



# EMI – TEST REPORT

- FCC Part 15.247, RSS-247 -

Type / Model Name : EasyLogger

Product Description : Temperature and Humidity Sensor with BLE Module

Applicant : fp floor protector GmbH

Address : Waldgasse 2

2700 WIENER NEUSTADT, AUSTRIA

Manufacturer : fp floor protector GmbH

Address : Waldgasse 2

2700 WIENER NEUSTADT, AUSTRIA

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

**POSITIVE**

Test Report No. : **T46146-00-03FX**

11. January 2021

Date of issue



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

## Contents

<b><u>1</u></b>	<b><u>TEST STANDARDS</u></b>	<b><u>3</u></b>
<b><u>2</u></b>	<b><u>EQUIPMENT UNDER TEST</u></b>	<b><u>4</u></b>
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	5
2.9	Transmit operating modes	5
2.10	Antennas	5
2.11	Power supply system utilised	5
2.12	Peripheral devices and interface cables	6
2.13	Determination of worst case conditions for final measurement	6
<b><u>3</u></b>	<b><u>TEST RESULT SUMMARY</u></b>	<b><u>7</u></b>
3.1	Final assessment	7
<b><u>4</u></b>	<b><u>TEST ENVIRONMENT</u></b>	<b><u>8</u></b>
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	9
4.2	Measurement protocol for FCC and ISED	9
<b><u>5</u></b>	<b><u>TEST CONDITIONS AND RESULTS</u></b>	<b><u>11</u></b>
5.1	EBW and OBW	11
5.2	Maximum peak radiated output power	20
5.3	Power spectral density	23
5.4	Radiated emissions in restricted bands	26
5.5	Spurious emissions radiated	42
5.6	Antenna application	46
<b><u>6</u></b>	<b><u>USED TEST EQUIPMENT AND ACCESSORIES</u></b>	<b><u>50</u></b>

## **1 TEST STANDARDS**

The tests were performed according to following standards:

### **FCC Rules and Regulations Part 15, Subpart A - General (September 2019)**

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 2019)**

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**

None.

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

### **2.5 Equipment type**

BLE device, mobile equipment

### **2.6 Short description of the equipment under test (EUT)**

The EUT is a Bluetooth 4.0 Low Energy system. The EUT is compatible with the standard 802.15.1. It supports the 2.4 GHz frequency band.

The EUT consists of a temperature and humidity sensor used in the building industry. The measurement data is transferred via Bluetooth to a digital device several times a day.

Number of tested samples: 2  
Serial number: 300268 (conducted), 300269 (radiated)  
Firmware version: 0120007048

#### **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 BT-Standard 802.15.1:

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

(kbps = *kilobits per second*)

## 2.10 Antennas

The following antenna shall be used with the EUT:

Number	Characteristic	Model number	Plug	Frequency range (GHz)	Gain (dBi)	Cable loss (dB)	Effective gain (dBi)
1	Omni-Directional	ANT3216LL00R2400A	solder	2.4	5.05	0	5.05

## 2.11 Power supply system utilised

Power supply voltage,  $V_{nom}$  : 3 VDC (battery)

Power supply voltage (alternative) : ---

## 2.12 Peripheral devices and interface cables

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

- Texas Instruments CC Debugger Model : CC Debugger rev. 1.0
- Notebook Model : Fujitsu Lifebook Pro

## 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 X 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.

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

Wireless system	Available channel	Tested channels	Power setting	Modulation	Data rate
802.15.1	0 – 39	37, 17, 39	Max.	GFSK	1 Mbps

- TX continuous carrier

### 2.13.1 Test jig

No test jig was used.

### 2.13.2 Test software

The test software for the EUT provides free power setting, the special test mode RX and the TX continuous mode, modulated. The EUT was set with test modulation to transmit data during the tests with a maximum duty cycle (x) from an internal packet generator.

### **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 EMI requirements cited in clause 1 test standards.

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

Testing commenced on : 06 March 2020

Testing concluded on : 20 March 2020

Checked by:

Tested by:

\_\_\_\_\_  
Klaus Gegenfurtner  
Teamleader Radio

\_\_\_\_\_  
Franz-Xaver Schrettenbrunner  
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%	$\pm 3.29 \text{ dB}$
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%	$\pm 3.53 \text{ dB}$
Radiated Spurious Emissions	30 MHz to 1000 MHz	95%	$\pm 3.71 \text{ dB}$
Radiated Spurious Emissions	1000 MHz to 10000 MHz	95%	$\pm 2.34 \text{ dB}$
Peak conducted output power	902 MHz to 928 MHz	95%	$\pm 0.35 \text{ dB}$
Conducted Spurious Emissions	9 kHz to 10000 MHz	95%	$\pm 2.15 \text{ dB}$



## 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. 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.

#### 4.2.2.2 Radiated emission (electrical field 30 MHz - 1 GHz)

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. The setup of the equipment under test is established in accordance with ANSI C63.10. The interface cables that are closer than 40 centimetres to the ground plane are bundled in the center in a serpentine fashion so that they are at least 40 centimetres from 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 in height from 1 to 4 metres and the EUT is rotated 360 degrees.

The final level in dBµV/m is calculated by taking the reading from the EMI receiver (Level dBµV) and adding the correction factors and cable loss factor (dB). The FCC or CISPR 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 (dBµV)	+	Factor (dB)	=	Level (dBµV/m)	-	CISPR Limit (dBµV/m)	=	Delta (dB)
719.0	75.0	+	32.6	=	107.6	-	110.0	=	-2.4

**4.2.2.3 Radiated emission (electrical field 1 GHz - 40 GHz)**

Radiated emissions from the EUT are measured in the frequency range 1 GHz up to the maximum frequency 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 1.0 X 1.5 metre non-conducting table, 1.5 metre above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. The setup of the equipment under test is following set out in ANSI C63.10. The interface cables that are closer than 40 centimetres to the ground plane are bundled in the center in a serpentine fashion so they are at least 40 centimetres from 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. Measurements are made in both the horizontal and vertical polarization planes in a fully anechoic room using a spectrum analyzer set to max peak detector function and a resolution 1 MHz and video bandwidth 3 MHz for peak measurement. The conditions determined as worst case will then be used for the final measurements. When the EUT is larger than the beam width of the measuring antenna it will be moved over the surface for the four sides of the equipment. Where appropriate, the test distance may be reduced in order to detect emissions under better uncertainty and are calculated at the specified test distance.

## **5 TEST CONDITIONS AND RESULTS**

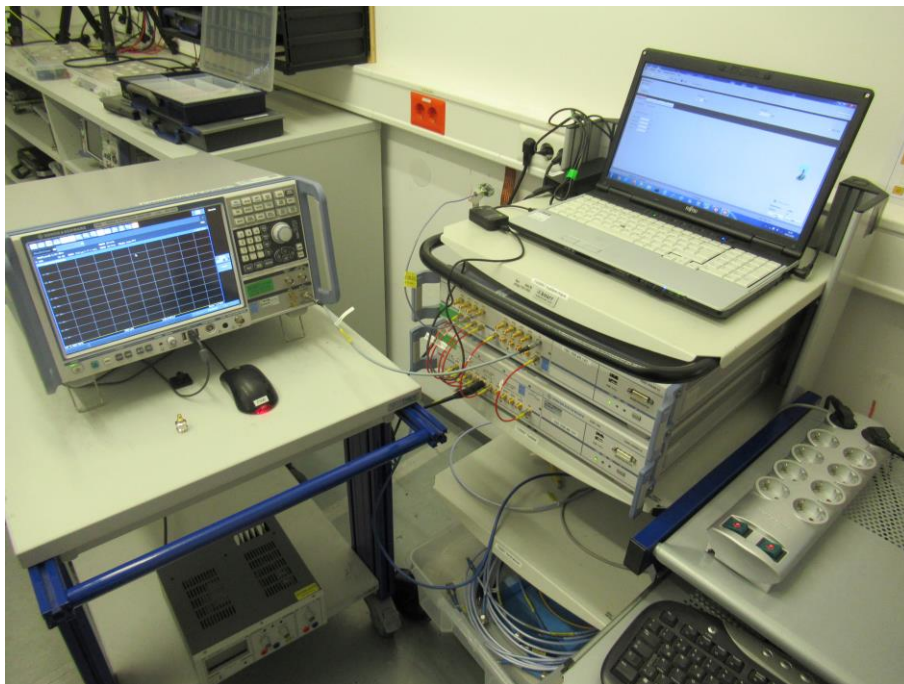
### **5.1 EBW and OBW**

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

#### **5.1.1 Description of the test location**

Test location:                      Shielded Room S6

#### **5.1.2 Photo documentation of the test set-up**





### 5.1.3 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.

### 5.1.4 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.

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;

### 5.1.5 Test result

6 dB Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Max Level (dBm)	Result
2402.000000	0.772278	0.500000	---	2401.623762	2402.396040	1.6	PASS
2440.000000	0.772278	0.500000	---	2439.623762	2440.396040	1.4	PASS
2480.000000	0.772278	0.500000	---	2479.623762	2480.396040	0.6	PASS

FCC ID: 2ADQTV1EL

IC: 12568A-V1EL

99 % Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Result
2402.000000	1.055000	---	---	2401.487500	2402.542500	PASS
2440.000000	1.050000	---	---	2439.487500	2440.537500	PASS
2480.000000	1.060000	---	---	2479.482500	2480.542500	PASS

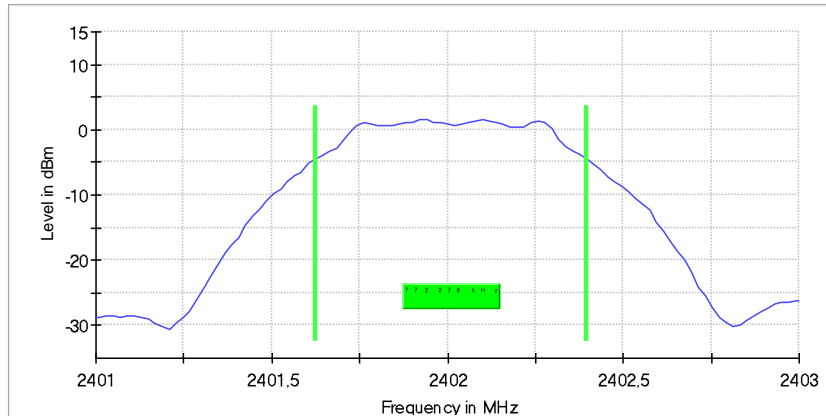
The requirements are **FULFILLED**.

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

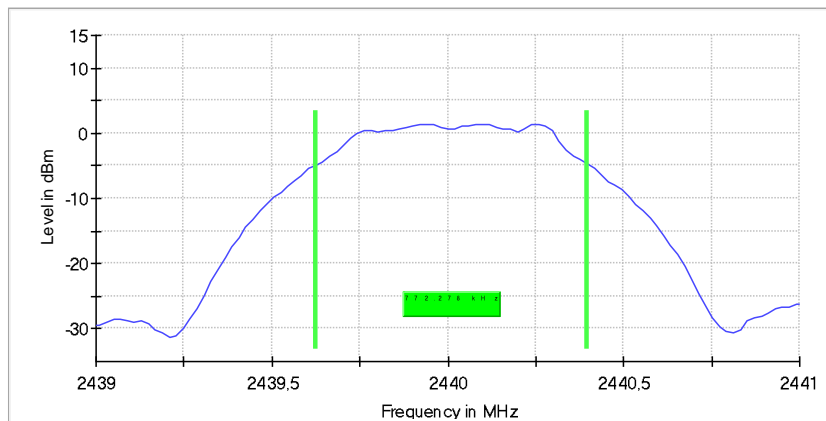
---

**5.1.6 Test protocols EBW**

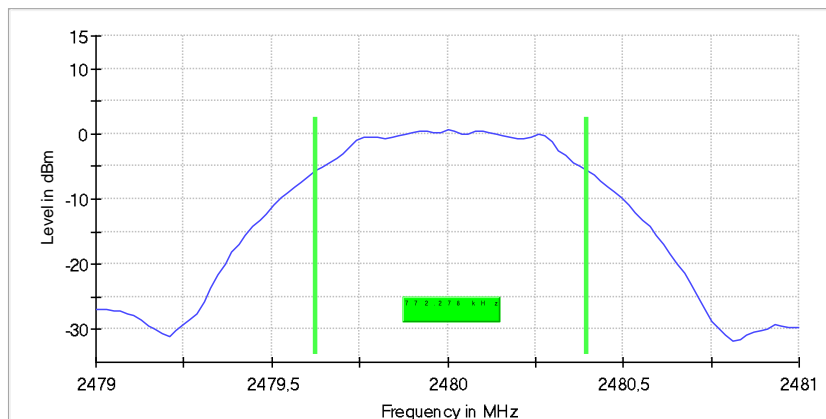
802.15.1, Channel 37 (2402 MHz)



802.15.1, Channel 17 (2440 MHz)

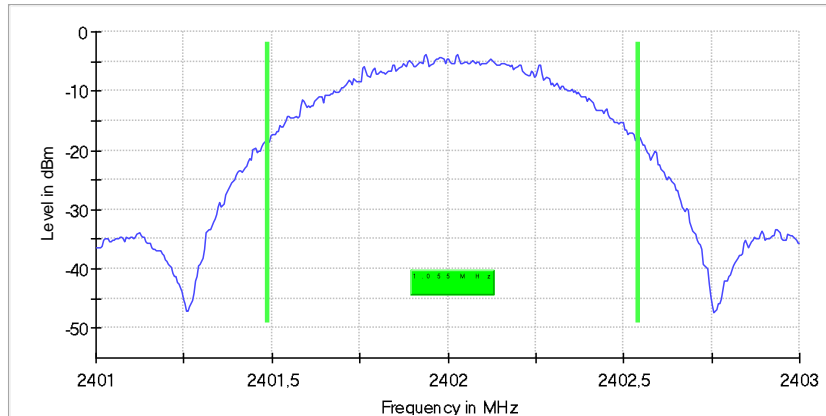


802.15.1, Channel 39 (2480 MHz)

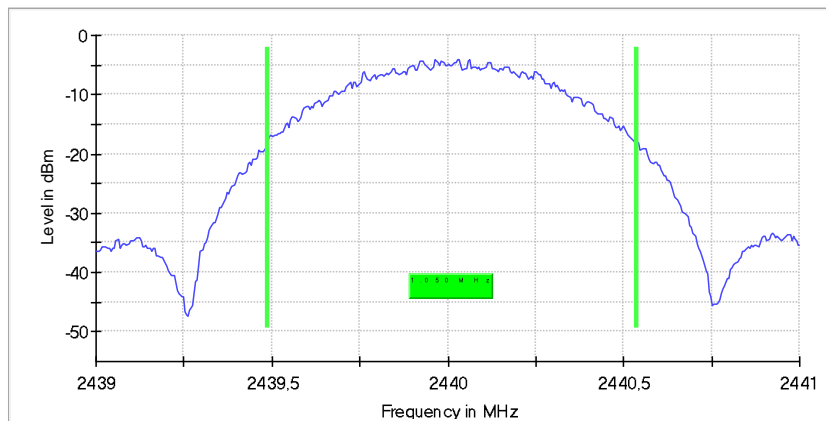


### 5.1.7 Test protocols OBW

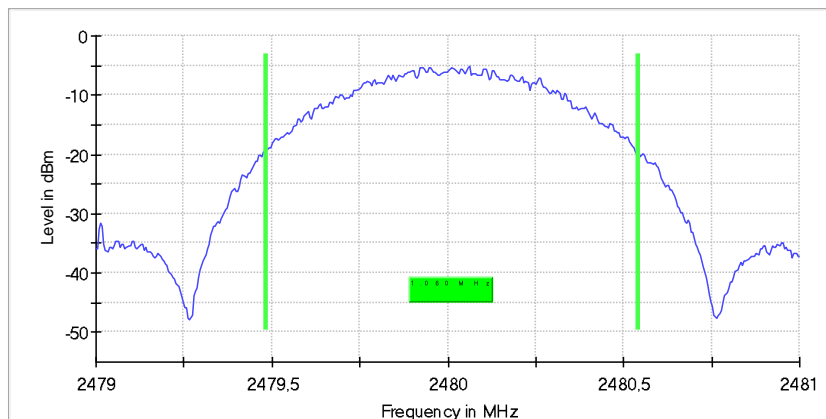
802.15.1, Channel 37 (2402 MHz)



802.15.1, Channel 17 (2440 MHz)

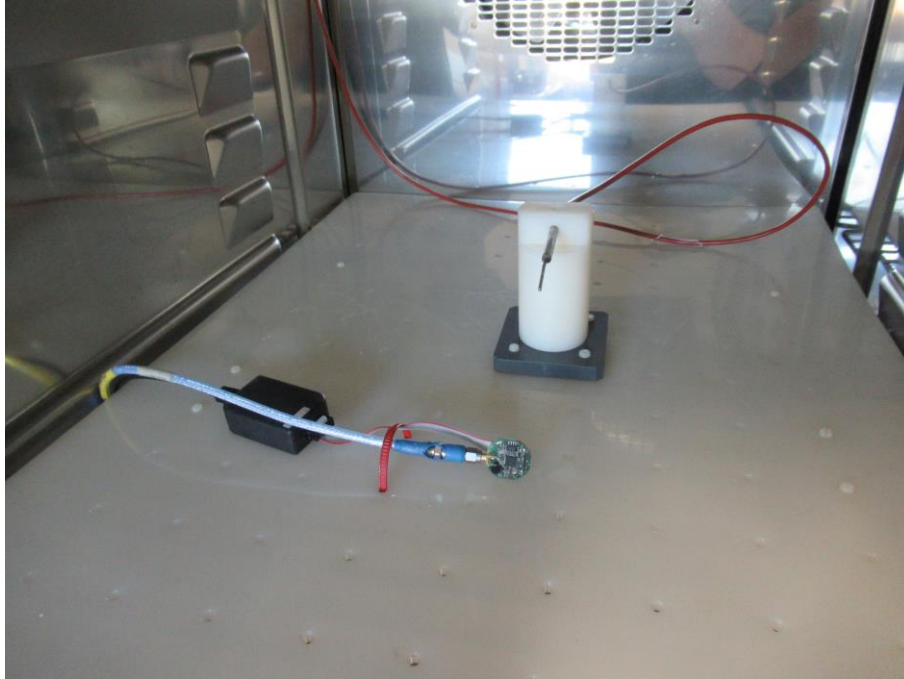


802.15.1, Channel 39 (2480 MHz)

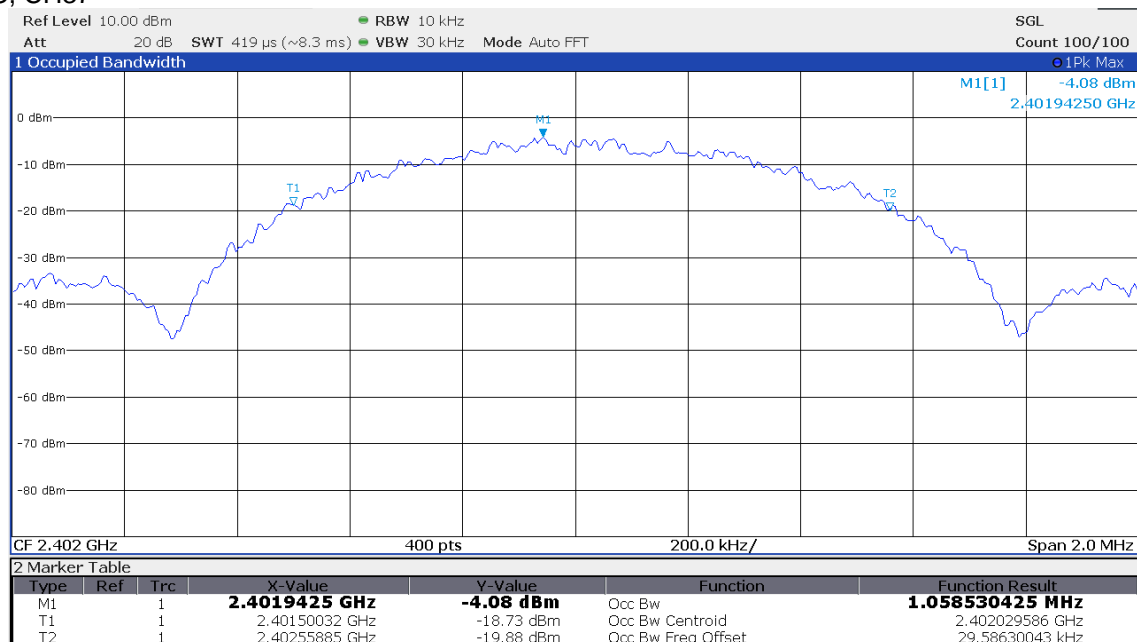


### 5.1.8 Transmitter frequency stability

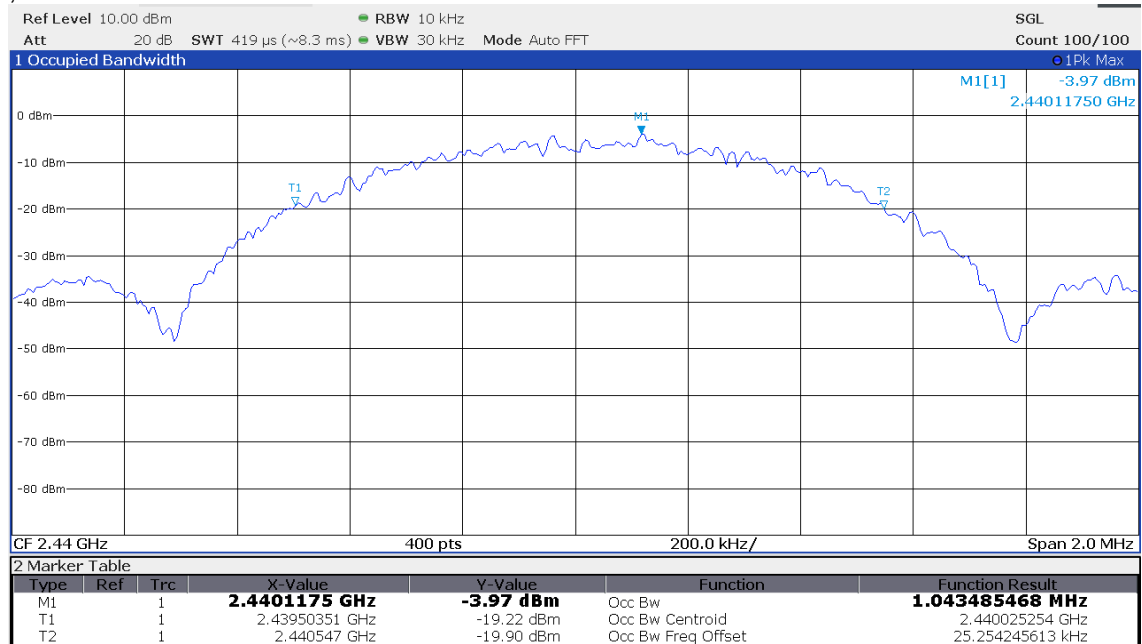
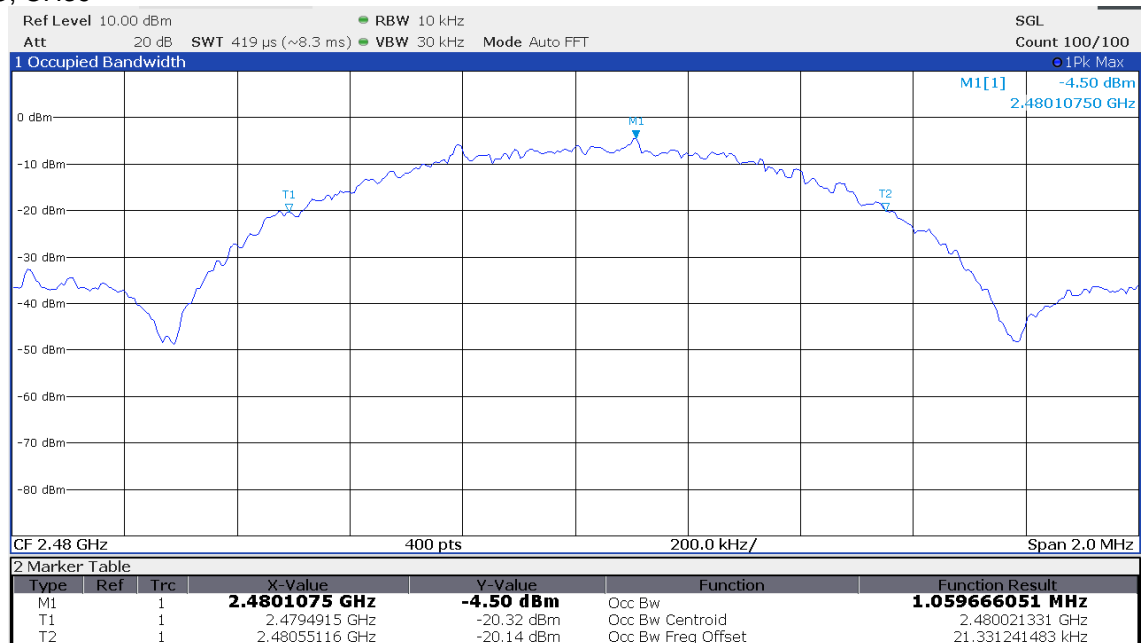
The tests were performed in a climatic chamber:

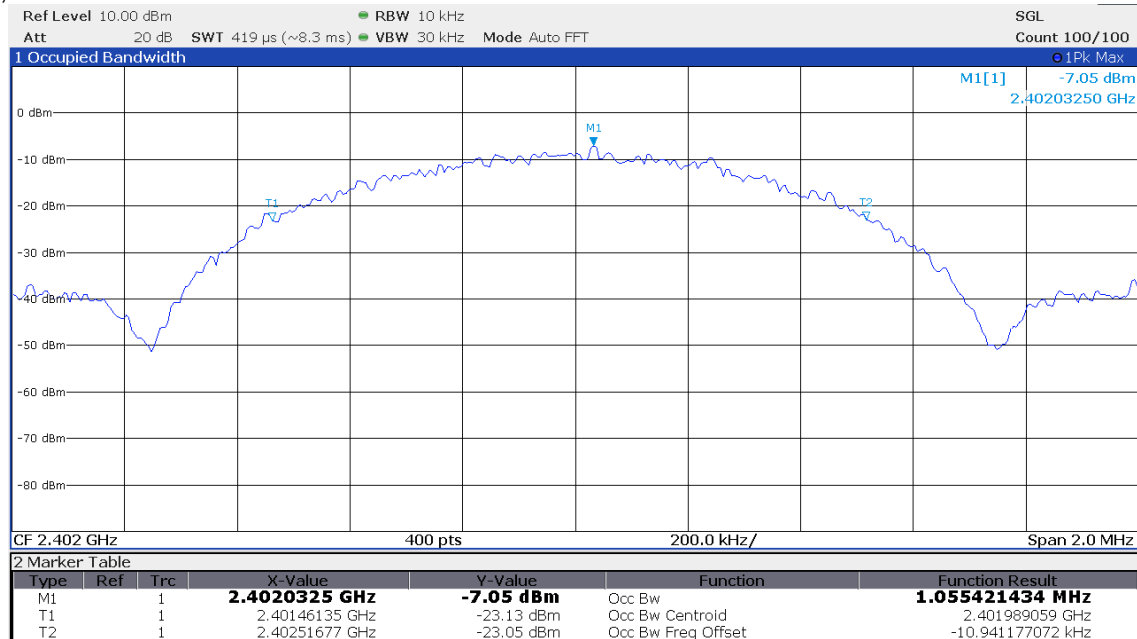
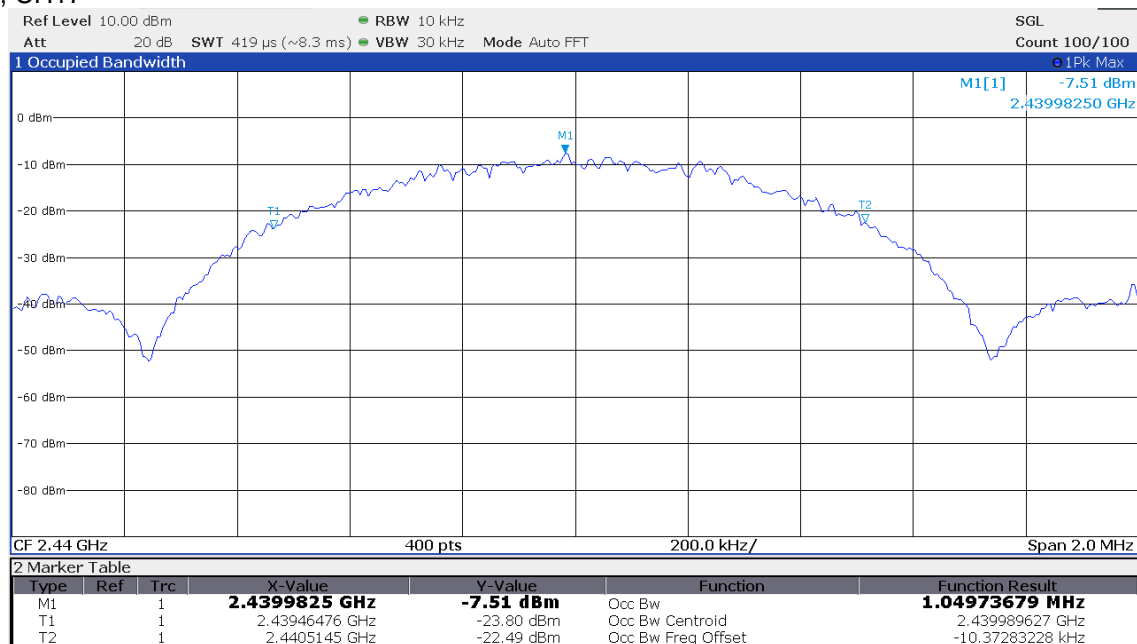


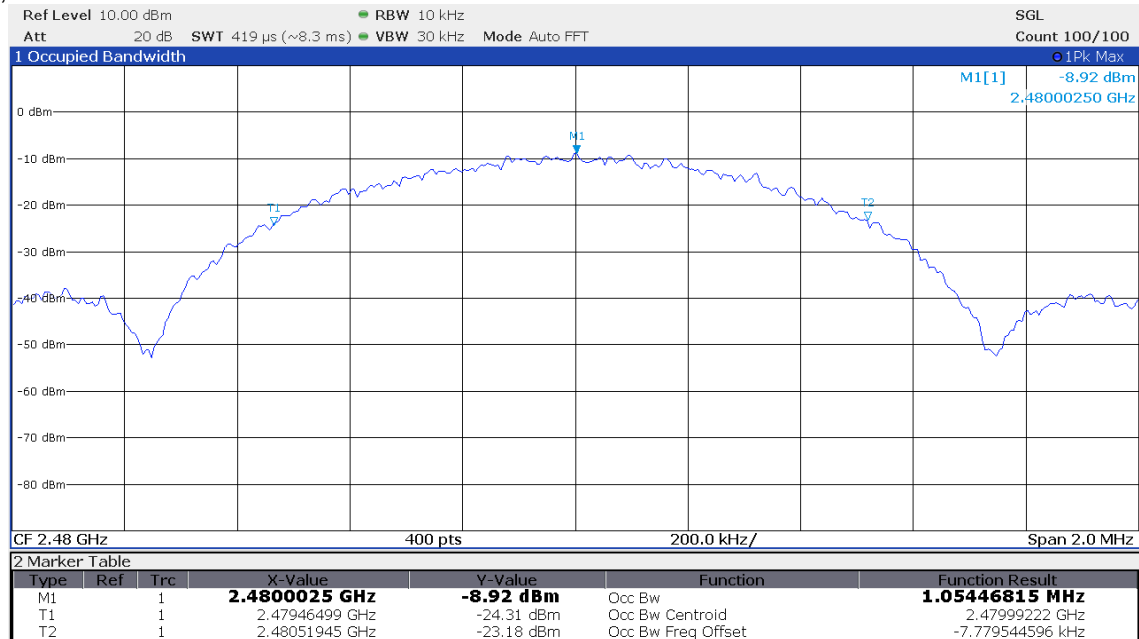
T = -20°C, CH37





**FCC ID: 2ADQTV1EL**
**IC: 12568A-V1EL**
**T = -20°C, CH17**

**T = -20°C, CH39**


**FCC ID: 2ADQTV1EL**
**IC: 12568A-V1EL**
**T = 50°C, CH37**

**T = 50°C, CH17**


**FCC ID: 2ADQTV1EL**
**IC: 12568A-V1EL**
**T = 50°C, CH39**


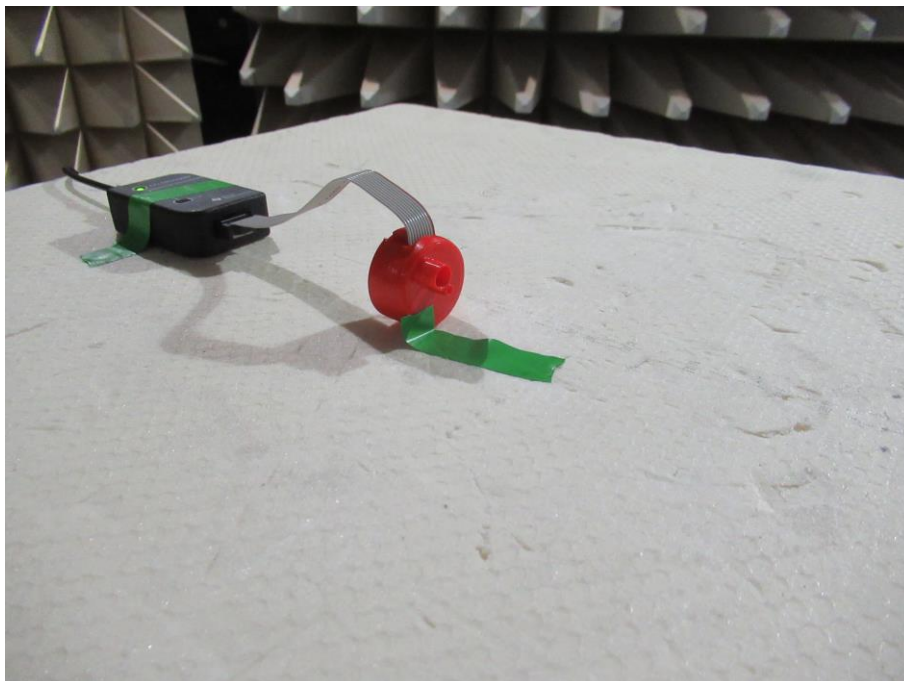
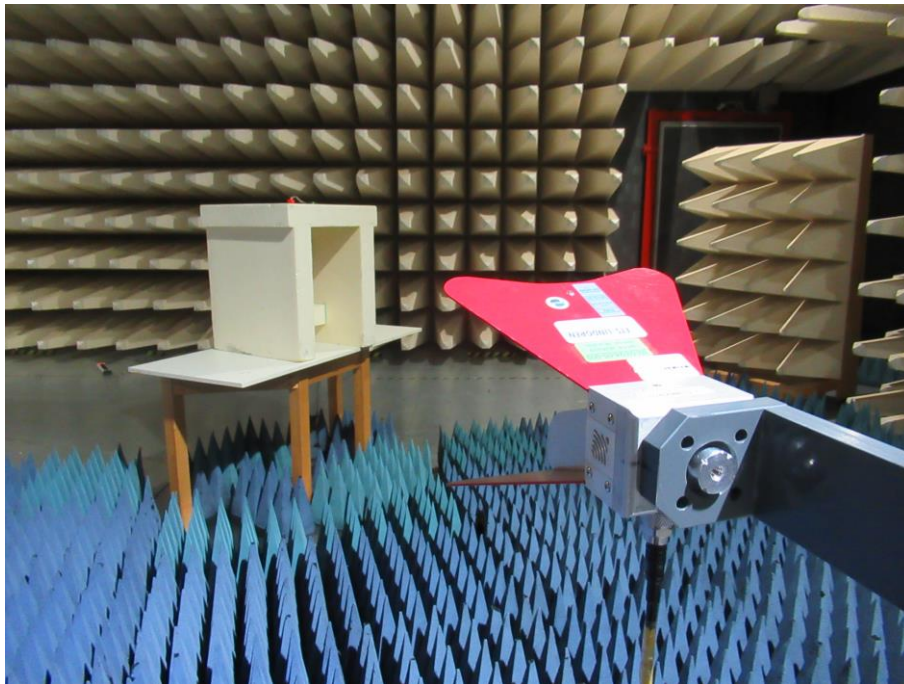
## **5.2 Maximum peak radiated output power**

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

### **5.2.2 Photo documentation of the test set-up**



### 5.2.3 Applicable standard

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

For systems using digital modulation in the 2400-2483.5 MHz and 5725 – 5850 MHz bands, 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.

### 5.2.4 Description of Measurement

The maximum peak radiated output power is measured using a spectrum analyser following the procedure set out in KDB 558074, item 9.1.1. The EUT is set in TX continuous advertising mode while measuring. The radiated measurement was performed in a fieldstrength measurement. Therefore the formula set out in KDB 558074, item 12.2.2 e) is changed into the following term:

$$E = \text{EIRP} - (20 \cdot \log_{10} 3) + 104.8$$

### 5.2.5 Test result

Standard 802.15.1

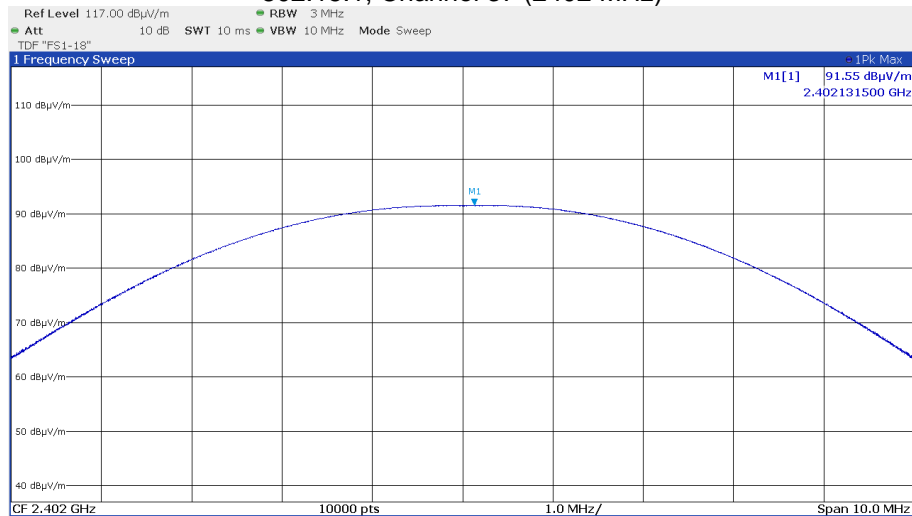
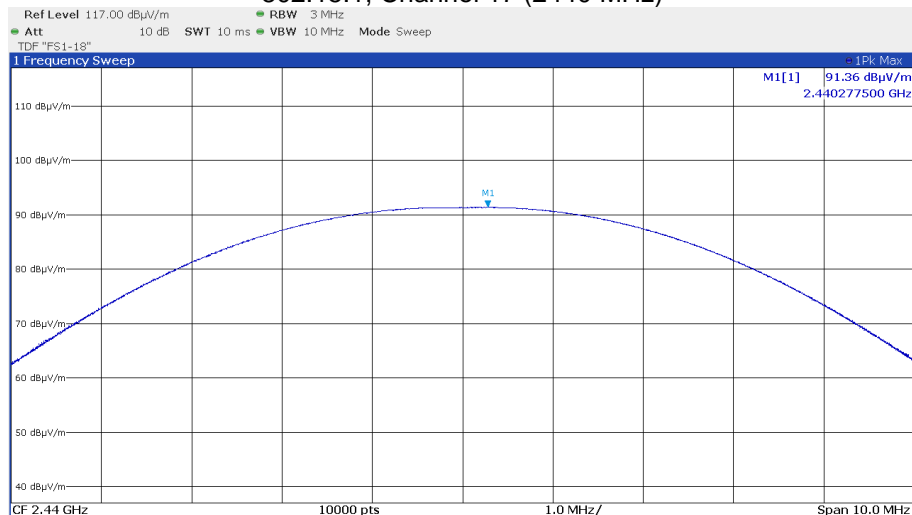
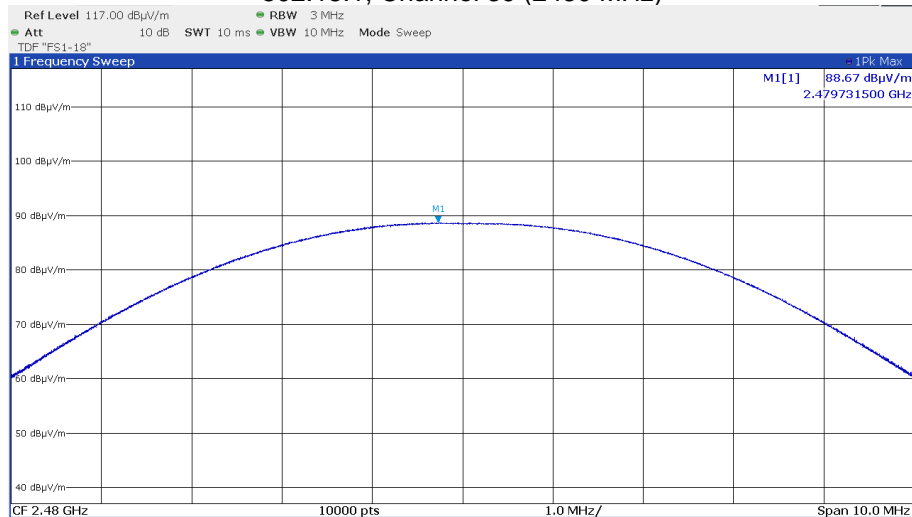
Channel	Peak power radiated (dBµV/m)	Correction factor (dB)	EIRP (dBm)
37	91.6	-95.3	-3.7
17	91.4	-95.3	-3.9
39	88.7	-95.3	-6.6

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

Frequency (MHz)	Peak Power Limit	
	(dBm)	(W)
902-928	36	4.0
<b>2400-2483.5</b>	<b>36</b>	<b>4.0</b>
5725-5850	36	4.0

The requirements are **FULFILLED**.

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

**5.2.6 Test protocols**
**802.15.1, Channel 37 (2402 MHz)**

**802.15.1, Channel 17 (2440 MHz)**

**802.15.1, Channel 39 (2480 MHz)**




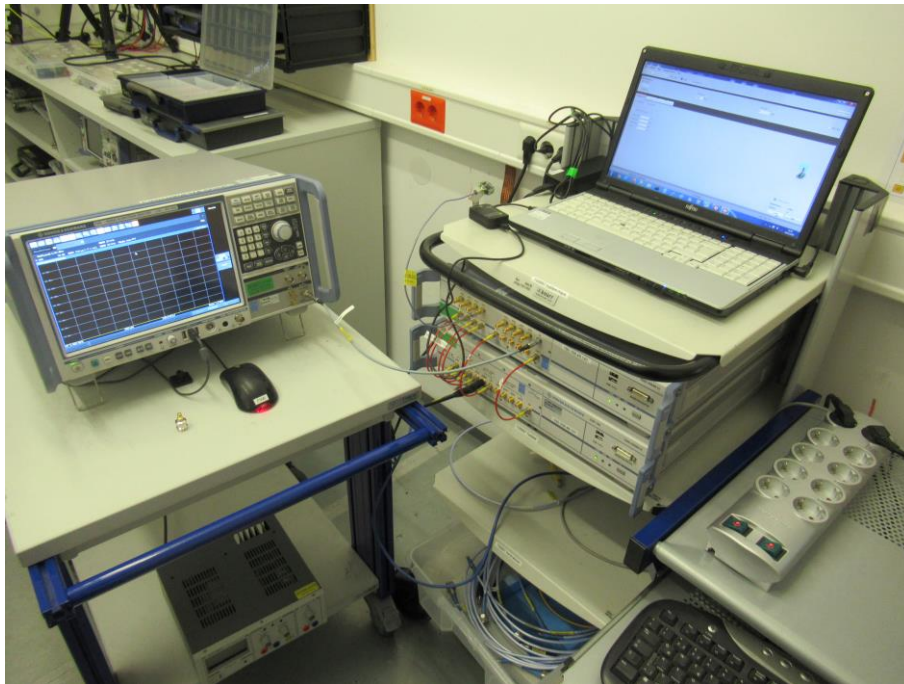
### 5.3 Power spectral density

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

#### 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(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.

### 5.3.4 Description of Measurement

The measurement is performed using the procedure 10.2 set out in KDB-558074. 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 10.5 dB was set to compensate the matching and cable attenuation. The maximum antenna gain being computed in paragraph 5.9 of this test report is used to calculate the maximum peak power spectral density.

Spectrum analyser settings:

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

### 5.3.5 Test result

Standard 802.15.1

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2402.000000	2401.922500	-3.379	8.0	PASS
2440.000000	2439.932500	-3.859	8.0	PASS
2480.000000	2480.027500	-4.660	8.0	PASS

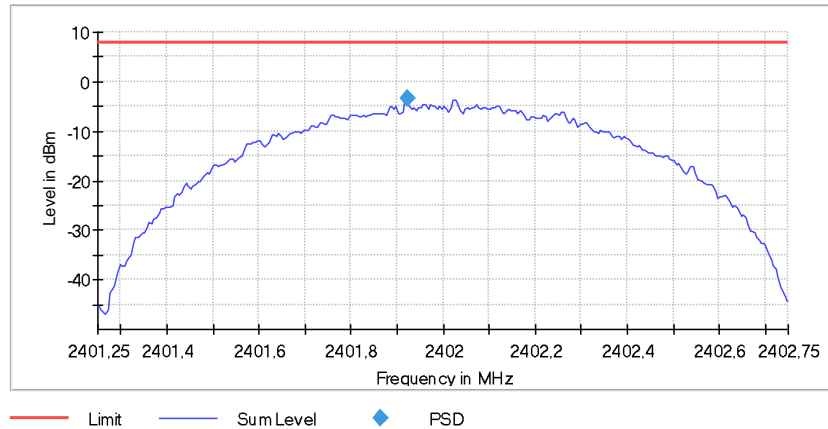
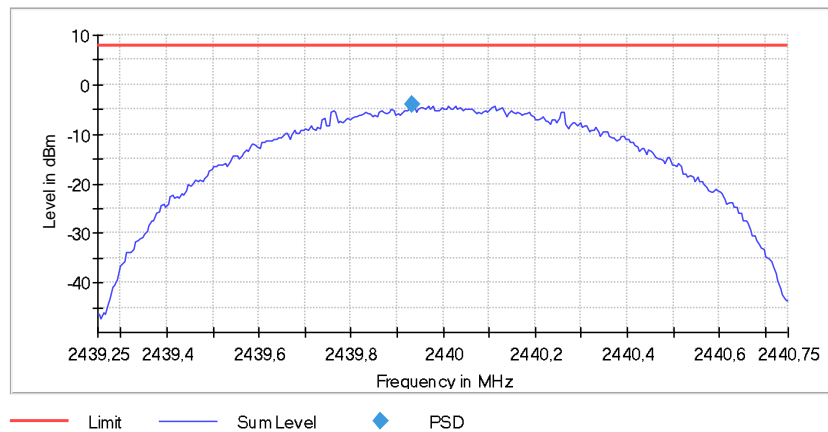
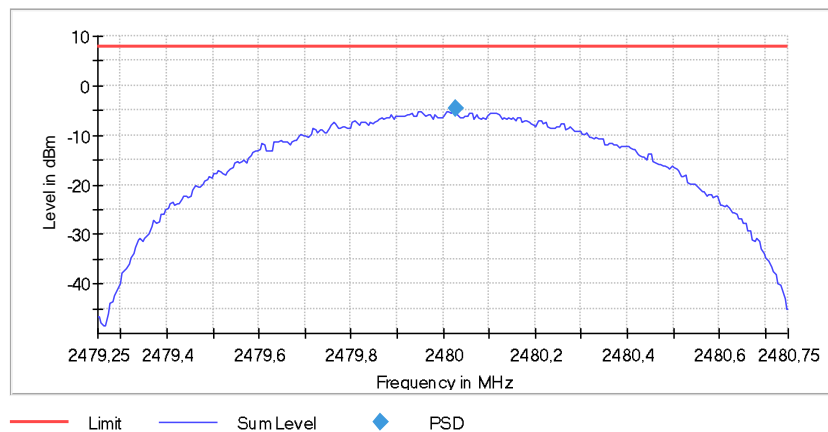
Power spectral density limit according to FCC Part 15, Section 15.247(e):

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.



**5.3.6 Test protocols**
**802.15.1, Channel 37 (2402 MHz)**

**802.15.1, Channel 17 (2440 MHz)**

**802.15.1, Channel 39 (2480 MHz)**


## **5.4 Radiated emissions in restricted bands**

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

### **5.4.1 Description of the test location**

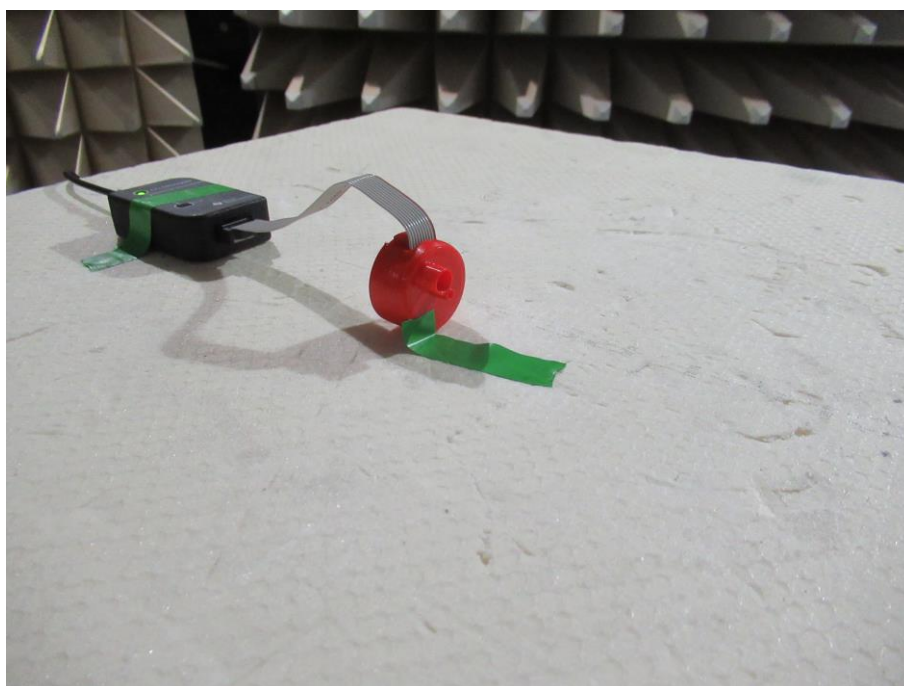
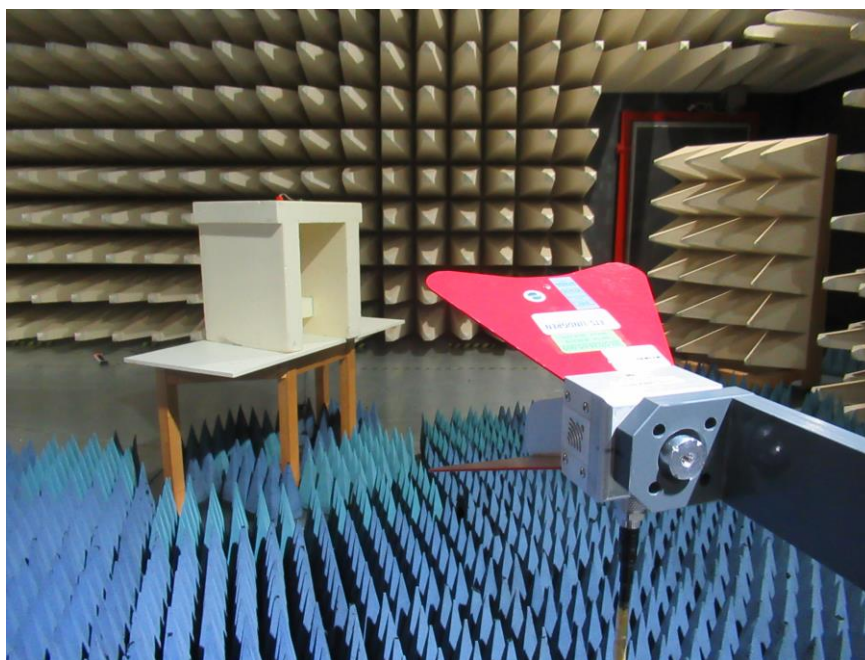
Test location: OATS 1  
Test location: Anechoic chamber 1  
Test distance: 3 m

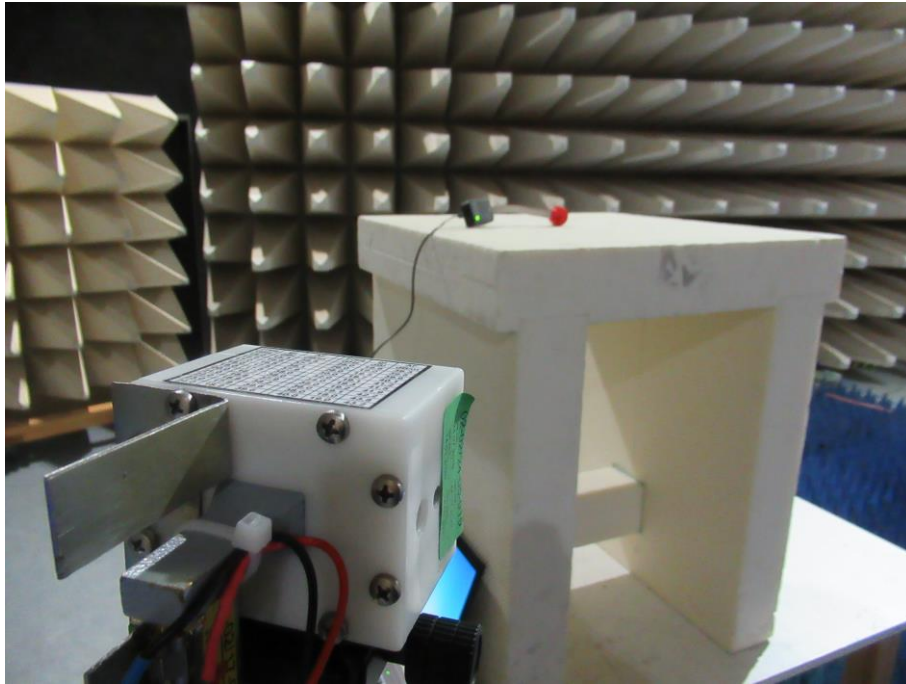
### **5.4.2 Photo documentation of the test set-up**

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).

### 5.4.3 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: Auto

### 5.4.4 Test result

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 ( $\mu\text{V/m}$ )		Measurement distance (metres)
		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

**FCC ID: 2ADQTV1EL**
**IC: 12568A-V1EL**
**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 10<sup>th</sup> harmonic. For detailed test results please see the following test protocols.

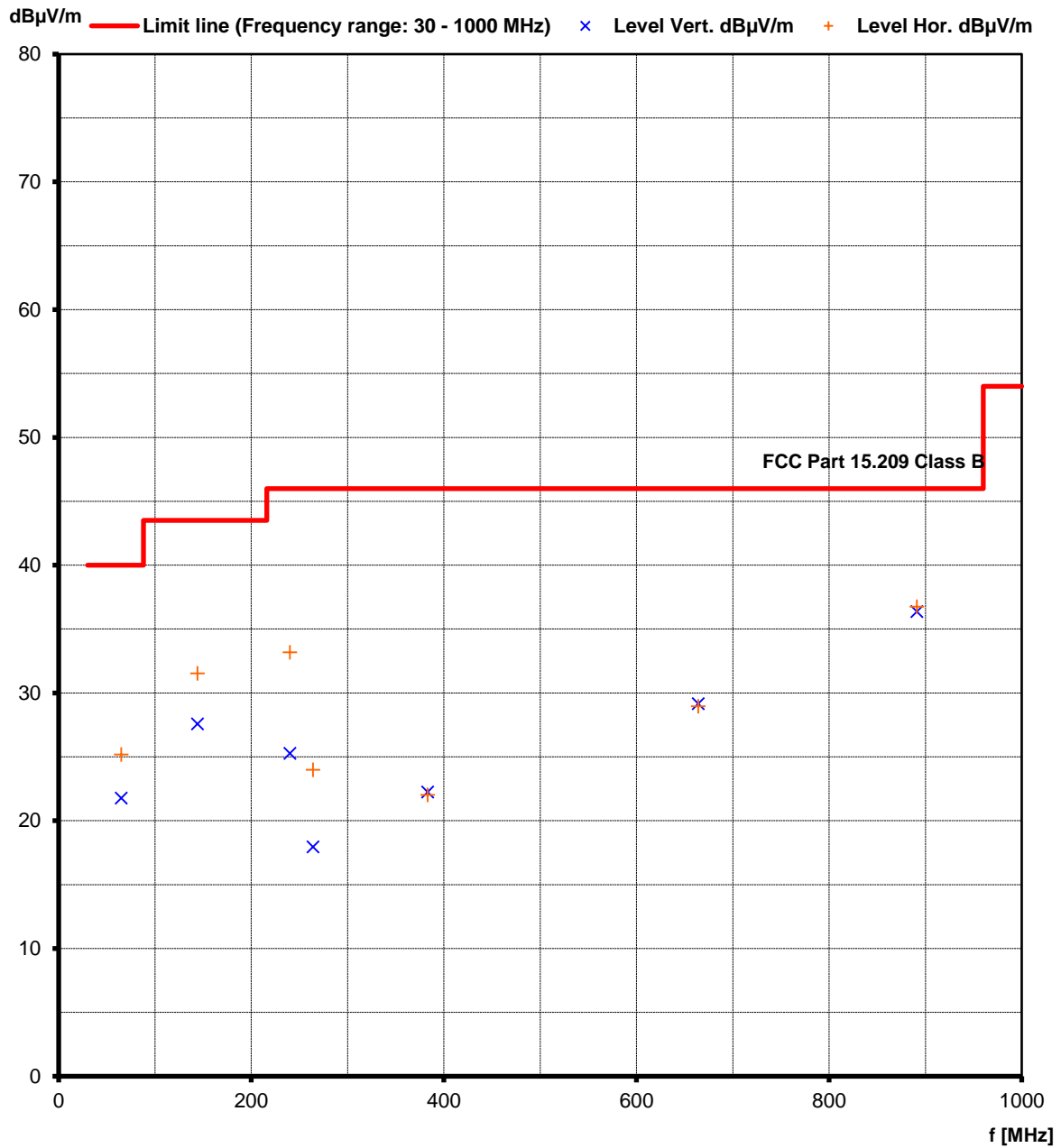


**FCC ID: 2ADQTV1EL**
**IC: 12568A-V1EL**
**5.4.5 Test protocols f < 1000 MHz**

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)
65.00	7.4	11.6	14.4	13.6	21.8	25.2	40.0	-14.8
144.00	14.0	17.1	13.6	14.4	27.6	31.5	43.5	-12.0
240.00	12.0	19.6	13.3	13.6	25.3	33.2	46.0	-12.8
264.00	3.3	9.3	14.7	14.7	18.0	24.0	46.0	-22.0
383.00	2.9	3.0	19.3	19.0	22.2	22.0	46.0	-23.8
664.00	2.7	2.9	26.4	26.1	29.1	29.0	46.0	-16.9
891.00	5.4	6.2	31.0	30.5	36.4	36.7	46.0	-9.3

FCC ID: 2ADQTV1EL

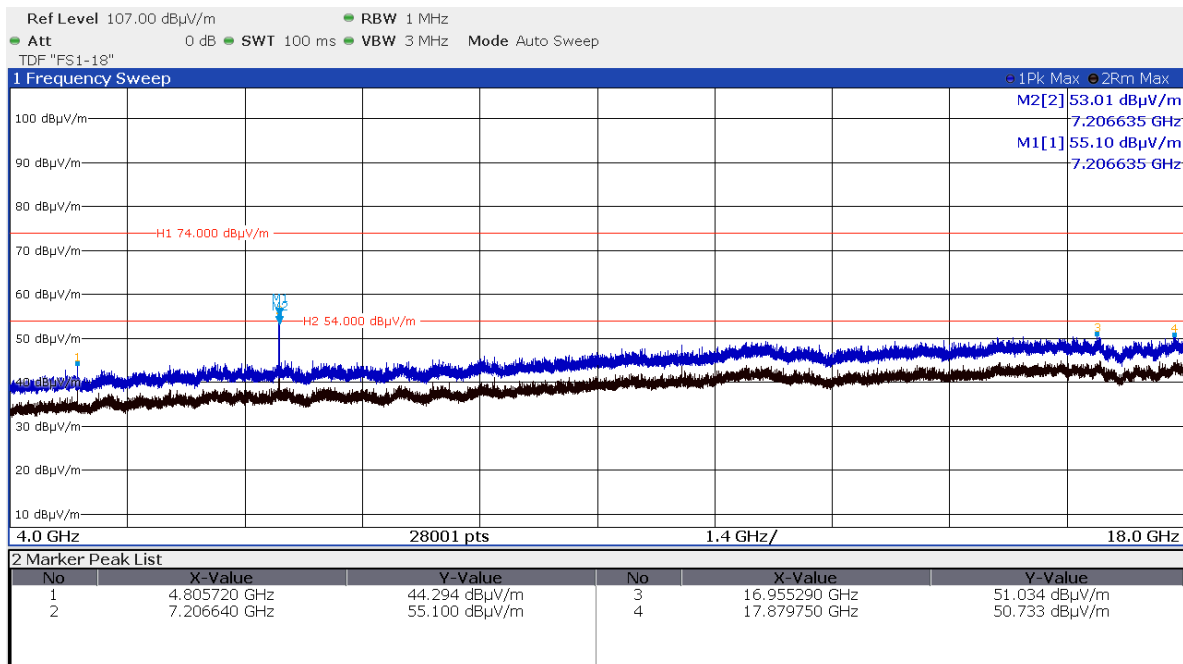
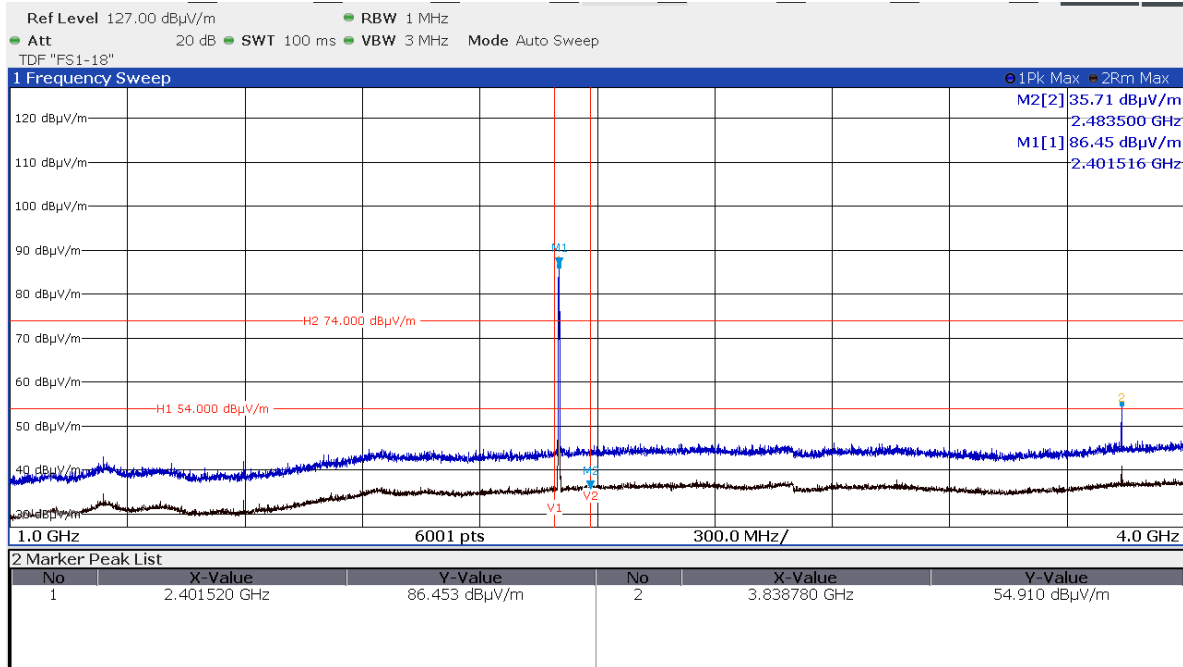
IC: 12568A-V1EL

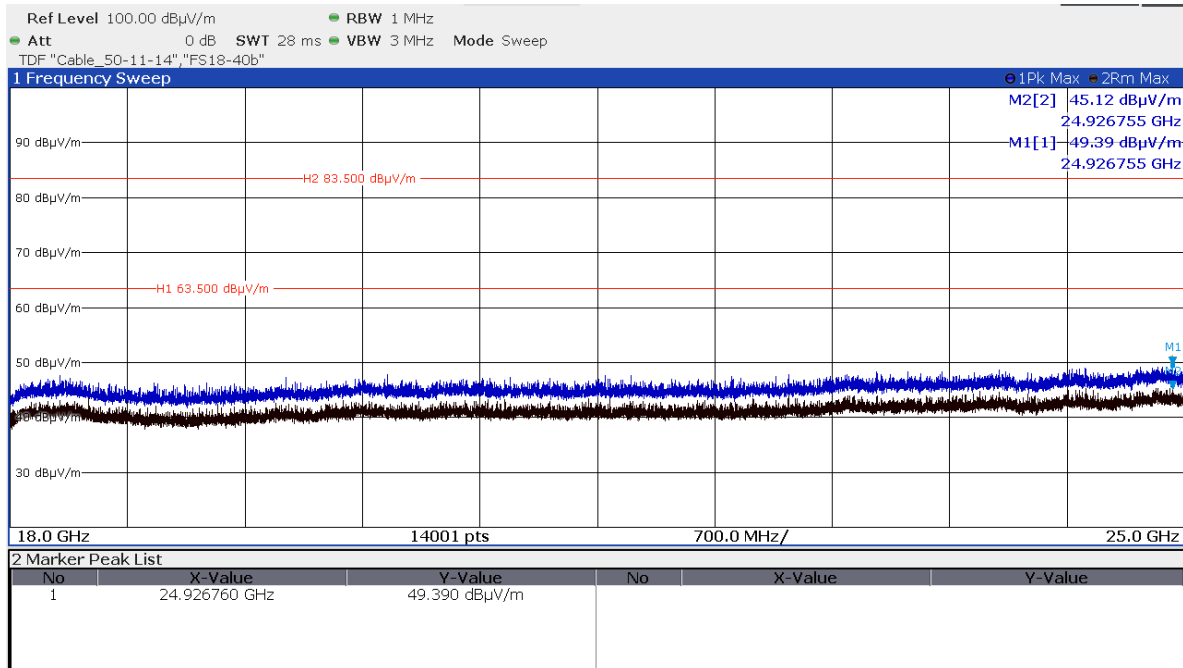
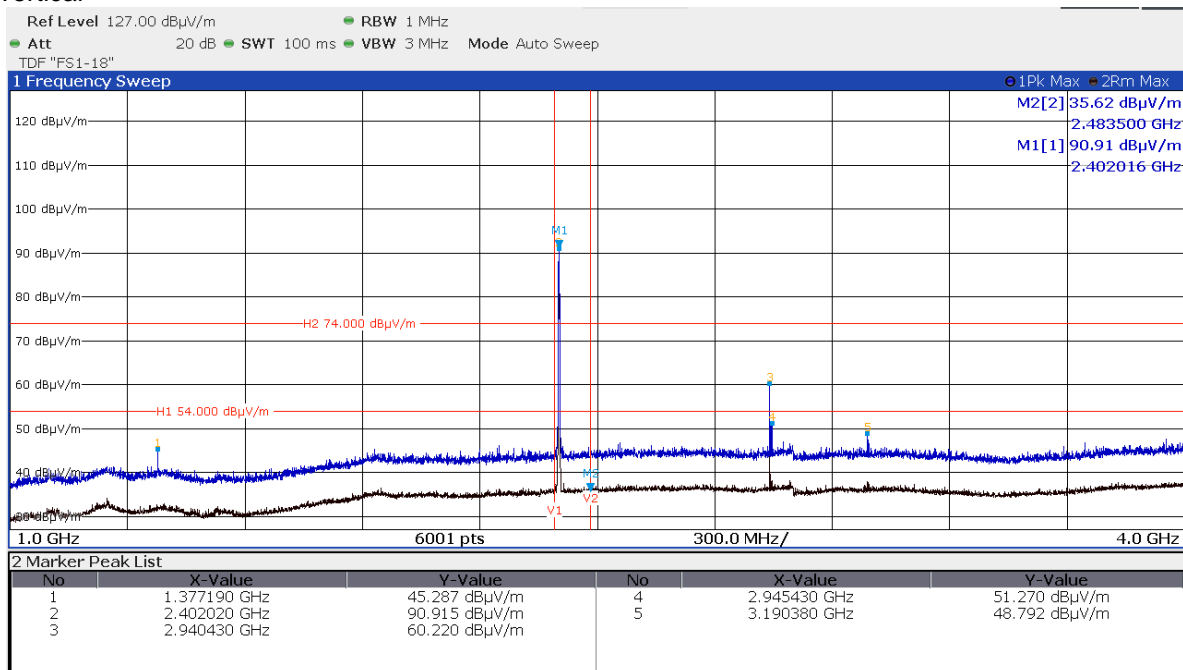


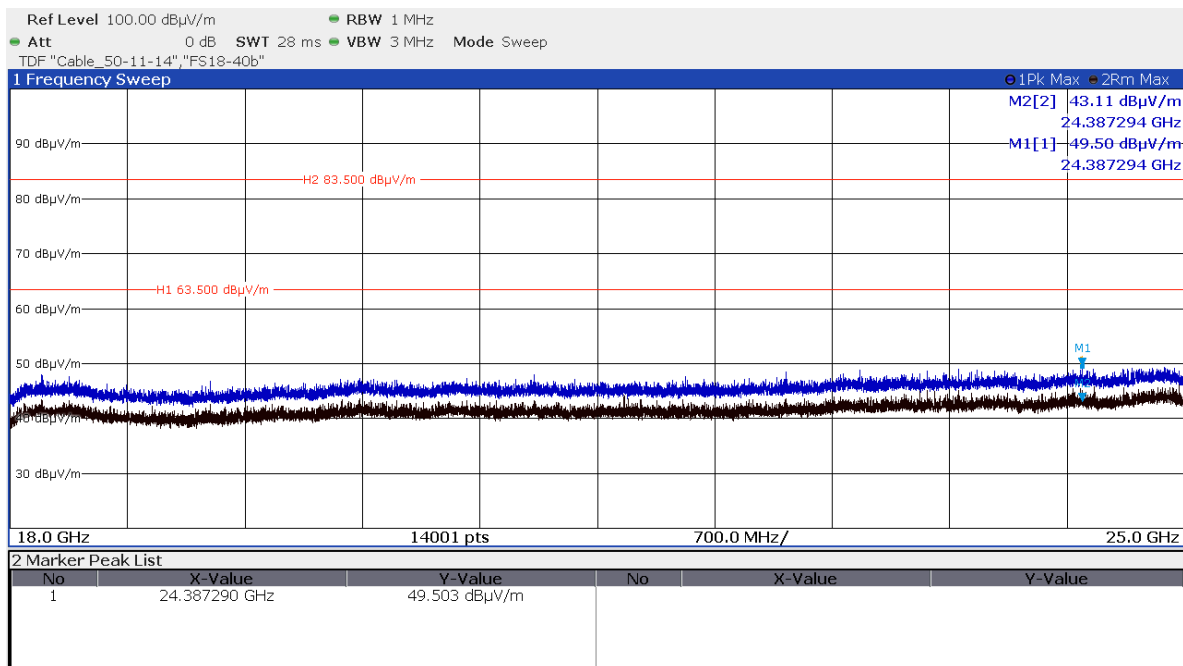
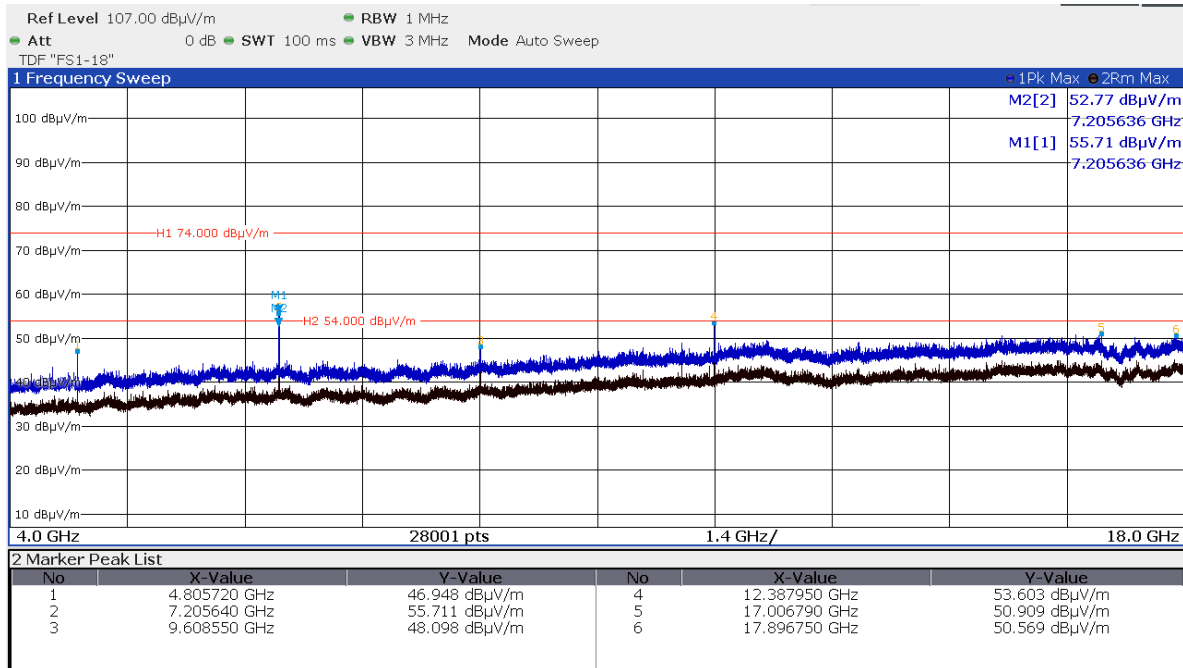


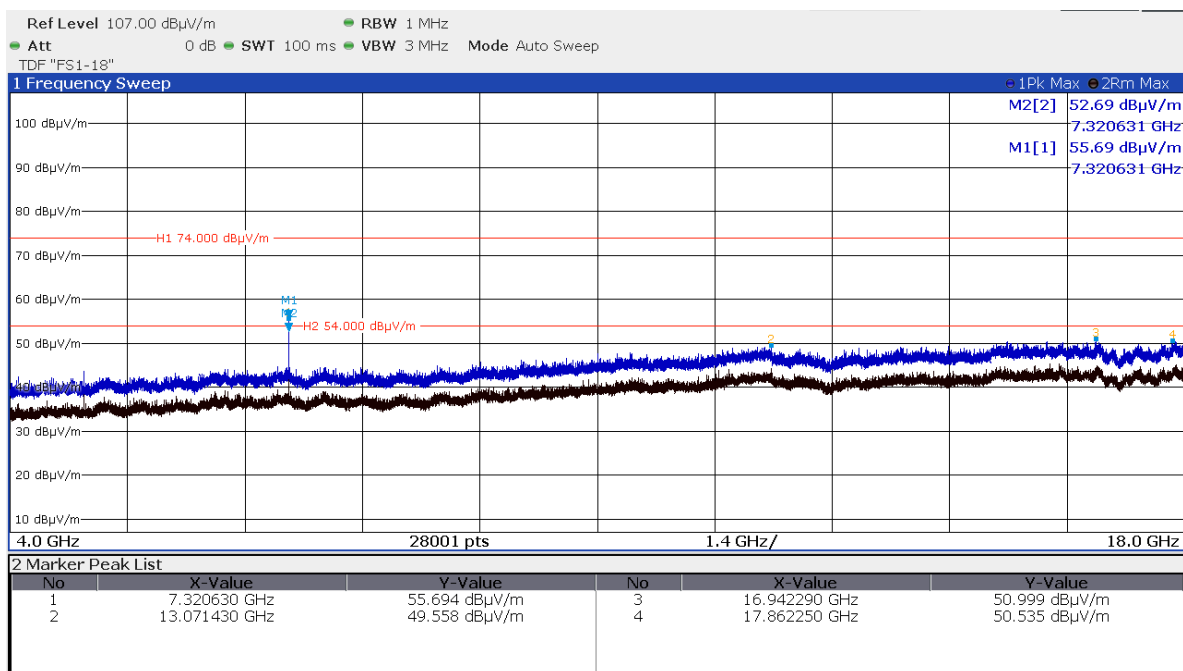
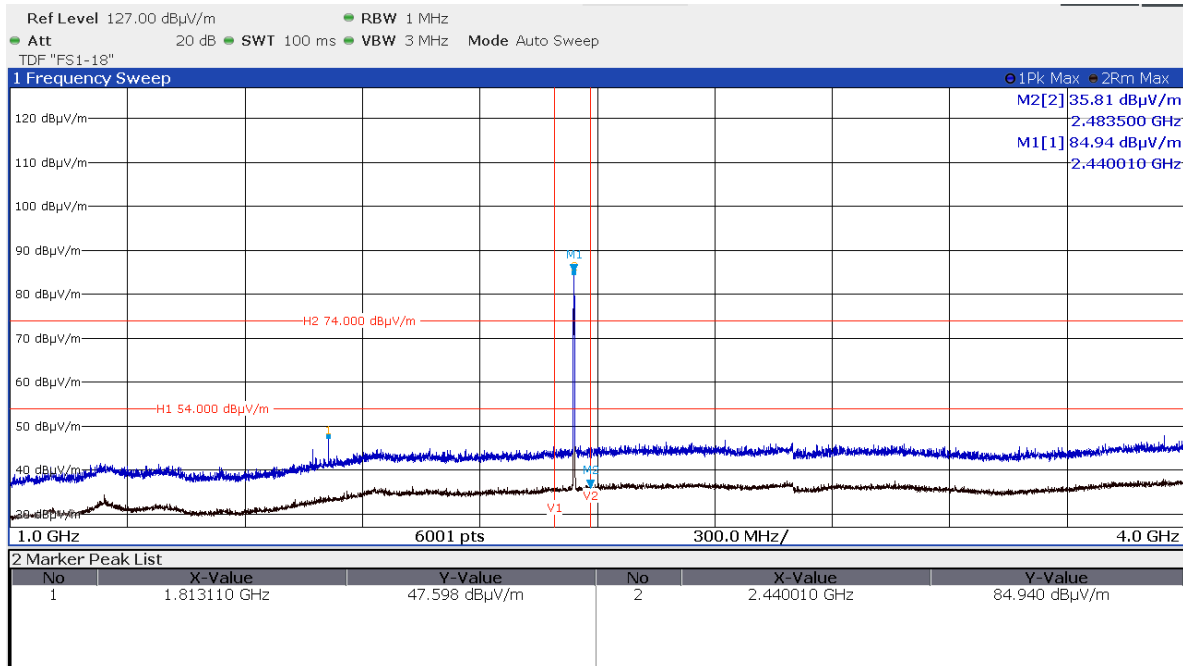
## 5.4.7 Test protocols f > 1000 MHz

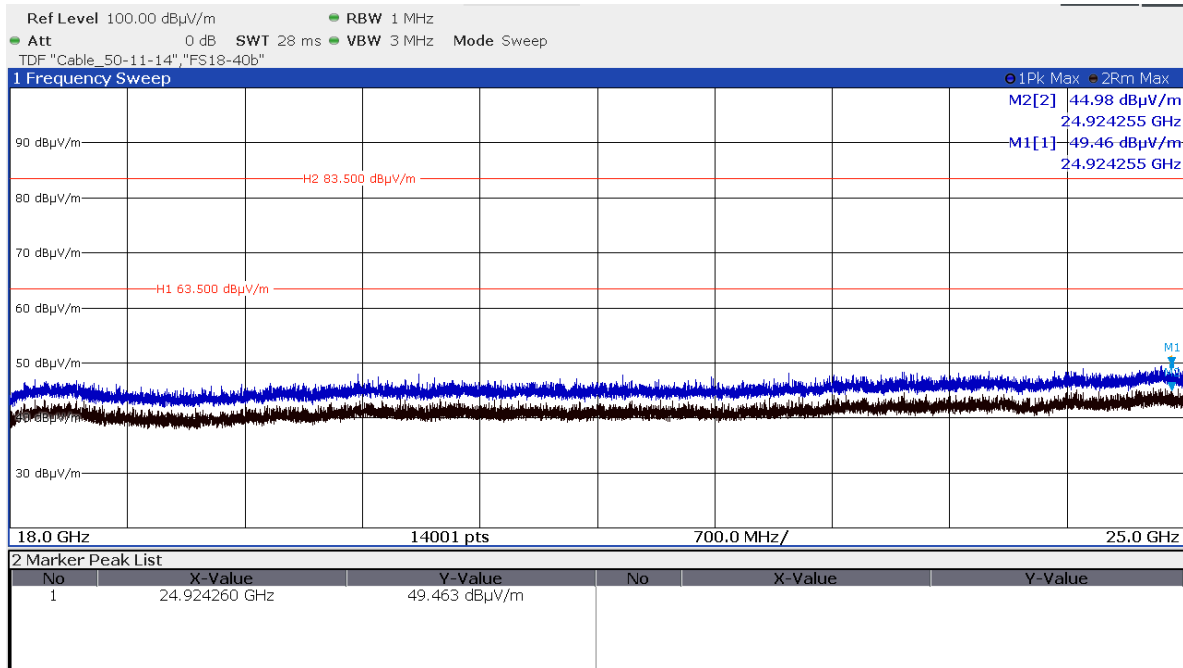
### CH 37 horizontal



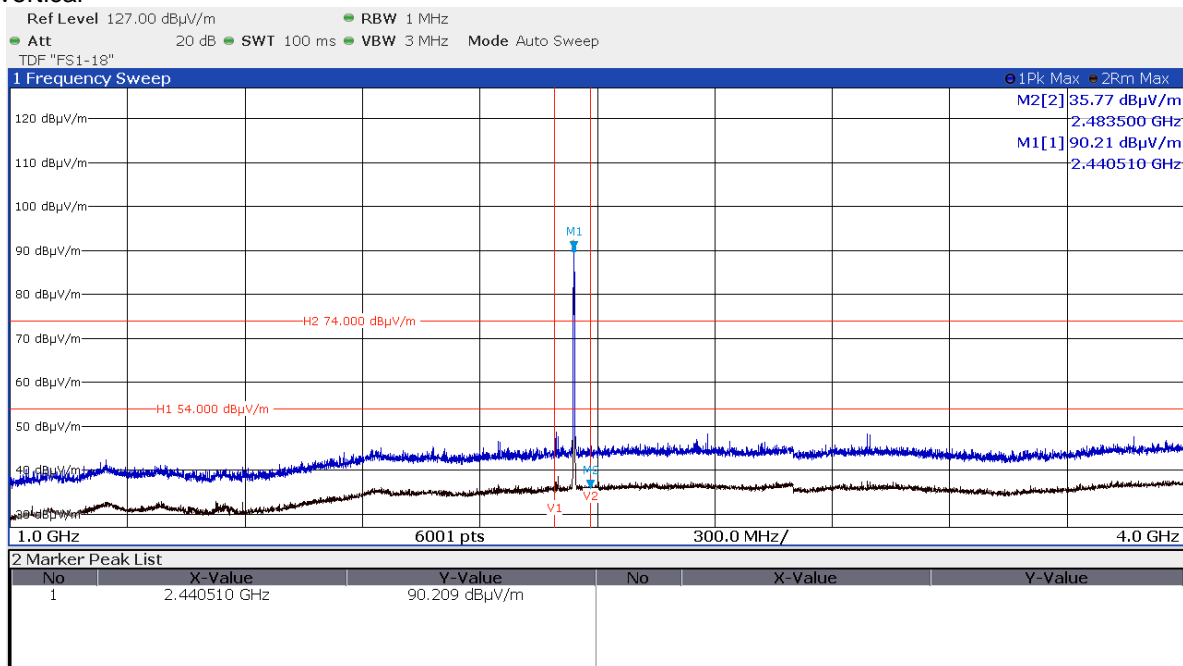
**FCC ID: 2ADQTV1EL**
**IC: 12568A-V1EL**

**CH 37 vertical**


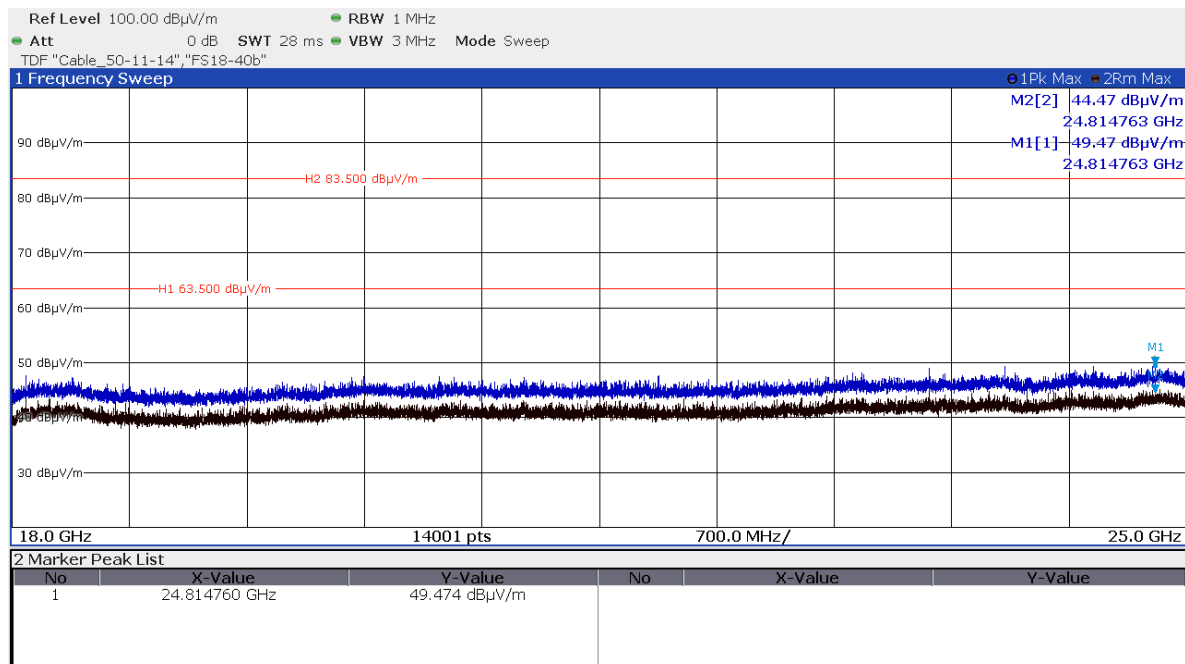
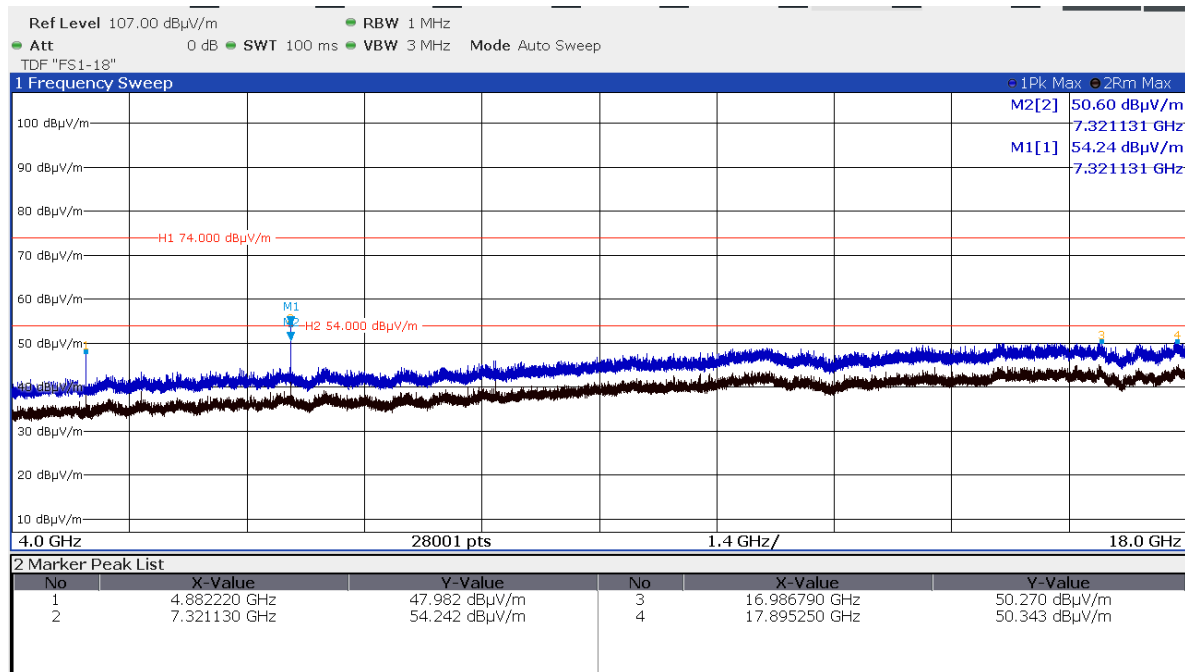
**FCC ID: 2ADQTV1EL**
**IC: 12568A-V1EL**


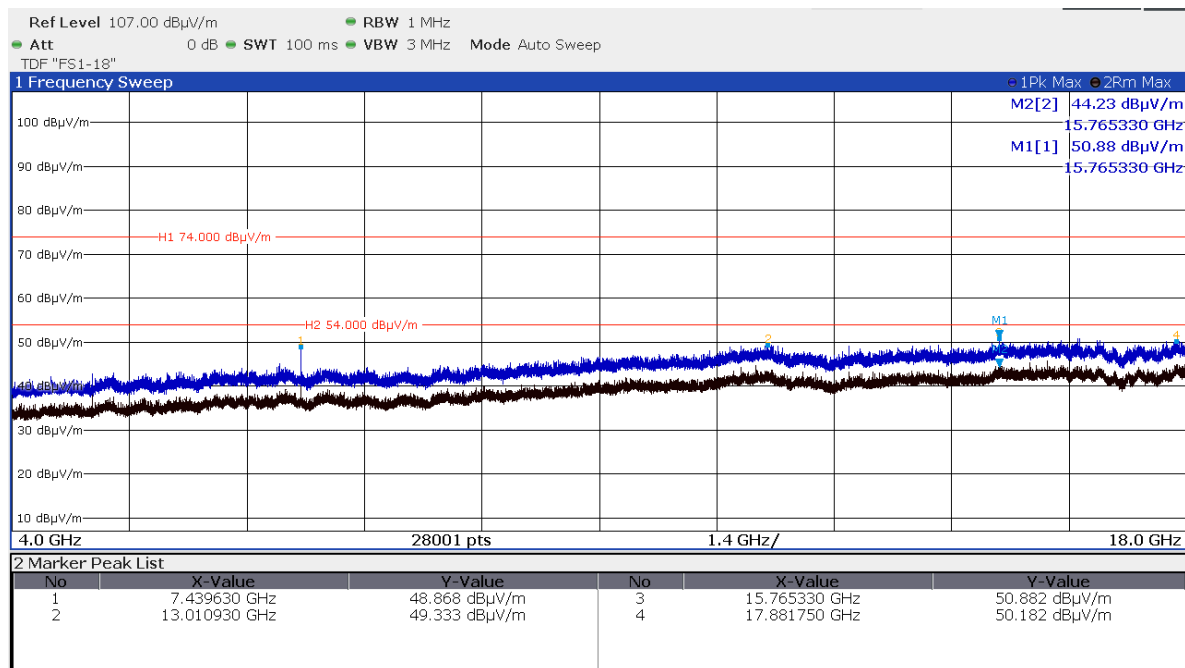
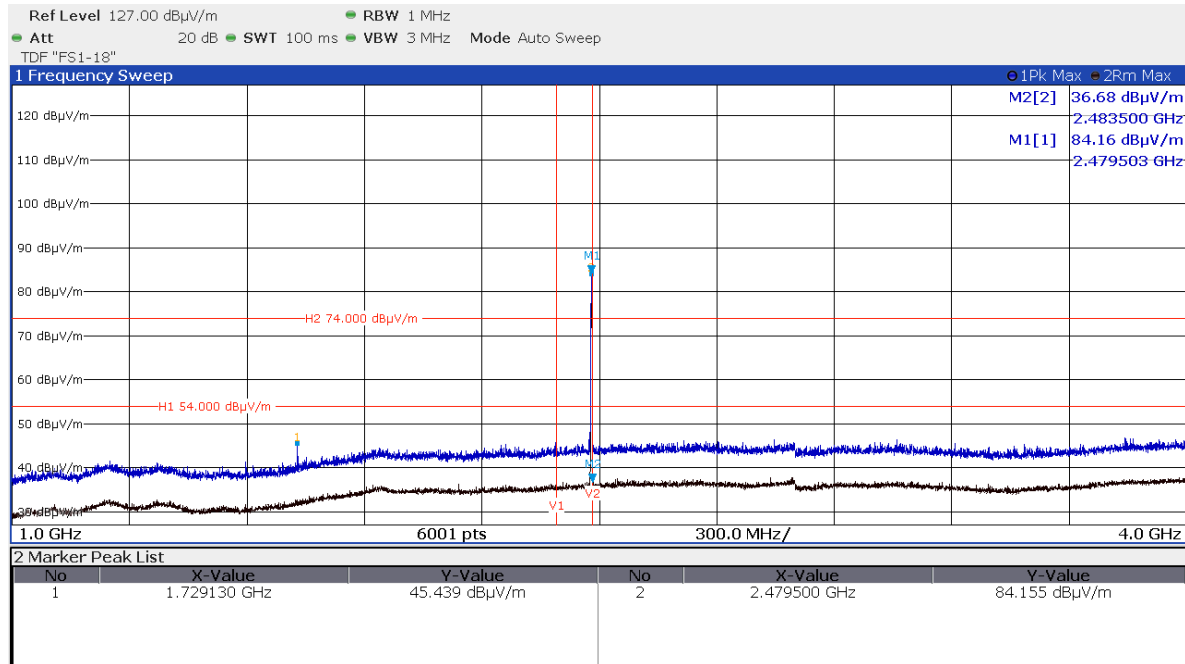
**CH 17 horizontal**


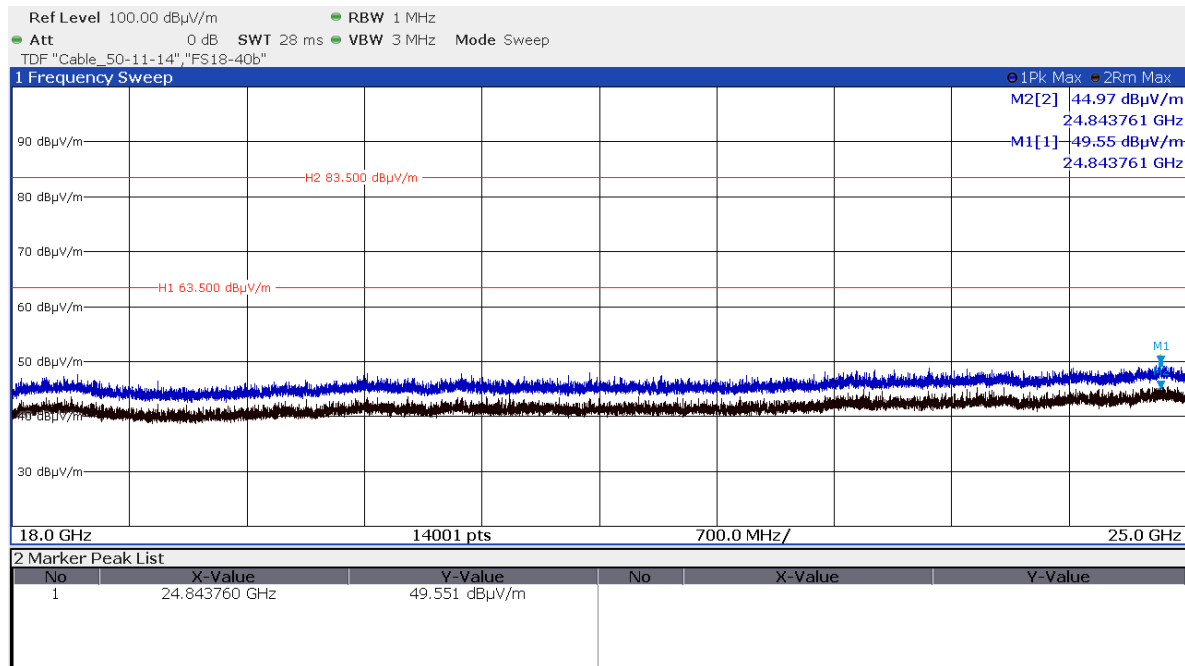
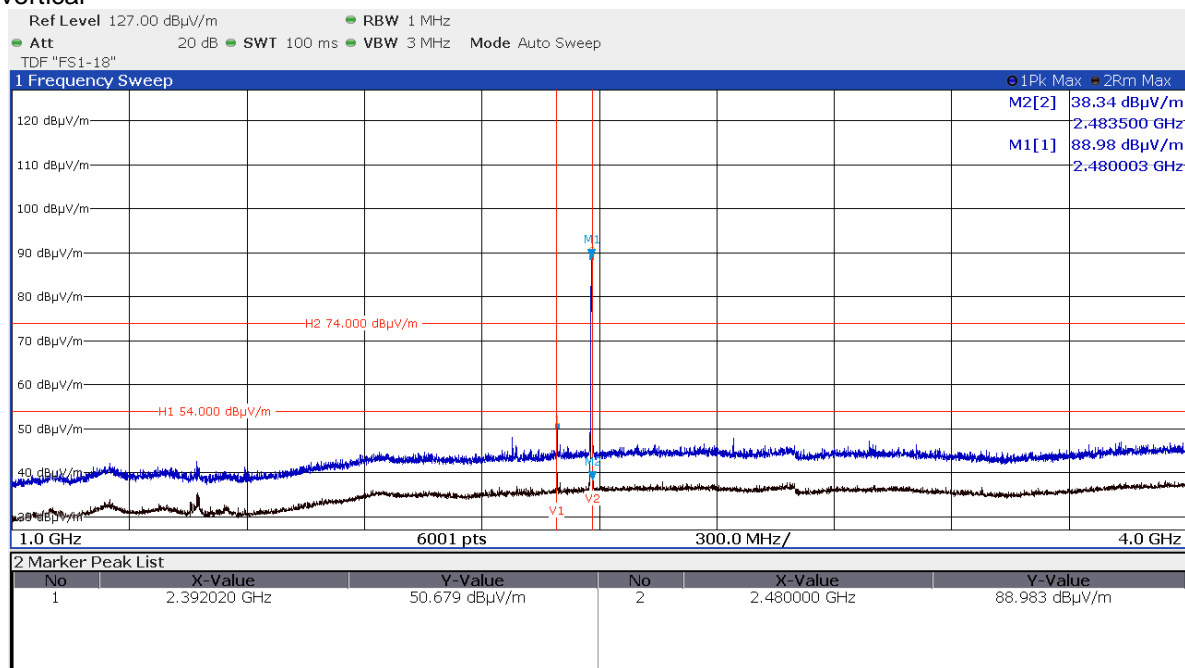
**FCC ID: 2ADQTV1EL**
**IC: 12568A-V1EL**


### CH 17 vertical

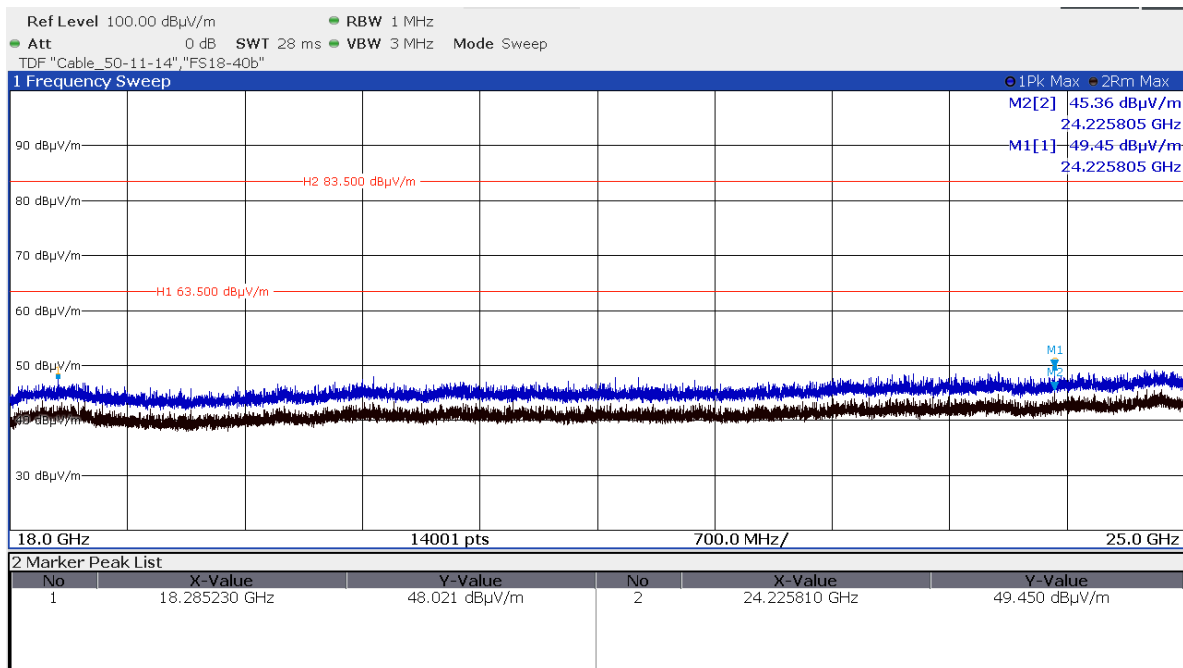
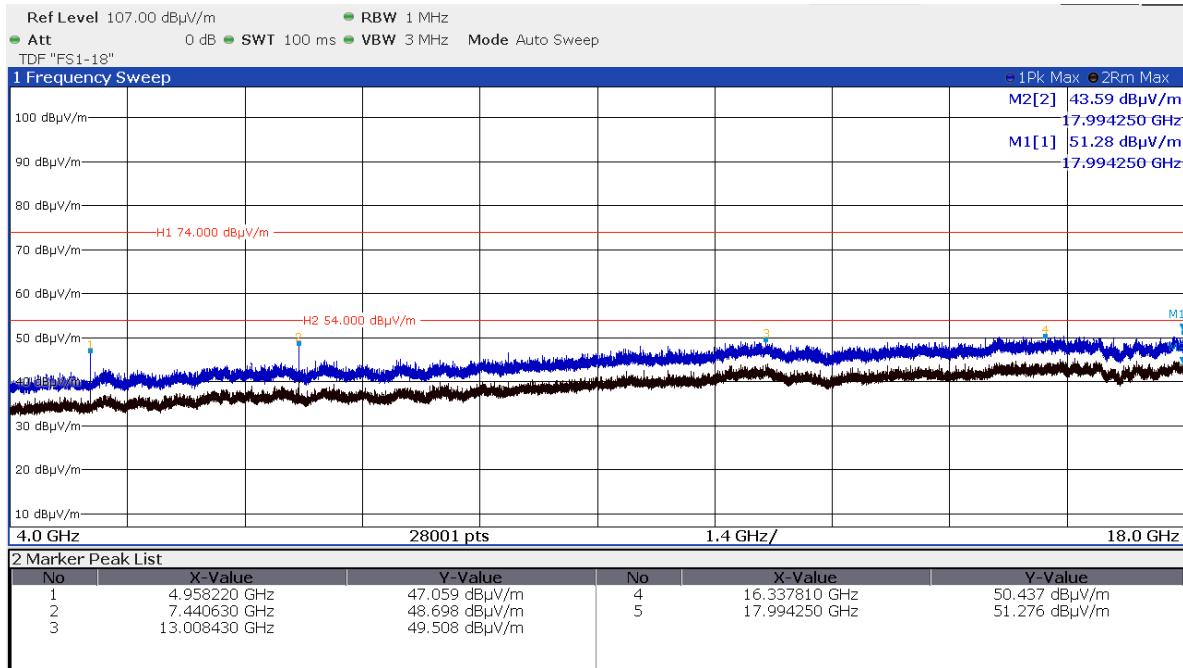


**FCC ID: 2ADQTV1EL**
**IC: 12568A-V1EL**


**FCC ID: 2ADQTV1EL**
**IC: 12568A-V1EL**
**CH 39 horizontal**


**FCC ID: 2ADQTV1EL**
**IC: 12568A-V1EL**

**CH 39 vertical**




**FCC ID: 2ADQTV1EL**
**IC: 12568A-V1EL**


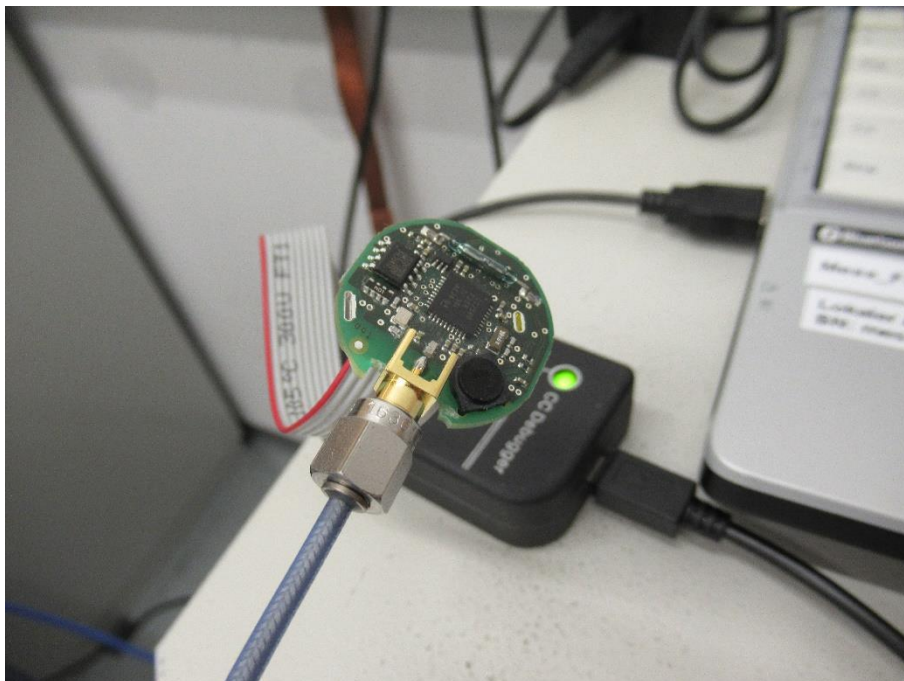
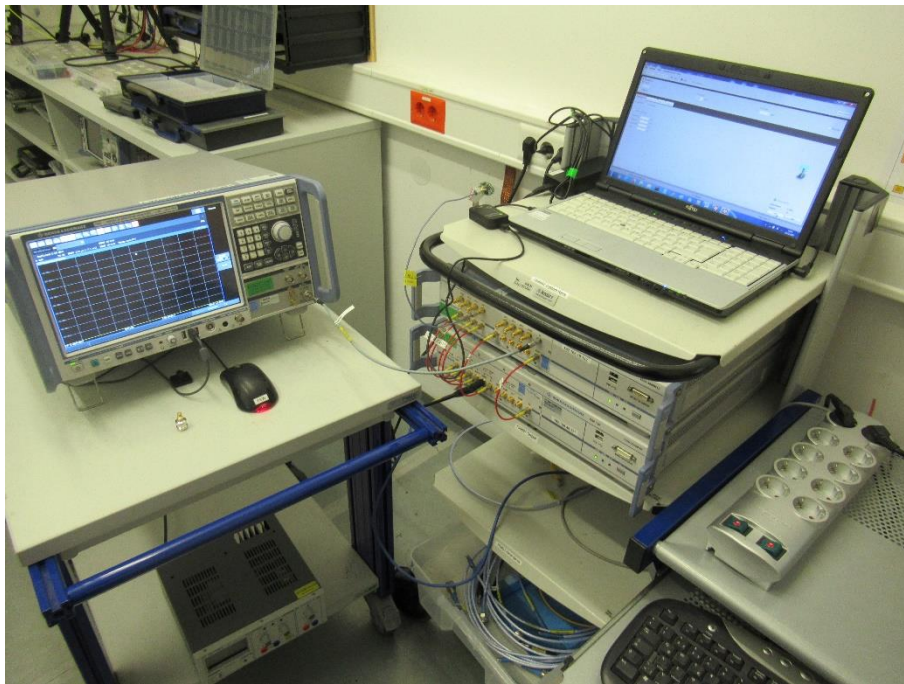
## 5.5 Spurious emissions radiated

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

### 5.5.1 Description of the test location

Test location:                Shielded Room S6

### 5.5.2 Photo documentation of the test set-up



### **5.5.3 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 an 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)).

### **5.5.4 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.

Spectrum analyser settings for  $f > 1$  GHz:

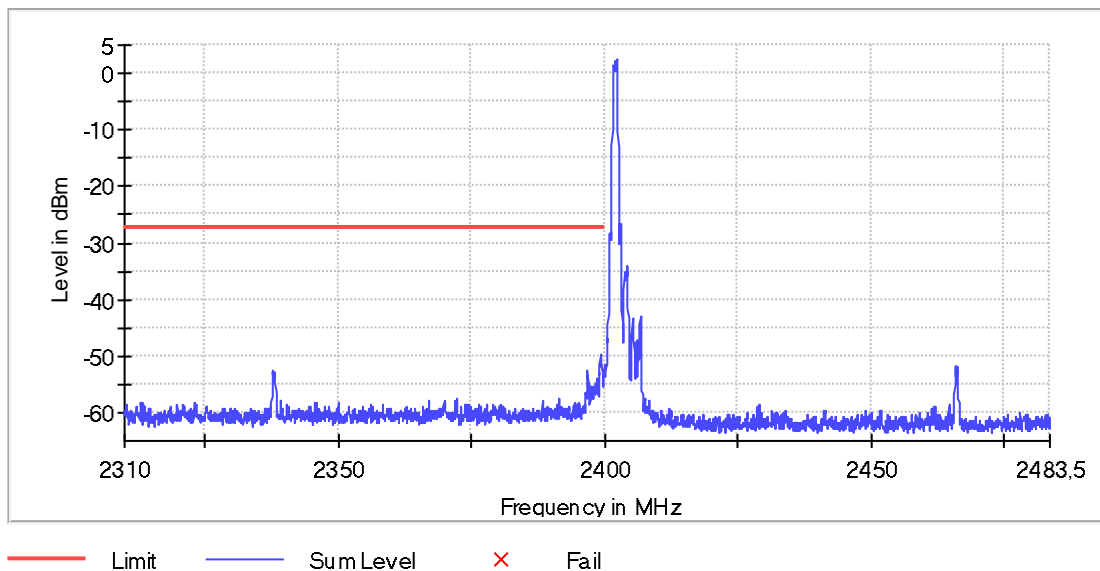
RBW: 100 kHz, VBW: 300 kHz, Detector: Max. peak, Trace: Max. hold, Sweep: Auto

### 5.5.5 Test result

**Note:**

Measurements were performed in the frequency range from 1 GHz up to 25 GHz with the analyser settings for restricted band measurements to show compliance for emissions falling into restricted bands. In the frequency ranges from 9 kHz up to 30 MHz and from 18 GHz up to 25 GHz no emission can be detected. Therefor measurements were only performed for the lower band edge when the EUT was in Tx mode (channel 37).

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2399.225000	-49.8	22.3	-27.4	PASS
2399.275000	-49.8	22.3	-27.4	PASS
2399.325000	-50.9	23.5	-27.4	PASS
2399.375000	-51.1	23.7	-27.4	PASS
2399.975000	-51.5	24.0	-27.4	PASS
2399.475000	-51.5	24.0	-27.4	PASS
2399.175000	-51.6	24.1	-27.4	PASS
2399.525000	-51.6	24.2	-27.4	PASS
2399.425000	-51.8	24.3	-27.4	PASS
2399.125000	-52.3	24.8	-27.4	PASS
2396.775000	-52.6	25.1	-27.4	PASS



**FCC ID: 2ADQTV1EL****IC: 12568A-V1EL**

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).

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 an 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:**      None.

---

---



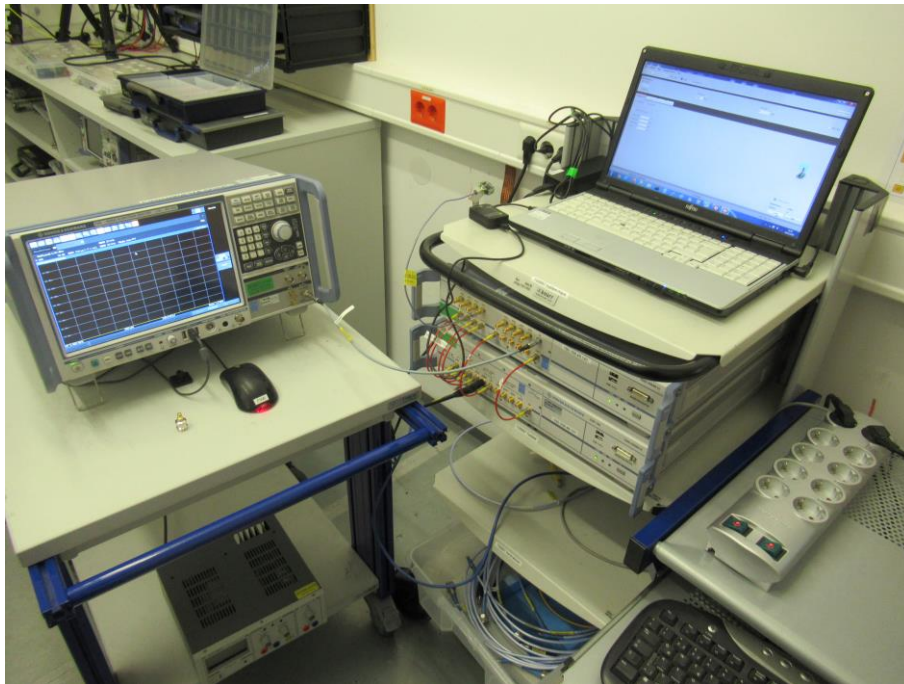
## 5.6 Antenna application

For test instruments and accessories used see section 6 Part **CPC3**.

### 5.6.1 Description of the test location

Test location:                Shielded room S6

### 5.6.2 Photo documentation of the test set-up



### 5.6.3 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. Additional to that a conducted output power measurement was performed. According to the following formula the maximum gain of the antenna was calculated.

$$\text{EIRP} = P + G$$

Where:

EIRP = Equivalent isotropic radiated power

P = Conducted output power

G = Calculated gain of the antenna

Result:  $\text{EIRP} = 2.3 \text{ dBm} + 5.05 \text{ dB} = 7.4 \text{ dBm}$

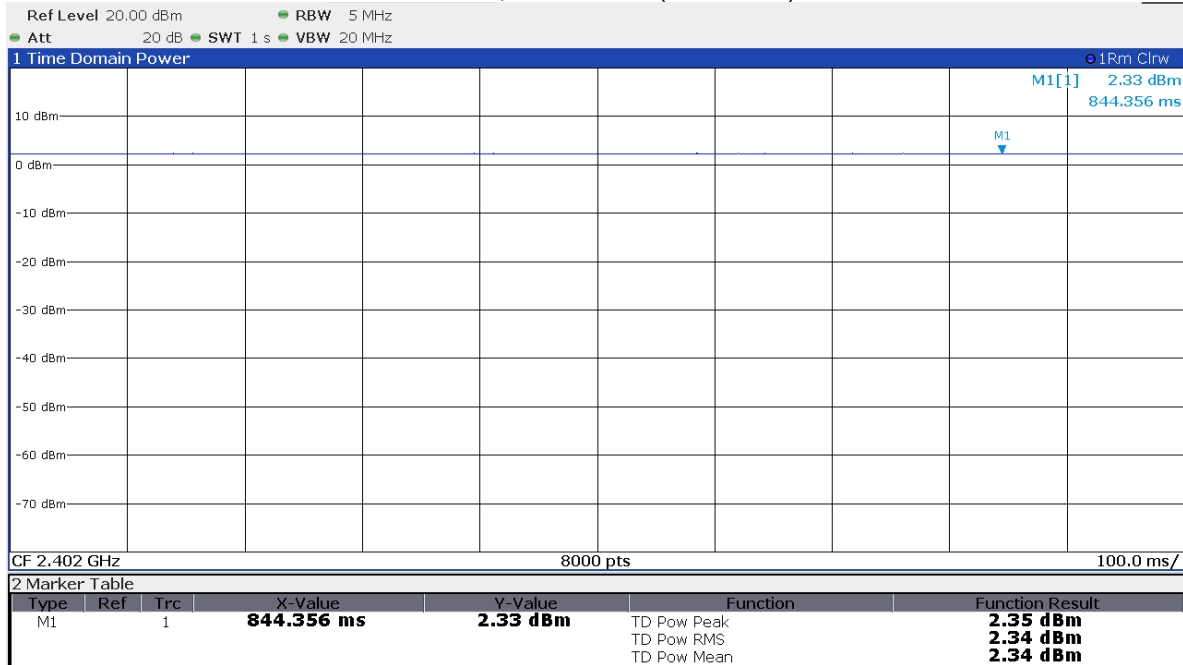
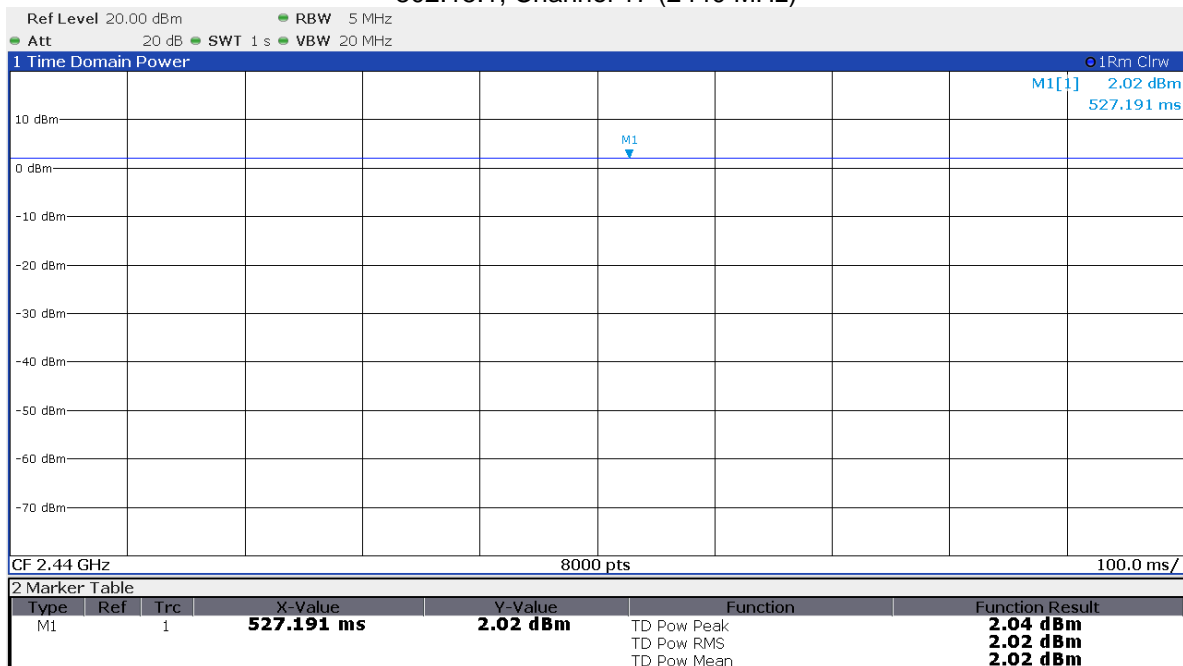
The supplied antenna meets the requirements of part 15.203 and 15.204.

### 5.6.4 Antenna requirements

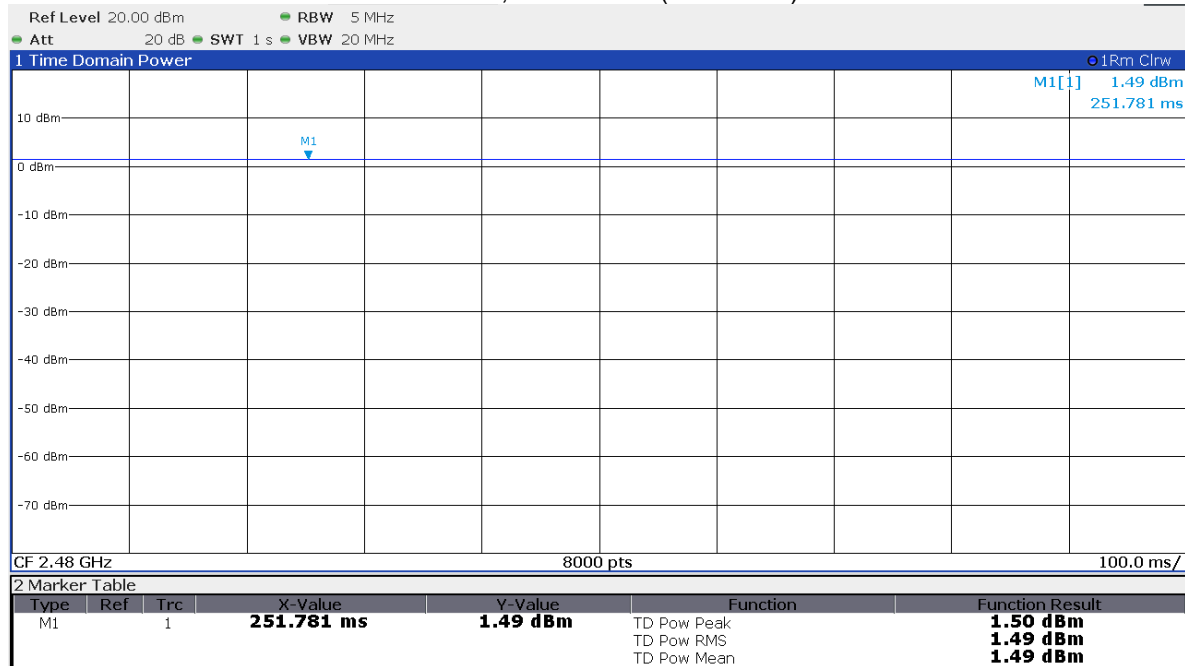
According to FCC Part 15C, Section 15.247(b)(4):

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 output power has not to be reduced.

**5.6.5 Test protocols**
**802.15.1, Channel 37 (2402 MHz)**

**802.15.1, Channel 17 (2440 MHz)**




**FCC ID: 2ADQTV1EL**
**IC: 12568A-V1EL**
**802.15.1, Channel 39 (2480 MHz)**


## **6 USED TEST EQUIPMENT AND ACCESSORIES**

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

<b>Test ID</b>	<b>Model Type</b>	<b>Equipment No.</b>	<b>Next Calib.</b>	<b>Last Calib.</b>	<b>Next Verif.</b>	<b>Last Verif.</b>
CPC 3	FSW43	02-02/11-15-001	08/04/2020	08/04/2019		
	OSP-B157W8 with OSP120	02-02/30-13-002	18/09/2020	18/09/2019		
	OSP-B157WX with OSP120	02-02/30-18-007	23/08/2020	23/08/2019		
	Sucoflex N-1000-SMA	02-02/50-05-072				
	KMS116-GL140SE-KMS116-	02-02/50-16-010				
	2.4/5.2/5.8GHz Antenna + S	02-02/50-17-027				
	Semflex K-400-K	02-02/50-19-013				
	SMB-K27 PULSETRAIN	02-02/68-19-001				
CPR 3	FSW43	02-02/11-15-001	08/04/2020	08/04/2019		
	AMF-6D-01002000-22-10P	02-02/17-15-004				
	311702-02/24-05-009	06/06/2020	06/06/2019			
	18N-20	02-02/50-17-003				
	NMS111-GL200SC01-NMS11	02-02/50-17-012				
	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				
MB	FSW43	02-02/11-15-001	08/04/2020	08/04/2019		
	OSP-B157W8 with OSP120	02-02/30-13-002	18/09/2020	18/09/2019		
	OSP-B157WX with OSP120	02-02/30-18-007	23/08/2020	23/08/2019		
	WK-340/40	02-02/45-05-001	18/04/2020	18/04/2019		
	Sucoflex N-1000-SMA	02-02/50-05-072				
	KMS116-GL140SE-KMS116-	02-02/50-16-010				
	2.4/5.2/5.8GHz Antenna + S	02-02/50-17-027				
	Semflex K-400-K	02-02/50-19-013				
SER 2	SMB-K27 PULSETRAIN	02-02/68-19-001				
	ESVS 30	02-02/03-05-006	19/08/2020	19/08/2019		
	VULB 9168	02-02/24-05-005	19/07/2020	19/07/2019		
	NW-2000-NB	02-02/50-05-113				
	KK-EF393/U-16N-21N20 m	02-02/50-12-018				
SER 3	KK-SD_7/8-2X21N-33,0M	02-02/50-15-028				
	FSW43	02-02/11-15-001	08/04/2020	08/04/2019		
	JS4-18004000-30-5A	02-02/17-05-017				
	AMF-6D-01002000-22-10P	02-02/17-15-004				
	311702-02/24-05-009	06/06/2020	06/06/2019			
	BBHA 9170	02-02/24-05-014	12/06/2021	12/06/2018	14/01/2021	14/01/2020
	KMS102-0.2 m	02-02/50-11-020				
	18N-20	02-02/50-17-003				
	NMS111-GL200SC01-NMS11	02-02/50-17-012				
	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				