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	02/04/2021	02/04/2020		
	AMF-6D-01002000-22-10P	02-02/17-15-004				
	LNA-40-18004000-33-5P	02-02/17-20-002				
	3117	02-02/24-05-009	18/06/2021	18/06/2020		
	BBHA 9170	02-02/24-05-013	19/05/2023	19/05/2020	14/01/2021	14/01/2020
	18N-20	02-02/50-17-003				
	BAM 4.5-P	02-02/50-17-024				
	NCD	02-02/50-17-025				
	KK-SF106-2X11N-6,5M	02-02/50-18-016				
	KMS116-GL140SE-KMS116-	02-02/50-20-026				
	BAT-EMC 3.19.1.24	02-02/68-13-001				