RF – TEST REPORT

- FCC Part 15.247, RSS-247 -

Type / Model Name	:	BMW FBD5
Product Description	:	UWB+BLE CAN gateway for comfort access function in vehicles
Applicant	:	Continental Automotive GmbH
Address	:	Siemensstraße 12 93055 REGENSBURG, GERMANY
Manufacturer	:	Continental Automotive GmbH
Address	:	Siemensstraße 12 93055 REGENSBURG, GERMANY

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

Test Report No. :	**80131513-01 Rev0**	29. June 2022 Date of issue

Deutsche Akkreditierungsstelle
D-PL-12030-01-03
D-PL-12030-01-04

FCC ID: KR5FBD5MY23 IC ID:7812D-FBD5MY23

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1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 15, Subpart A - General (September 2021)

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 2021)

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.

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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

2.6 Short description of the equipment under test (EUT)

The FBD5 is a wireless UWB and BLE transceiver with CAN gateway for comfort access function in vehicles. 2 FBD5 anchors are mounted under the headliner of a vehicle. UWB is used for ranging, BLE for data transfer and security features. 4 further anchors (FBD5s) are mounted at the outer body of a vehicle and provide UWB functionality for ranging purposes. The anchors are connected to a central control unit and paired with a smartphone or wearable ID tag. The FBD5 can also communicate among each other for an initialization procedure. After initialization and training procedure the distance between FBD5 and smartphone or ID tag is measured and the position in relation to the vehicle is determined. The vehicle is unlocked, locked or started in case the smartphone or ID tag is in a permitted area around or inside the vehicle.

Number of tested samples:	2
Serial number:	00002, Homologation Sample (conducted) 00004, Homologation Sample (radiated)
Firmware version:	51C23110

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:

- 500 kbps
- 1000 kbps

(kbps = *kilobits per second)*

2.10 Antenna

The following antennas shall be used with the EUT:
The EUT has only an integrated PCB antenna, no temporary connector and no external antenna to be connected.

Number	Characteristic	Type	Plug	*f*-range (GHz)	Max. Gain (dBi)
1	Omni	PCB antenna	none	2.4 - 2.4835	+ 3.3

2.11 Power supply system utilised

Power supply voltage, V_{nom} : 12 V DC
Power supply voltage (alternative) : 6 – 16 V DC

2.12 Peripheral devices and interface cables

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

- PCAN-USB FD Model : Peak IPEH 004022027090
- Notebook Model : Fujitsu Lifebook
- Model :

2.13 Determination of worst-case conditions for final measurement

Preliminary tests are performed in all three orthogonal axes of the EUT 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 Y position.

The tests are carried out in the following frequency band:

2400 MHz – 2483.5 MHz

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
802.15.1	0 - 39	37, 18, 39	Max.	DSSS	GFSK	500 kbps
802.15.1	0 - 39	37, 18, 39	Max.	DSSS	GFSK	1000 kbps

2.13.1 Test jig

No test jig is used.

2.13.2 Test software

Special test software “BMW_FBD5_BLE_ALL_v22.exe” was provided by the manufacturer.

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3 TEST RESULT SUMMARY

FCC Rule Part	RSS Rule Part	Description	Result
15.207(a)	RSS-Gen, 8.8	AC power line conducted emissions	passed
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	passed
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 + Amendment 1 + Amendment 2, March 2019
RSS-247, Issue 2, February 2017

3.1 Revision history of test report

Test report No	Rev.	Issue Date	Changes
80131513-01	0	29 June 2022	Initial test report

The test report with the highest revision number replaces the previous test reports.

3.2 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 : 28 January 2022

Testing concluded on : 03 February 2022

Checked by:

K. Gegenfurtner

Klaus Gegenfurtner
I confirm the correctness and integrity of this document
2022.06.30 09:12:34 +02'00'

Klaus Gegenfurtner
Teamleader Radio

Tested by:

I am the author of this document
2022.06.29 21:31:55 +02'00'

Franz-Xaver Schrettenbrunner
Radio Team

FCC ID: KR5FBD5MY23 IC ID:7812D-FBD5MY23

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 on basis of the ETSI Technical Report TR 100 028 Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 1 and Part 2. The results are documented in the quality system acc. to DIN EN ISO/IEC 17025. 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

4.4 Conformity Decision Rule

The applied conformity decision rule is based on ILAC G8:09/2019 clause 4.2.1 Binary Statement for Simple Acceptance Rule (w = 0).
Details can be found in the procedure CSA_B_V50_29.

4.5 Measurement protocol for FCC and ISED

4.5.1 General information

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

FCC: DE 0011
ISED: DE0009

4.5.2 General Standard information

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

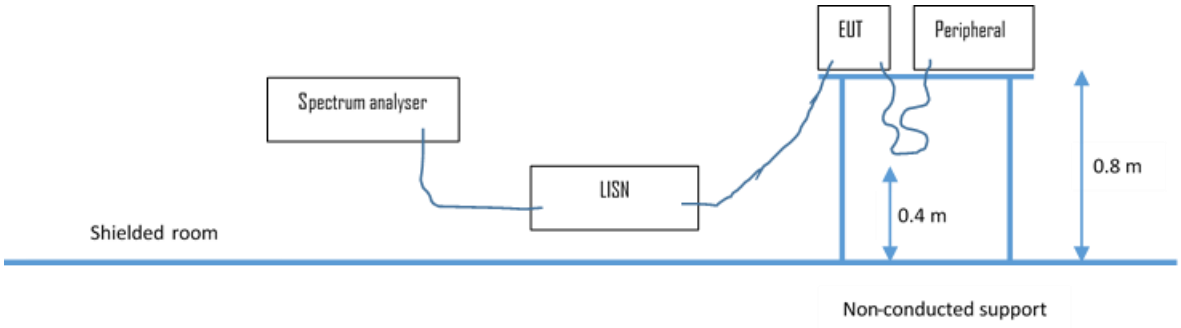
4.5.2.1 Justification

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

4.5.3 Details of test procedures

4.5.3.1 Conducted emission

Test setup according ANSI C63.10



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

To convert between dBµV and µV, the following conversions apply:

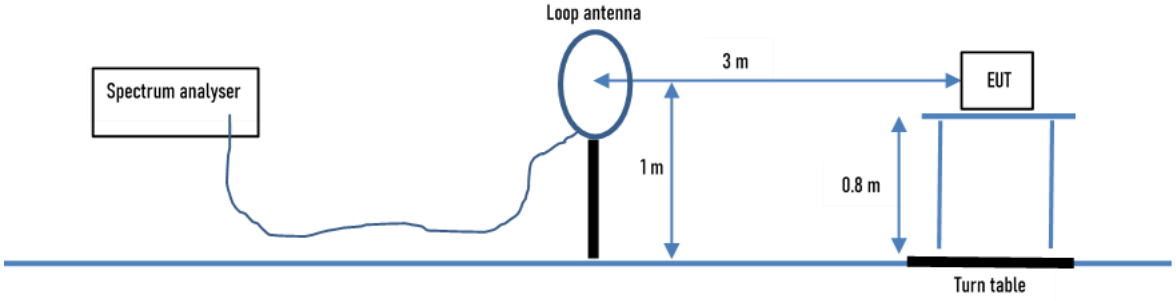
dBµV = 20(log µV)
µV = Inverse log(dBµV/20)

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 µH (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.

4.5.3.2 Radiated emission

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

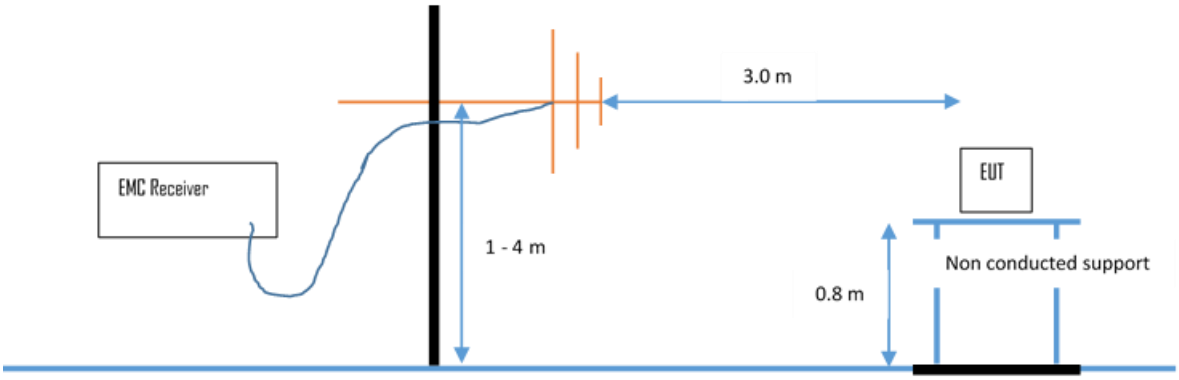
Test setup according ANSI C63.10



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 centre 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.

4.5.3.2.2 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 centre 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 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 limit is subtracted from this result in order to provide the limit margin listed in the measurement protocol.

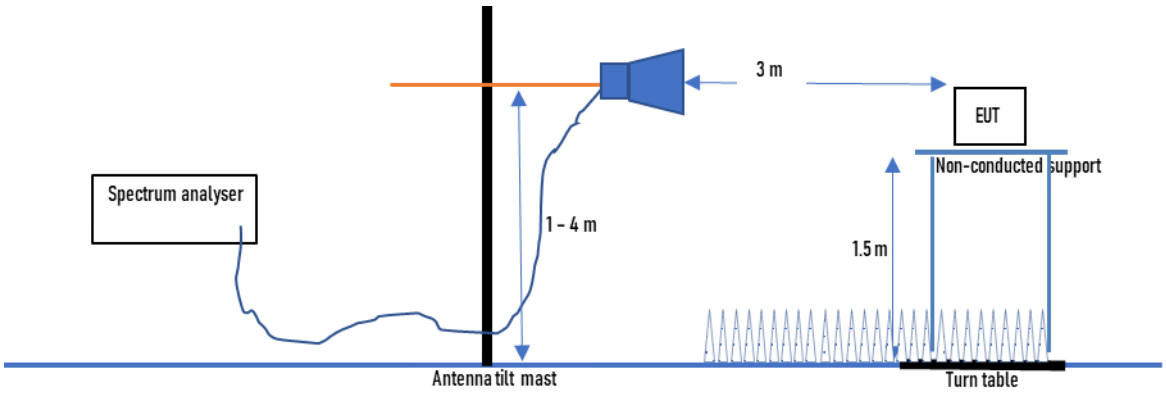
The resolution bandwidth setting:
30 MHz – 1000 MHz: RBW: 120 kHz

Example:

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

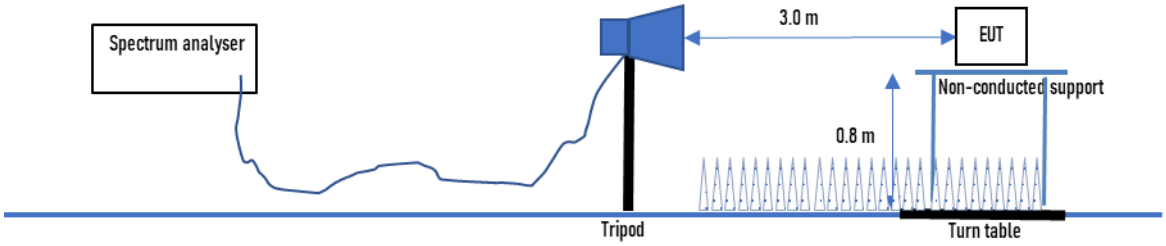
4.5.3.2.3 Anechoic chamber 1 (1000 MHz – 18000 MHz)

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 centre, forming a bundle 30 cm to 40 cm long. Measurements are made in 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.

4.5.3.2.4 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 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.

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5 TEST CONDITIONS AND RESULTS

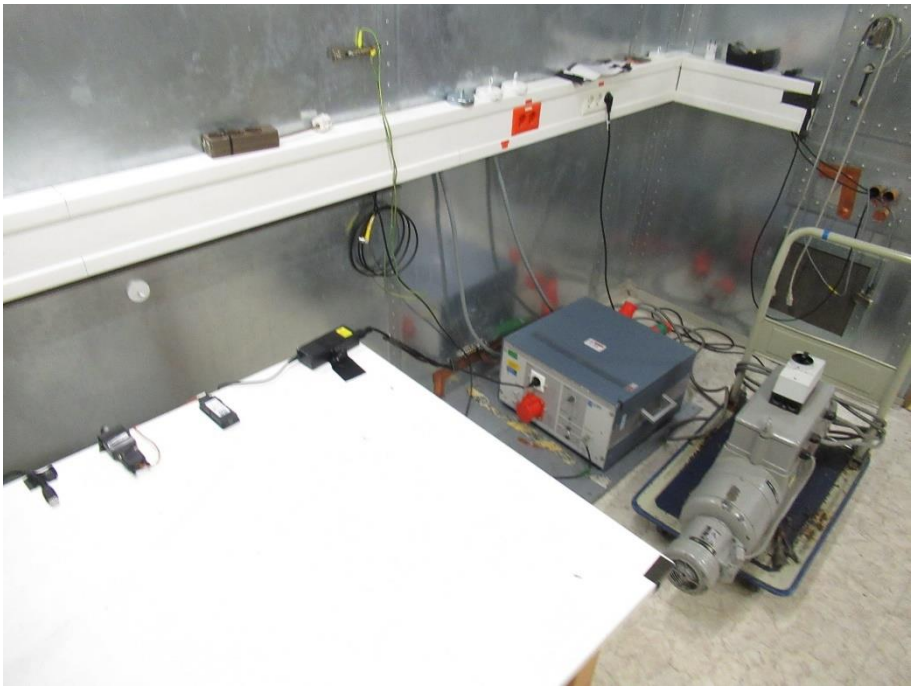
5.1 AC power line conducted emissions

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

5.1.1 Description of the test location

Test location: Shielded Room S2

5.1.2 Photo documentation of the test set-up



5.1.3 Applicable standard

According to FCC Part 15, Section 15.207(a):
Except as shown in paragraphs (b) and (c) of this Section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the given limits.

5.1.4 Description of Measurement

The measurements are performed following the procedures set out in ANSI C63.10 described under item 4.4.3. If the minimum limit margin appears to be less than 20 dB with a peak mode measurement, the emissions are re-measured using a tuned receiver with quasi-peak and average detection and recorded on the data sheets.

For the measurement, the following accesoires according §2.1033 were used:

- 12V 5A Universal Adapter Model : LEYF Adptr12V-5A

5.1.5 Test result

Frequency range: 0.15 MHz - 30 MHz

Min. limit margin -24.3 dB at 1.515 MHz

Limit according to FCC Part 15, Section 15.207(a):

Frequency of Emission (MHz)	Conducted Limit (dBµV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency

The requirements are **FULFILLED.**

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

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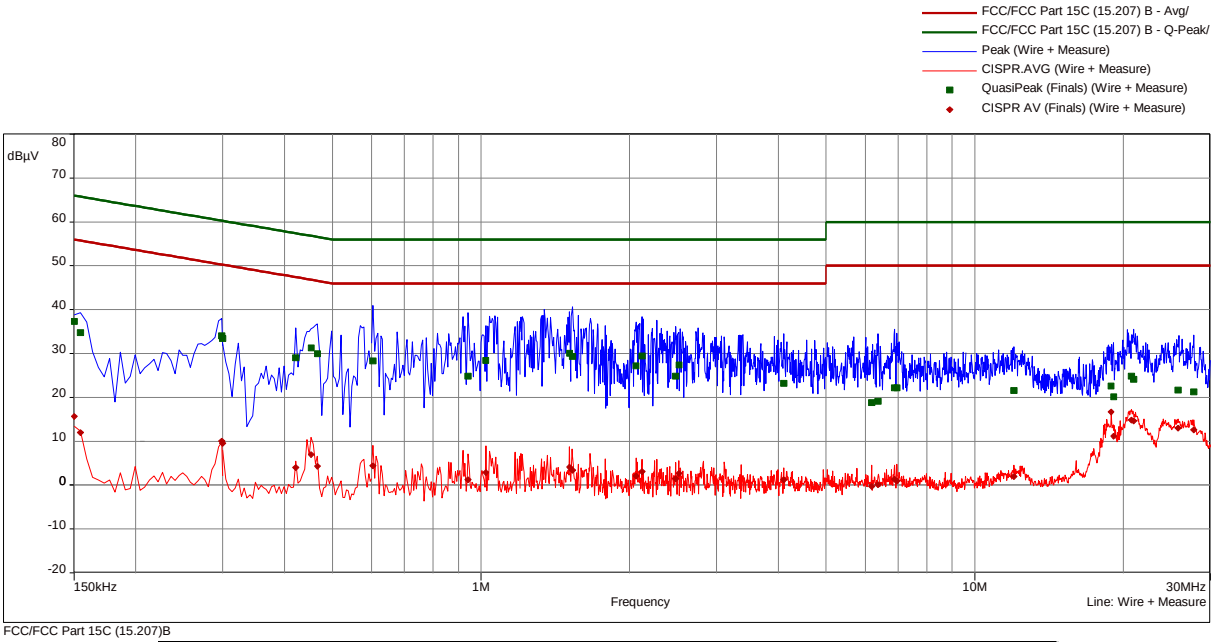
5.1.6 Test protocol

Test point wire +
Operation mode: Cont. TX BLE ch37 1 Mbps
Remarks: None.

Result: passed



FCC/FCC Part 15C (15.207)B

freq	QP	margin	limit	AV	margin	limit
MHz	dB(µV)	dB	dB	dB(µV)	dB	dB
0.150	37.4	-28.6	66.0	15.7	-40.3	56.0
0.155	34.8	-31.0	65.8	12.1	-43.7	55.8
0.299	34.1	-26.2	60.3	10.0	-40.3	50.3
0.300	33.5	-26.8	60.2	9.5	-40.7	50.2
0.422	29.1	-28.3	57.4	4.1	-43.4	47.4
0.453	31.4	-25.5	56.8	7.0	-39.8	46.8
0.467	30.0	-26.6	56.6	4.4	-42.2	46.6
0.605	28.4	-27.7	56.0	4.4	-41.6	46.0
0.942	24.9	-31.1	56.0	1.2	-44.8	46.0
1.023	28.5	-27.5	56.0	2.9	-43.1	46.0
1.511	30.1	-25.9	56.0	4.1	-41.9	46.0
1.533	29.4	-26.6	56.0	3.5	-42.6	46.0
2.064	27.3	-28.8	56.0	2.1	-43.9	46.0
2.118	29.5	-26.5	56.0	3.1	-42.9	46.0
2.481	24.9	-31.1	56.0	1.4	-44.6	46.0
2.517	27.4	-28.6	56.0	2.7	-43.3	46.0
4.106	23.3	-32.8	56.0	1.2	-44.8	46.0
6.191	18.8	-41.2	60.0	-0.3	-50.3	50.0
6.366	19.1	-40.9	60.0	0.1	-49.9	50.0
6.879	22.2	-37.8	60.0	1.4	-48.6	50.0
6.960	22.2	-37.8	60.0	1.0	-49.0	50.0
12.012	21.6	-38.4	60.0	2.0	-48.0	50.0
18.915	22.7	-37.4	60.0	16.7	-33.3	50.0
19.086	20.2	-39.8	60.0	11.2	-38.9	50.0
20.753	24.9	-35.1	60.0	14.8	-35.2	50.0
20.982	24.2	-35.8	60.0	14.6	-35.4	50.0
25.797	21.7	-38.3	60.0	13.1	-36.9	50.0
27.777	21.3	-38.7	60.0	12.6	-37.4	50.0

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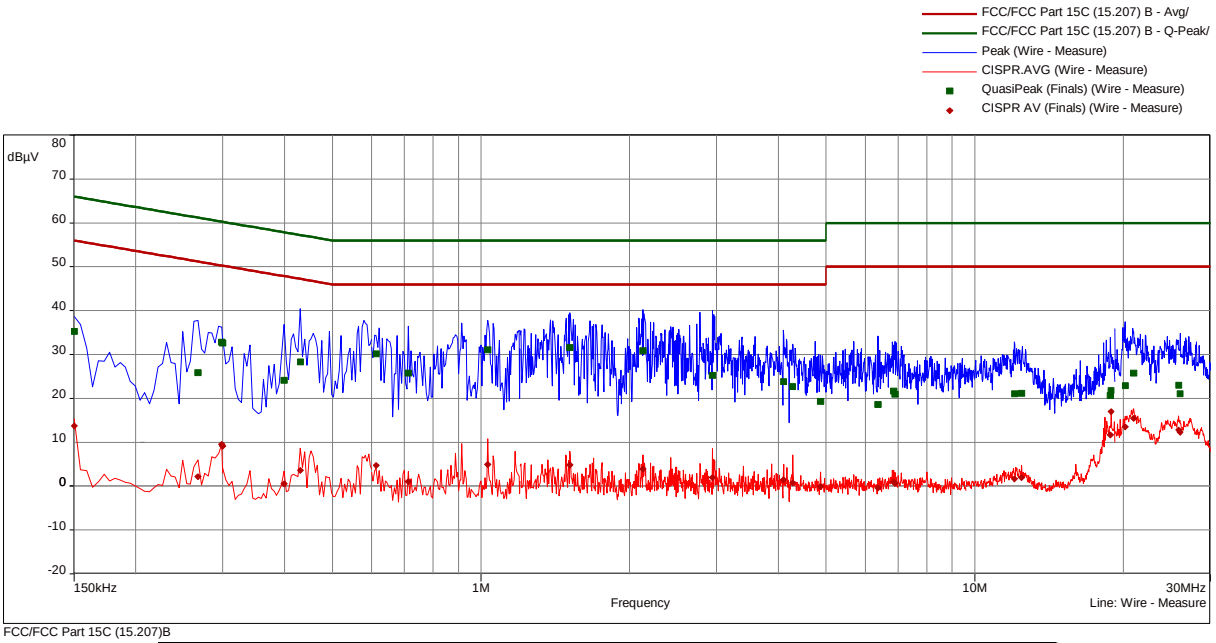
Test point wire -
Operation mode: Cont. TX BLE ch37 1 Mbps
Remarks: None.

Result: passed



FCC/FCC Part 15C (15.207)B

freq	QP	margin	limit	AV	margin	limit
MHz	dB(µV)	dB	dB	dB(µV)	dB	dB
0.150	35.4	-30.7	66.0	13.7	-42.3	56.0
0.267	25.9	-35.3	61.2	2.2	-49.0	51.2
0.299	32.9	-27.4	60.3	9.5	-40.8	50.3
0.300	32.6	-27.6	60.2	9.1	-41.1	50.2
0.399	24.2	-33.6	57.9	0.5	-47.4	47.9
0.431	28.3	-28.9	57.2	3.6	-43.7	47.2
0.614	30.2	-25.8	56.0	4.7	-41.3	46.0
0.713	25.8	-30.2	56.0	1.1	-44.9	46.0
1.032	31.1	-24.9	56.0	5.0	-41.0	46.0
1.515	31.7	-24.3	56.0	4.8	-41.2	46.0
2.127	30.9	-25.1	56.0	4.0	-42.0	46.0
2.945	25.3	-30.7	56.0	2.0	-44.0	46.0
4.097	23.9	-32.1	56.0	1.5	-44.5	46.0
4.277	22.7	-33.3	56.0	0.8	-45.2	46.0
4.872	19.4	-36.6	56.0	-0.1	-46.1	46.0
6.366	18.6	-41.4	60.0	-0.4	-50.4	50.0
6.848	21.7	-38.3	60.0	1.0	-49.0	50.0
6.902	21.0	-39.0	60.0	0.7	-49.3	50.0
12.021	21.1	-38.9	60.0	1.7	-48.3	50.0
12.435	21.2	-38.8	60.0	2.0	-48.0	50.0
18.830	20.7	-39.3	60.0	11.7	-38.3	50.0
18.915	21.8	-38.2	60.0	17.0	-33.0	50.0
20.181	22.9	-37.1	60.0	13.6	-36.5	50.0
20.987	25.8	-34.2	60.0	15.5	-34.5	50.0
25.860	23.1	-36.9	60.0	12.9	-37.2	50.0
26.058	21.1	-38.9	60.0	12.3	-37.7	50.0

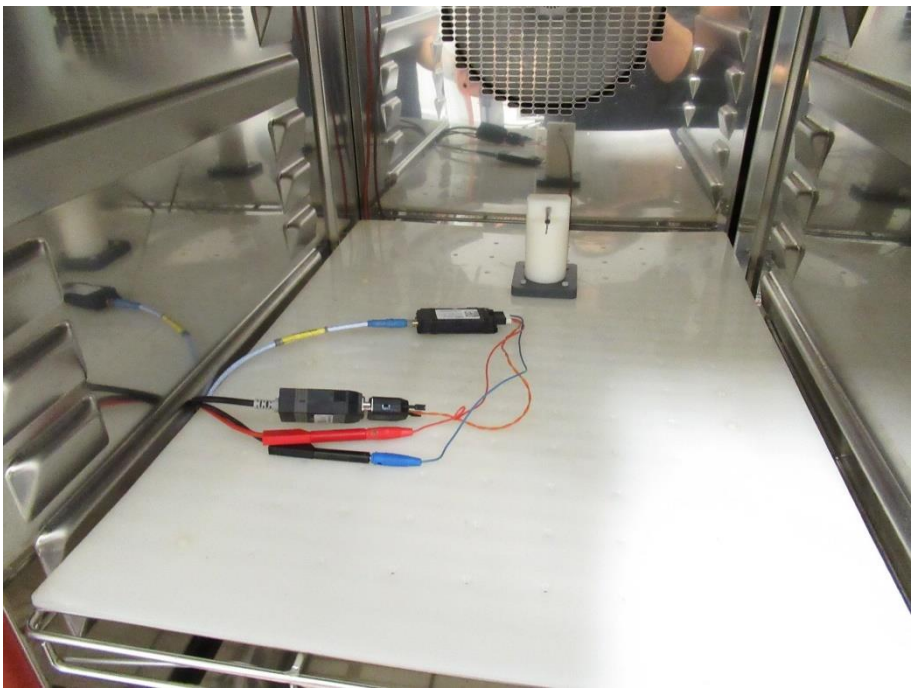
5.2 EBW and OBW

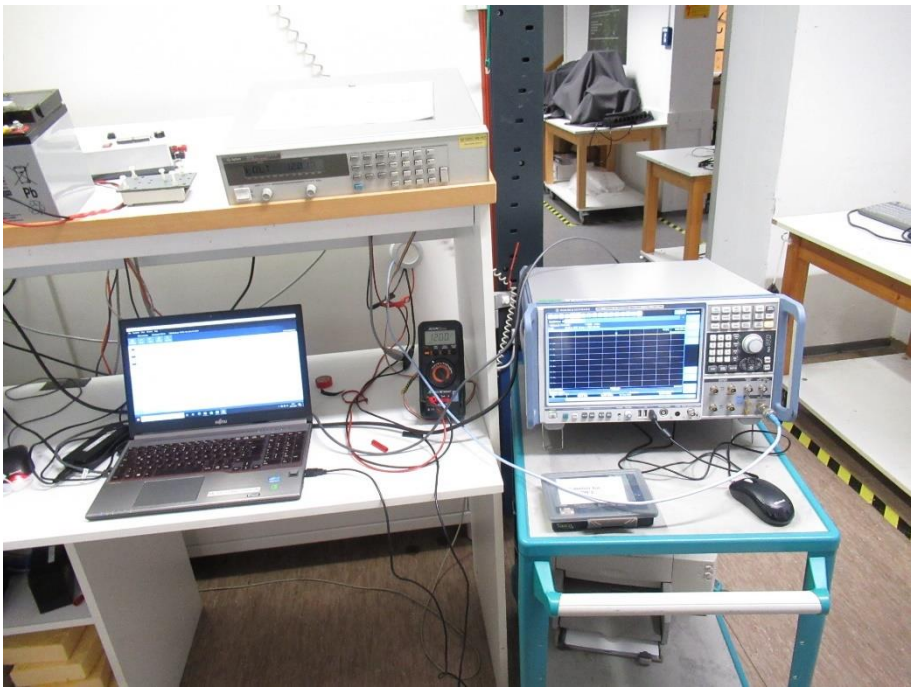
For test instruments and accessories used see section 6 Part **MB**.

5.2.1 Description of the test location

Test location: AREA4

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.

Spectrum analyser settings for EBW:
RBW: 100 kHz, VBW: 300 kHz, Detector: Max peak, Sweep time: auto Span: 2 EBW;
Spectrum analyser settings for OBW:
RBW: 1-5% OBW, VBW: 3 RBW, Detector: Max peak, Sweep time: auto, Span: 2 OBW;

5.2.5 Test result

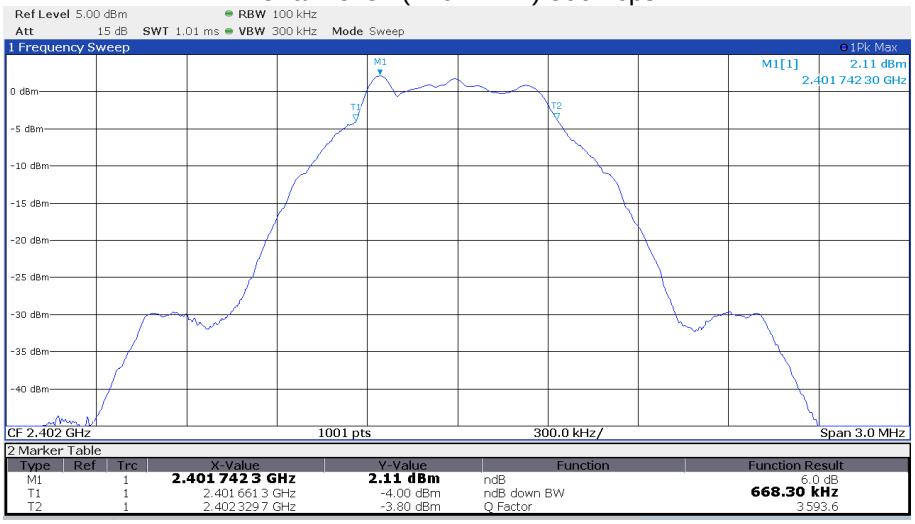
Channel	Data rate (kbps)	Bandwidth (MHz)	Limit Min. (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Max. Level (dBm)	Result
37	500	0.6683	0.500	2401.6613	2402.3297	2.11	PASS
18		0.6713		2441.6613	2442.3327	2.21	PASS
39		0.6683		2479.6613	2480.3297	1.52	PASS
37	1000	0.6743		2401.6253	2402.6267	2.46	PASS
18		0.6713		2441.6523	2442.3237	2.26	PASS
39		0.6773		2479.6494	2480.3267	1.54	PASS

The requirements are **FULFILLED.**

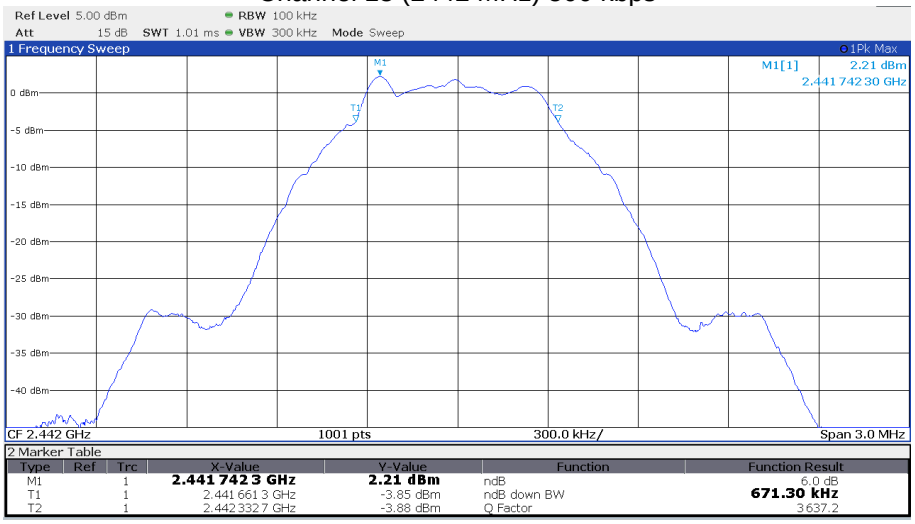
Remarks: For detailed test result please see the following test protocols

5.2.6 Test protocols EBW

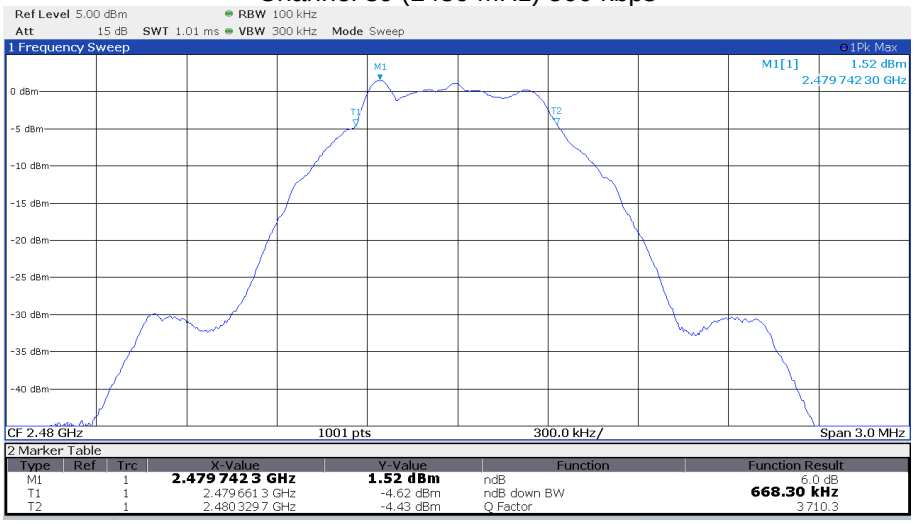
Channel 37 (2402 MHz) 500 kbps



Channel 18 (2442 MHz) 500 kbps

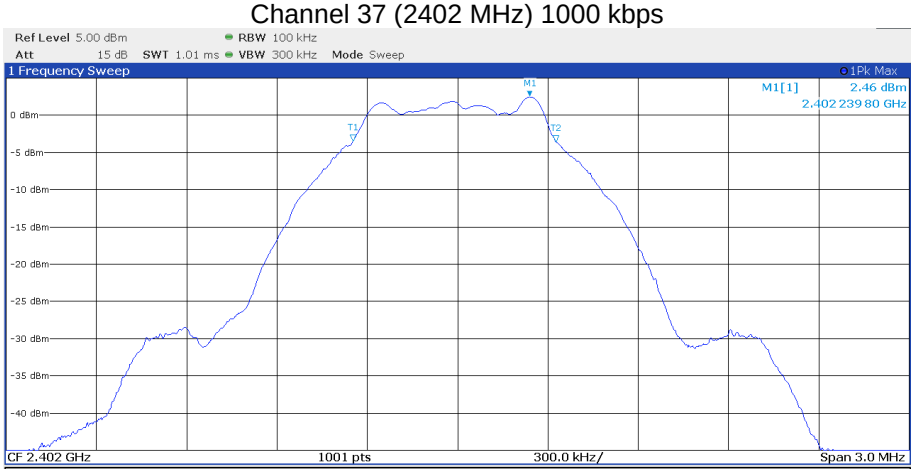


Channel 39 (2480 MHz) 500 kbps



FCC ID: KR5FBD5MY23 IC ID:7812D-FBD5MY23

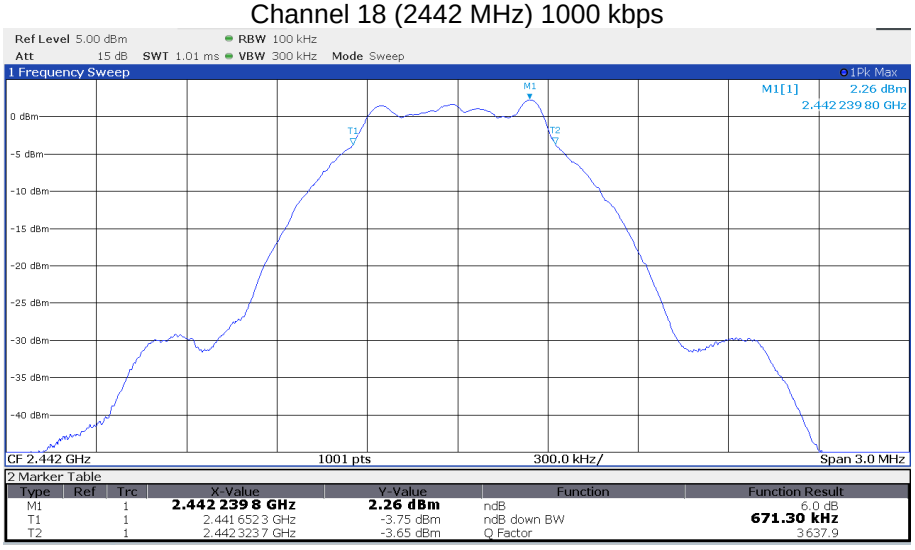
Channel 37 (2402 MHz) 1000 kbps



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**2.402 239 8 GHz**	**2.46 dBm**	ndB	6.0 dB
T1		1	2.401 652 3 GHz	-3.45 dBm	ndB down BW	**674.30 kHz**
T2		1	2.402 326 7 GHz	-3.60 dBm	Q Factor	3 562.4

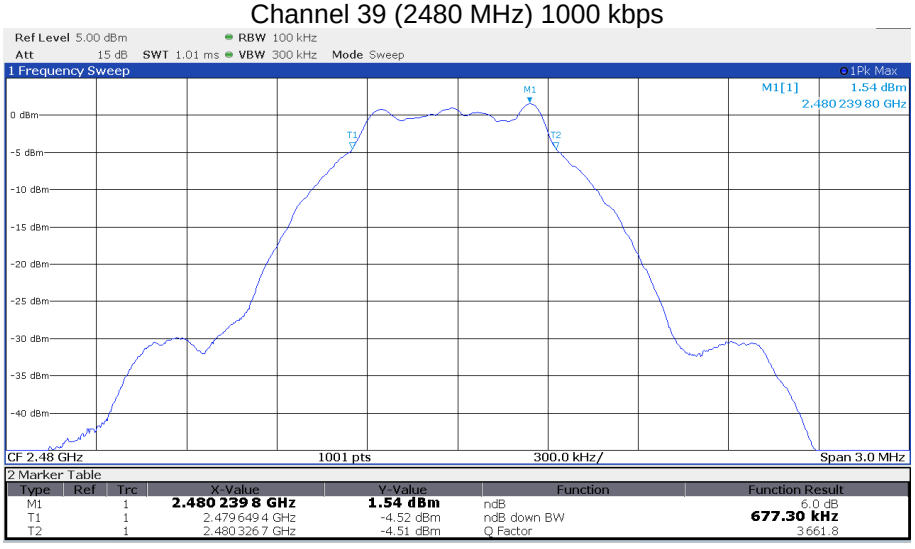
Channel 18 (2442 MHz) 1000 kbps



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**2.442 239 8 GHz**	**2.26 dBm**	ndB	6.0 dB
T1		1	2.441 652 3 GHz	-3.75 dBm	ndB down BW	**671.30 kHz**
T2		1	2.442 323 7 GHz	-3.65 dBm	Q Factor	3 637.9

Channel 39 (2480 MHz) 1000 kbps

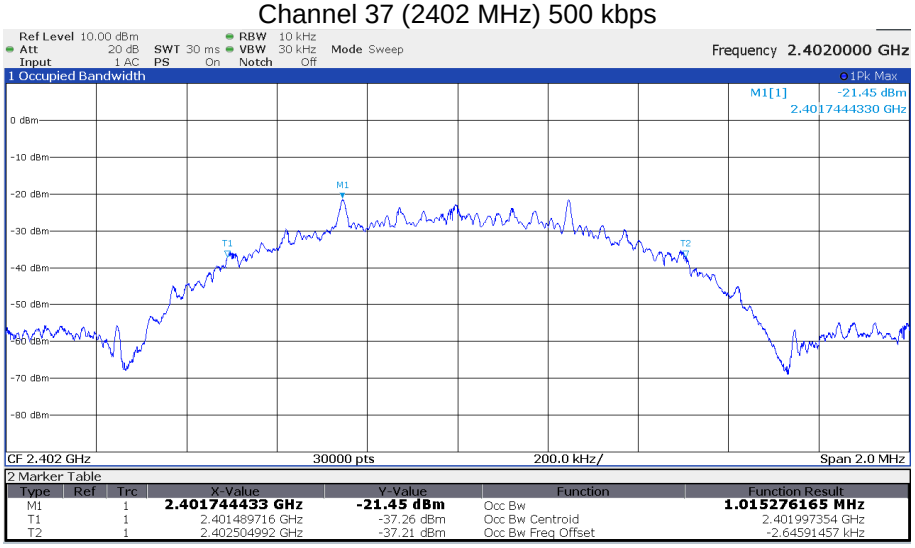


2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**2.480 239 8 GHz**	**1.54 dBm**	ndB	6.0 dB
T1		1	2.479 649 4 GHz	-4.52 dBm	ndB down BW	**677.30 kHz**
T2		1	2.480 326 7 GHz	-4.51 dBm	Q Factor	3 661.8

5.2.7 Test protocols OBW

Channel 37 (2402 MHz) 500 kbps



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**2.401744433 GHz**	**-21.45 dBm**	Occ Bw	**1.015276165 MHz**
T1		1	2.401489716 GHz	-37.26 dBm	Occ Bw Centroid	2.401997354 GHz
T2		1	2.402504992 GHz	-37.21 dBm	Occ Bw Freq Offset	-2.64591457 kHz

Channel 18 (2442 MHz) 500 kbps

2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**2.441745833 GHz**	**-24.59 dBm**	Occ Bw	**1.015820666 MHz**
T1		1	2.441489372 GHz	-40.71 dBm	Occ Bw Centroid	2.441997283 GHz
T2		1	2.442505193 GHz	-40.77 dBm	Occ Bw Freq Offset	-2.717351251 kHz

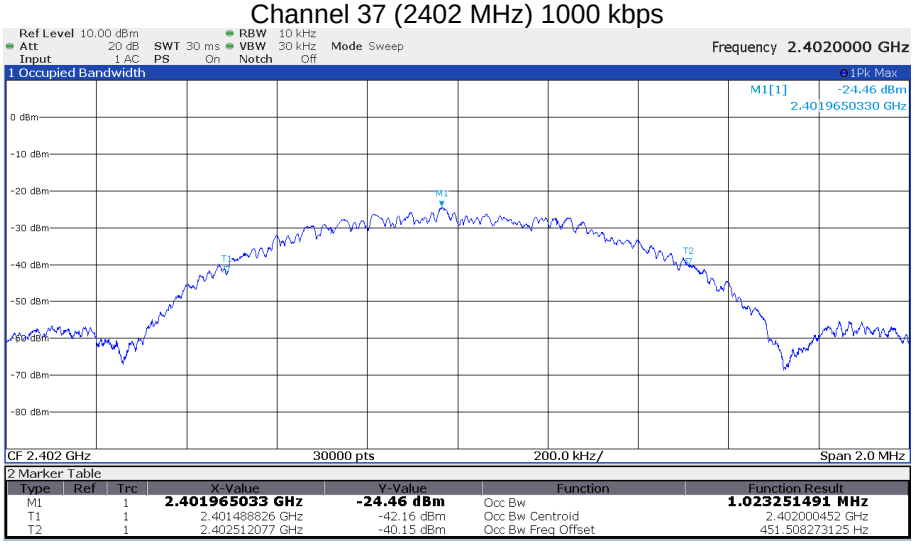
Channel 39 (2480 MHz) 500 kbps

2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**2.479744767 GHz**	**-25.53 dBm**	Occ Bw	**1.014781991 MHz**
T1		1	2.479489595 GHz	-41.96 dBm	Occ Bw Centroid	2.479996986 GHz
T2		1	2.480504377 GHz	-41.82 dBm	Occ Bw Freq Offset	-3.014368232 kHz

FCC ID: KR5FBD5MY23 IC ID:7812D-FBD5MY23

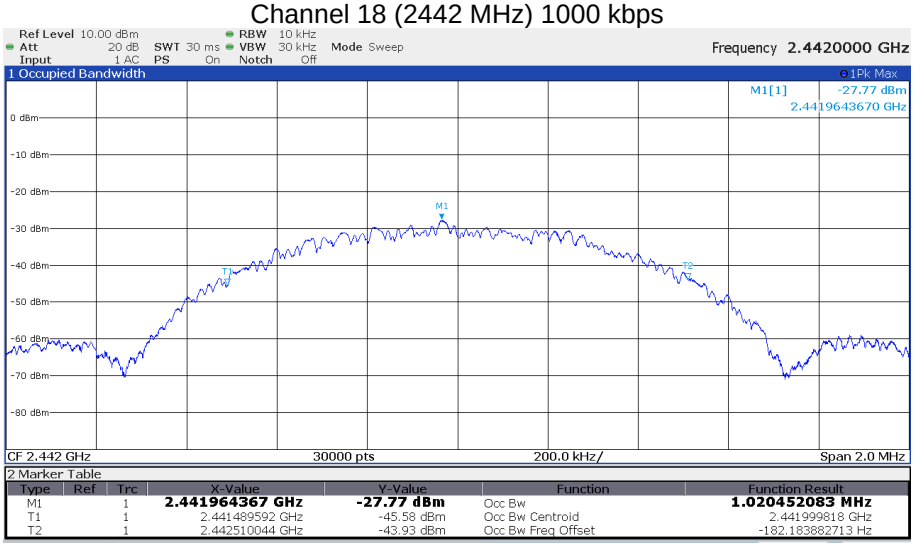
Channel 37 (2402 MHz) 1000 kbps



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**2.401965033 GHz**	**-24.46 dBm**	Occ Bw	**1.023251491 MHz**
T1		1	2.401488826 GHz	-42.16 dBm	Occ Bw Centroid	2.402000452 GHz
T2		1	2.402512077 GHz	-40.15 dBm	Occ Bw Freq Offset	451.508273125 Hz

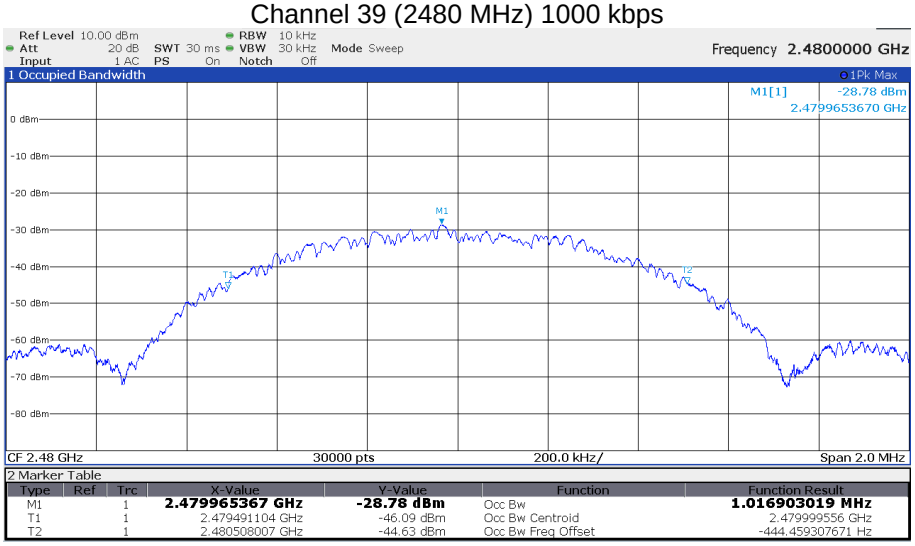
Channel 18 (2442 MHz) 1000 kbps



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**2.441964367 GHz**	**-27.77 dBm**	Occ Bw	**1.020452083 MHz**
T1		1	2.441489592 GHz	-45.58 dBm	Occ Bw Centroid	2.441999818 GHz
T2		1	2.442510044 GHz	-43.93 dBm	Occ Bw Freq Offset	-182.183882713 Hz

Channel 39 (2480 MHz) 1000 kbps



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**2.479965367 GHz**	**-28.78 dBm**	Occ Bw	**1.016903019 MHz**
T1		1	2.479491104 GHz	-46.09 dBm	Occ Bw Centroid	2.479999556 GHz
T2		1	2.480508007 GHz	-44.63 dBm	Occ Bw Freq Offset	-444.459307671 Hz

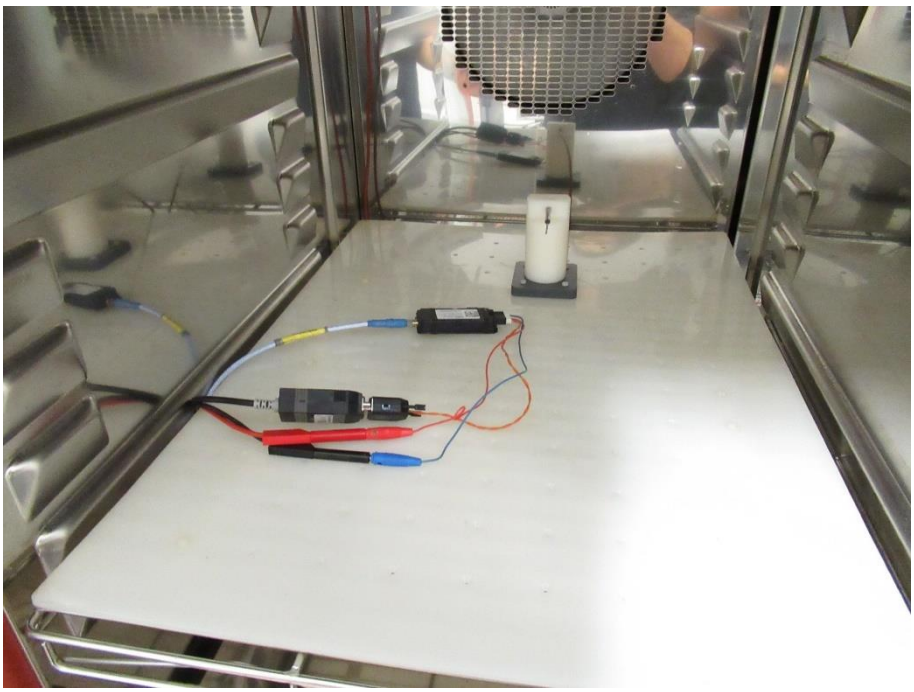
5.3 Maximum peak conducted output power

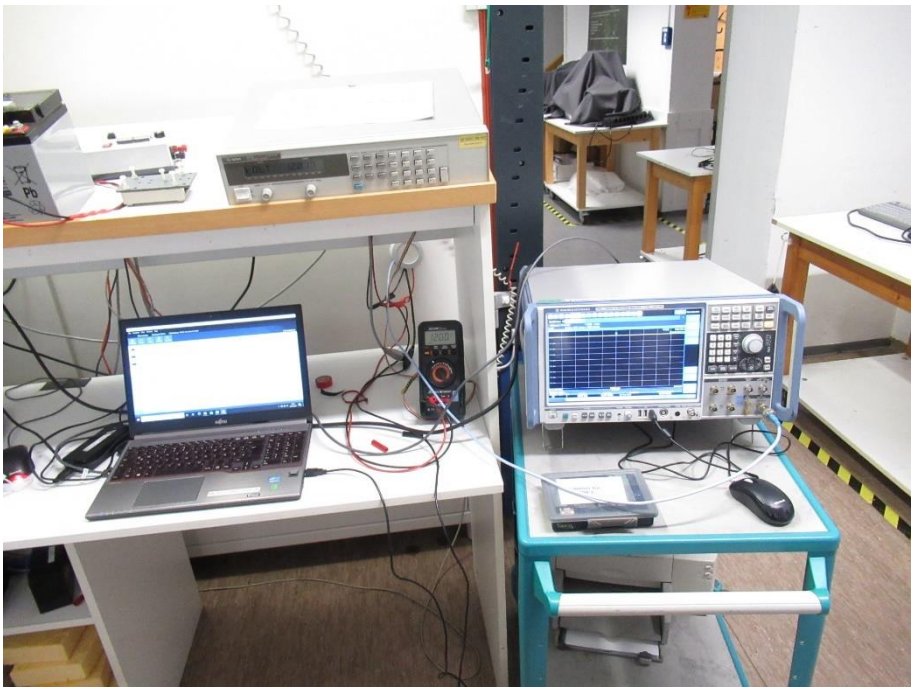
For test instruments and accessories used see section 6 Part **CPC 3**.

5.3.1 Description of the test location

Test location: AREA4

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):
The maximum peak conducted output power of the intentional radiator shall not exceed the following:
For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt.

5.3.4 Description of Measurement

The maximum peak conducted 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.

Spectrum analyser settings:
RBW: 3 MHz, VBW: 10 MHz, Detector: Max peak, Sweep time: auto Span: 10 MHz;

5.3.5 Test result

Channel	Data rate (kbps)	P meas. (dBm)	Cable att (dBm).	P cond. (dBm)	Limit (dBm)	Margin (dBm)	Result
37	500	2.8	0.8	3.6	30.0	-26.4	PASS
18		2.8		3.6		-26.4	PASS
39		2.0		2.8		-27.2	PASS
37	1000	2.9		3.7		-26.3	PASS
18		2.9		3.7		-26.3	PASS
39		2.1		2.9		-27.1	PASS

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

Frequency (MHz)	Peak Power Limit	
	(dBm)	(W)
902-928	30	1.0
2400-2483.5	**30**	**1.0**
5725-5850	30	1.0

The requirements are **FULFILLED.**

Remarks: None.

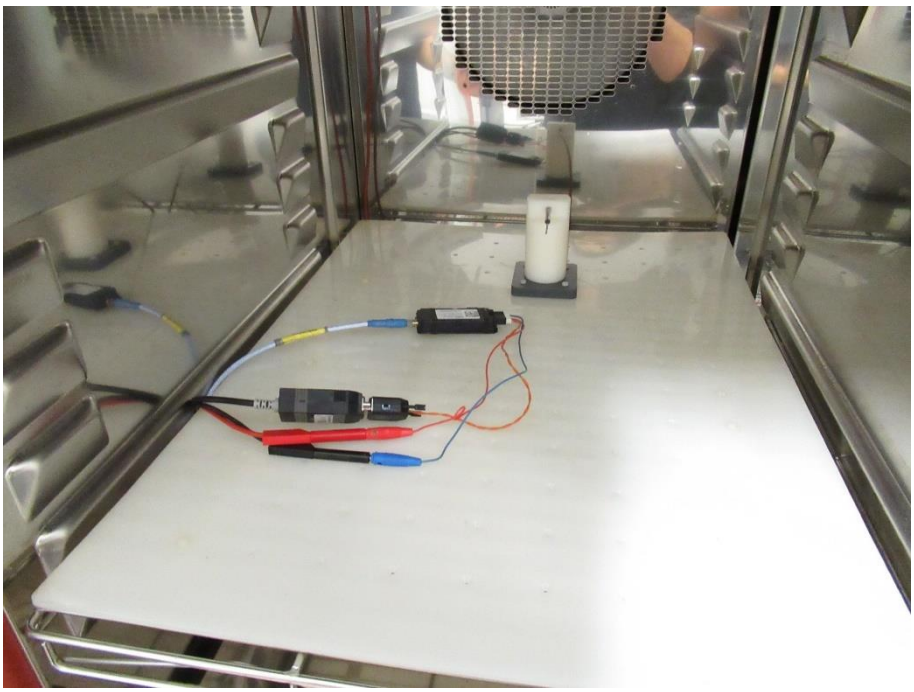
5.4 Power spectral density

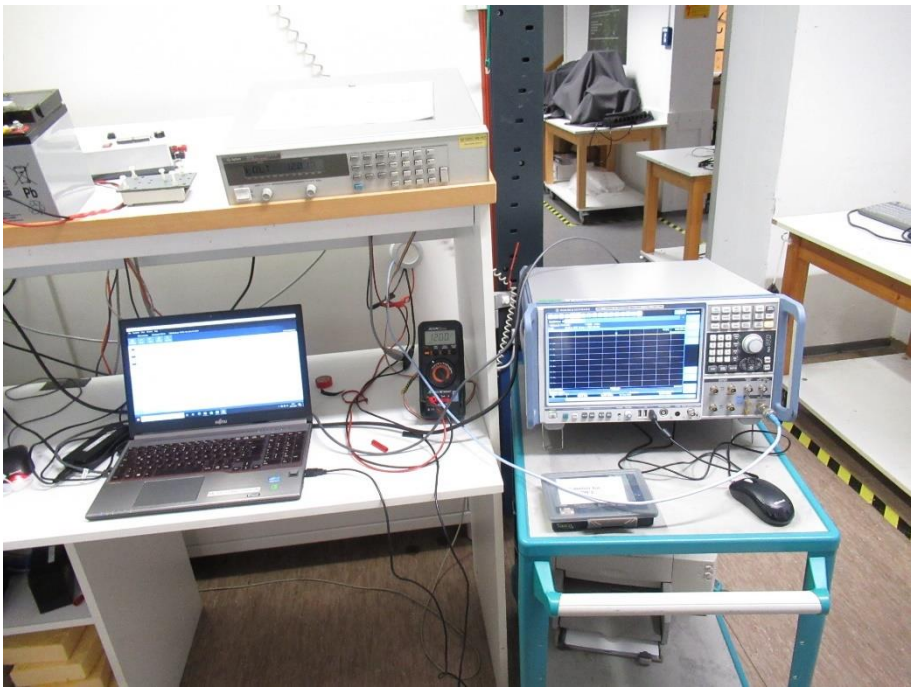
For test instruments and accessories used see section 6 Part **MB**.

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 15.247(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 11.10 of ANSI C63.10. The power measurement was done as peak power measurement. Therefore, the PKPSD is measured. The max peak was located and with the spectrum analyser and a marker set to peak.

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

5.4.5 Test result

Channel	Data rate (kbps)	frequency (MHz)	PSD meas. (dBm)	Cable att (dBm).	PSD. (dBm)	Limit (dBm)	Margin (dBm)	Result
37	500	2402.2408	-4.2	0.8	-3.4	8.0	-11.4	PASS
18		2441.7413	-4.0		-3.2		-11.2	PASS
39		2479.7403	-4.9		-4.1		-12.1	PASS
37	1000	2401.9740	-13.8		-13.0		-21.0	PASS
18		2441.9730	-13.8		-13.0		-21.0	PASS
39		2479.9730	-14.7		-13.9		-21.9	PASS

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

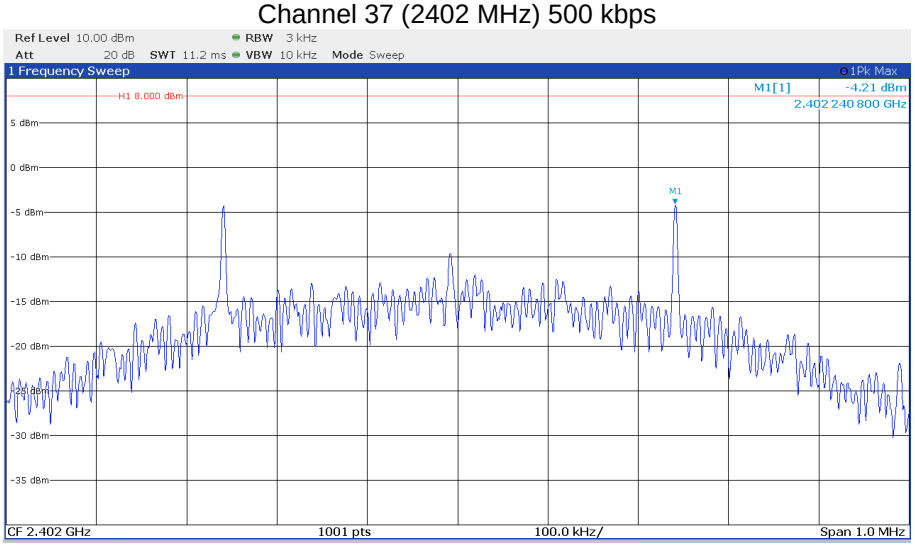
Frequency (MHz)	Power spectral density limit (dBm/3 kHz)
2400 - 2483.5	8

The requirements are **FULFILLED.**

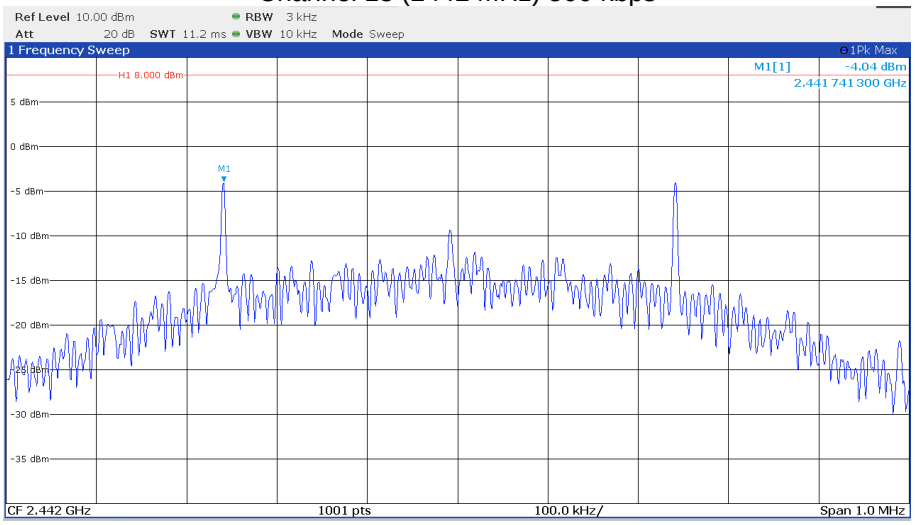
Remarks: For detailed test result please see the following test protocols.

5.4.6 Test protocols

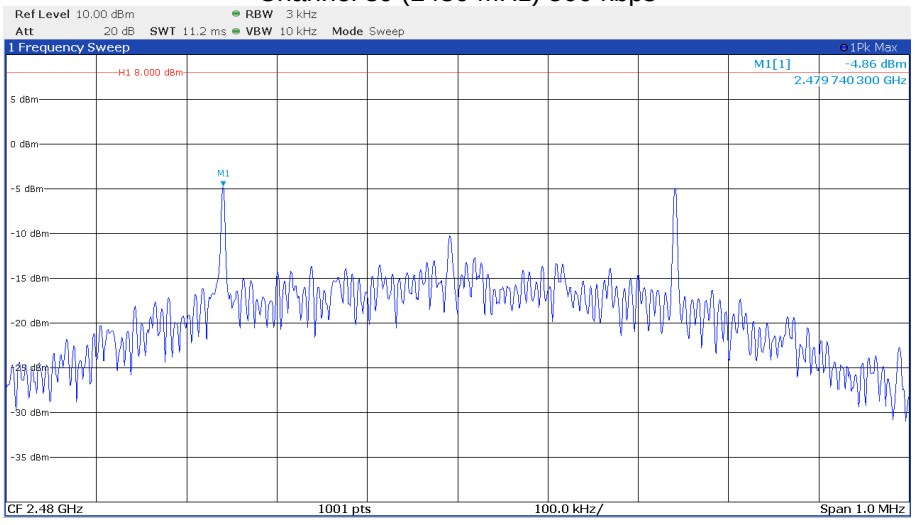
Channel 37 (2402 MHz) 500 kbps



Channel 18 (2442 MHz) 500 kbps

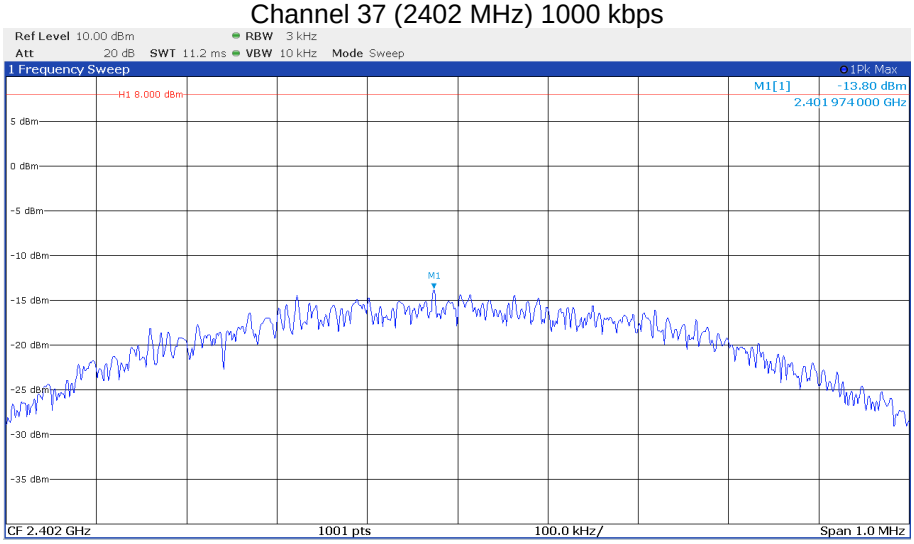


Channel 39 (2480 MHz) 500 kbps

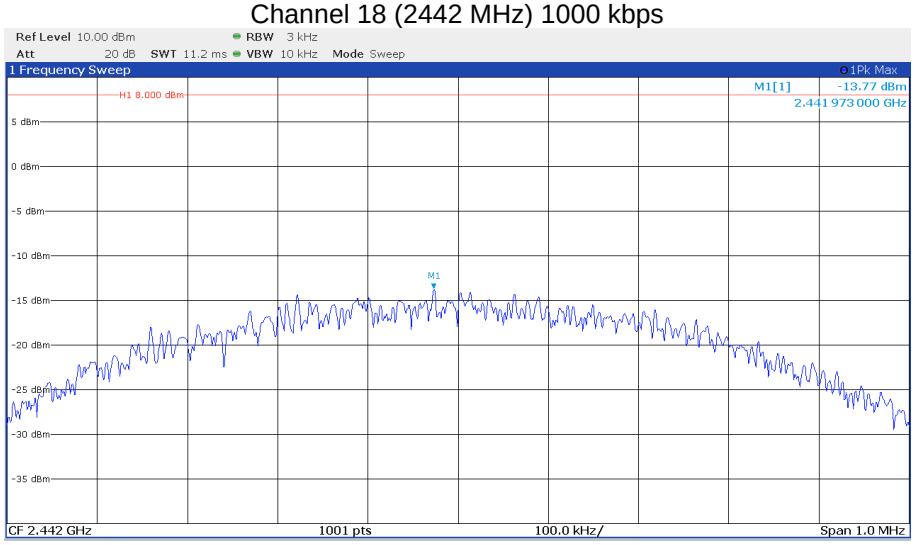


FCC ID: KR5FBD5MY23 IC ID:7812D-FBD5MY23

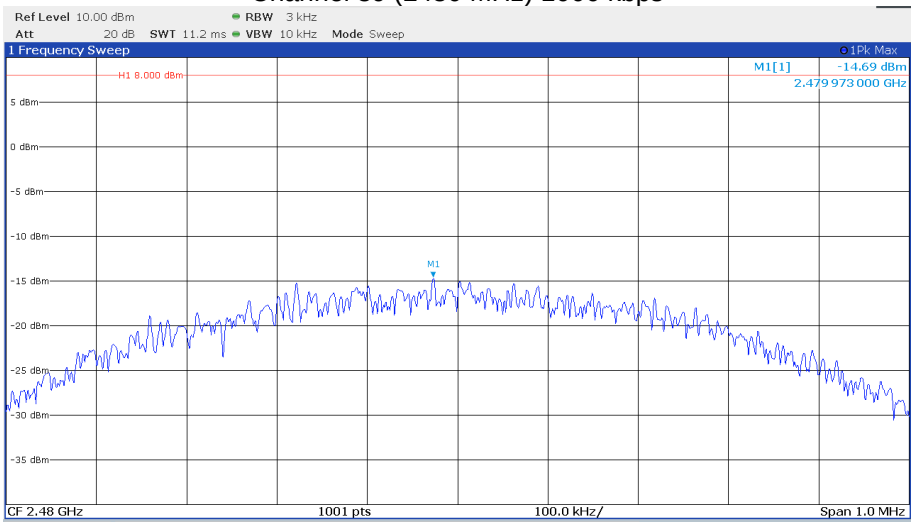
Channel 37 (2402 MHz) 1000 kbps



Channel 18 (2442 MHz) 1000 kbps



Channel 39 (2480 MHz) 1000 kbps



5.5 Radiated emissions in restricted bands

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

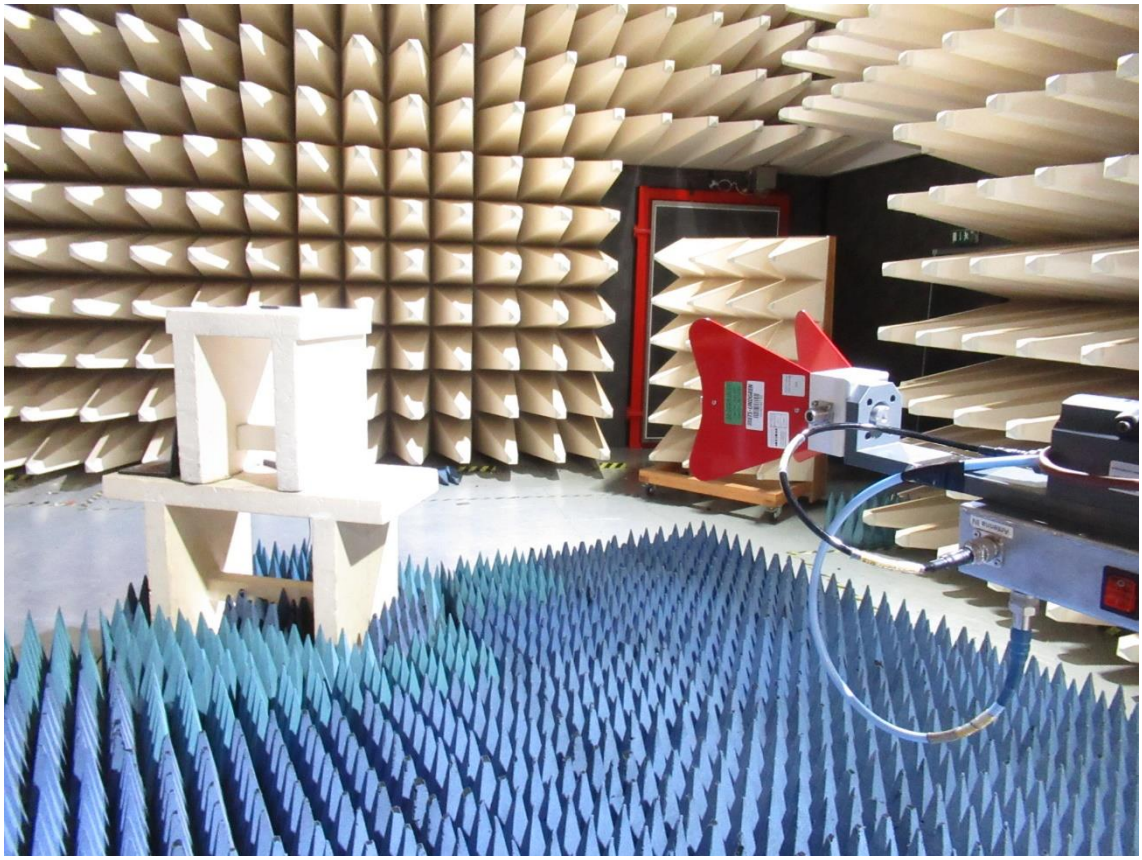
5.5.1 Description of the test location

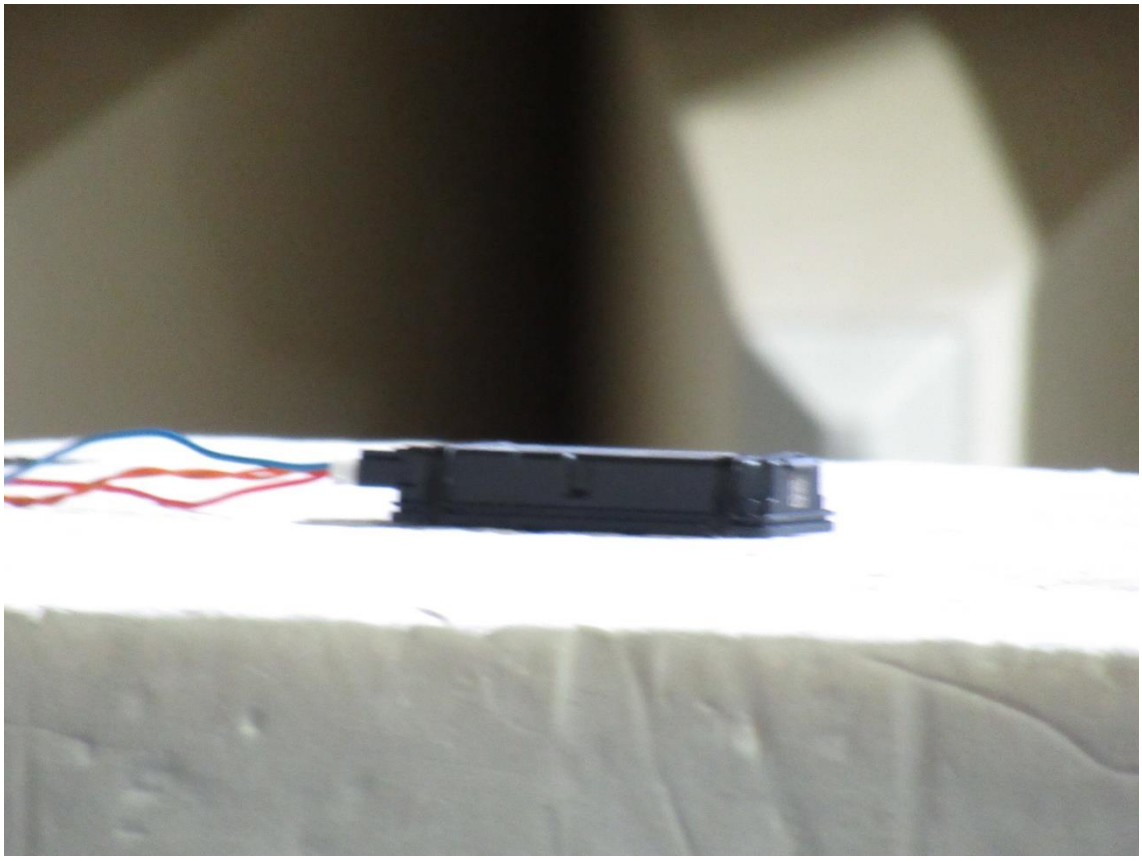
Test location: OATS 1
Test location: Anechoic chamber 1

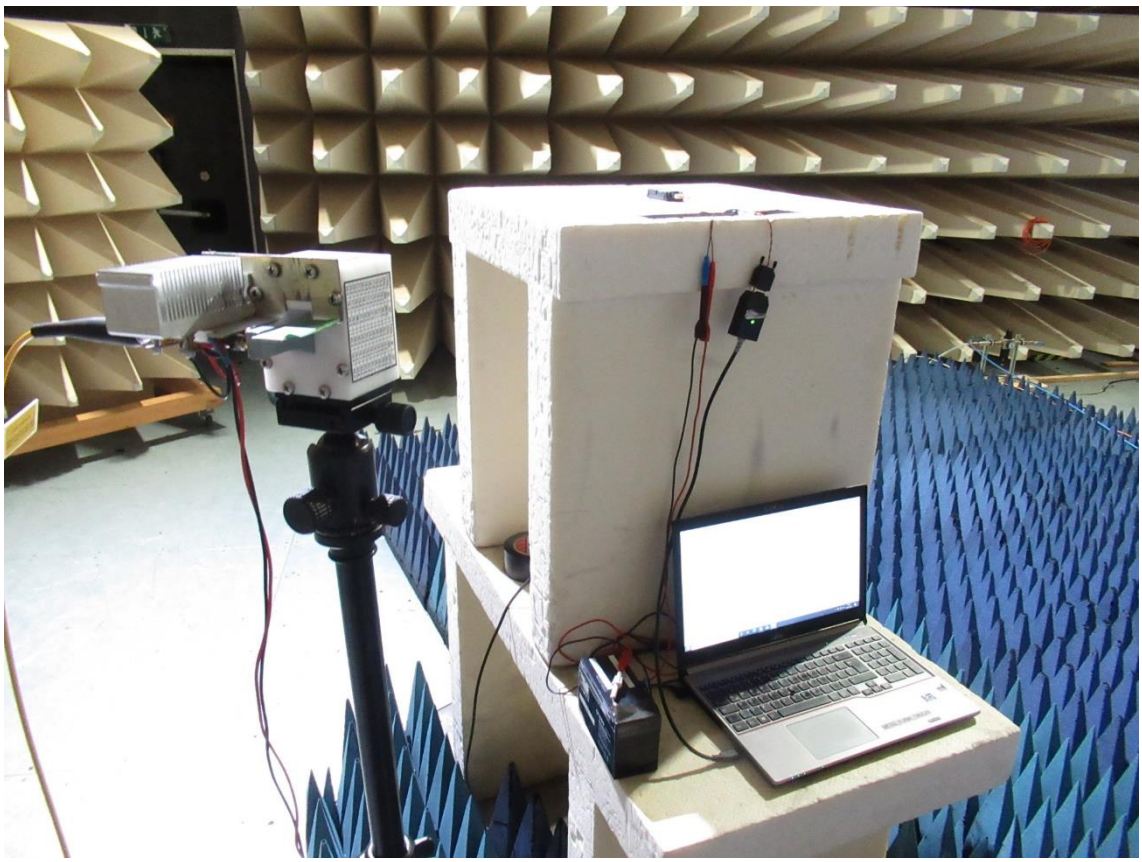
Test distance: 3 m

5.5.2 Photo documentation of the test set-up

FCC ID: KR5FBD5MY23 IC ID:7812D-FBD5MY23







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: Auto

5.5.4 Test result

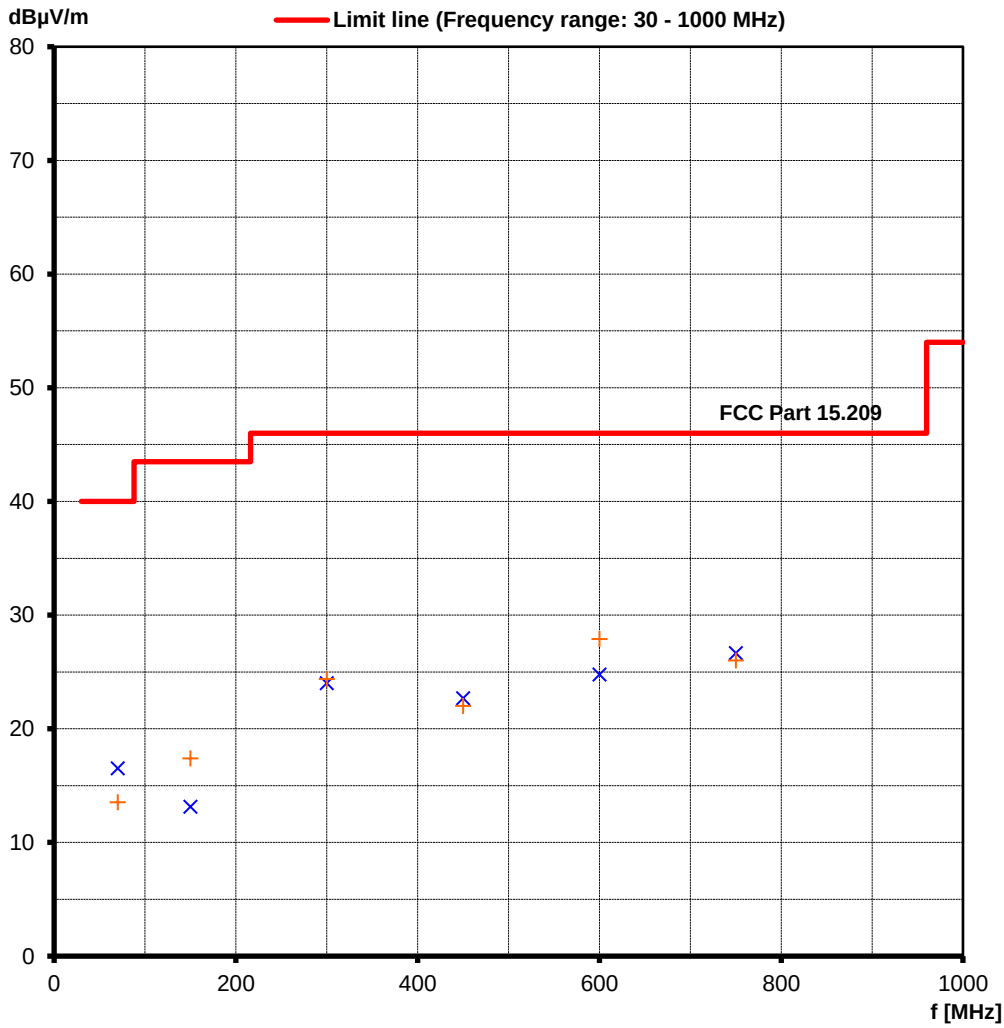
5.5.4.1 Measurement 9 kHz to 30 MHz

Note: Pre-measurements have shown, there are no detectable emissions in this frequency range.

5.5.4.2 Measurement 30 MHz to 960 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)
70.00	2.5	0.2	14.0	13.3	16.5	13.5	40.0	-23.5
150.00	-0.8	2.6	13.9	14.8	13.1	17.4	43.5	-26.1
300.00	7.1	7.9	16.9	16.5	24.0	24.4	46.0	-21.6
450.00	1.5	1.1	21.2	20.9	22.7	22.0	46.0	-23.3
600.00	-0.7	2.6	25.5	25.3	24.8	27.9	46.0	-18.1
750.00	-1.6	-1.7	28.3	27.7	26.7	26.0	46.0	-19.3

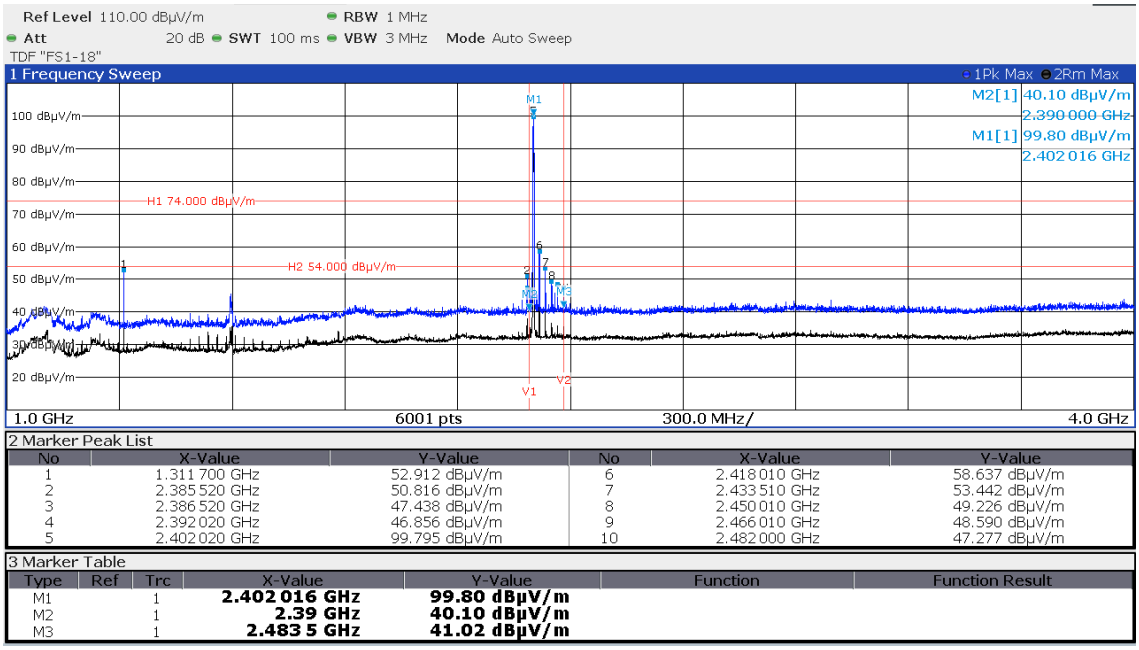
Note: No emissions could be detected in the frequency range f < 1000 MHz. All recorded values represent the noise level of the test site.



FCC ID: KR5FBD5MY23 IC ID:7812D-FBD5MY23

5.5.4.3 f > 1000 MHz

Channel 37 (2402 MHz) 500 kbps hor

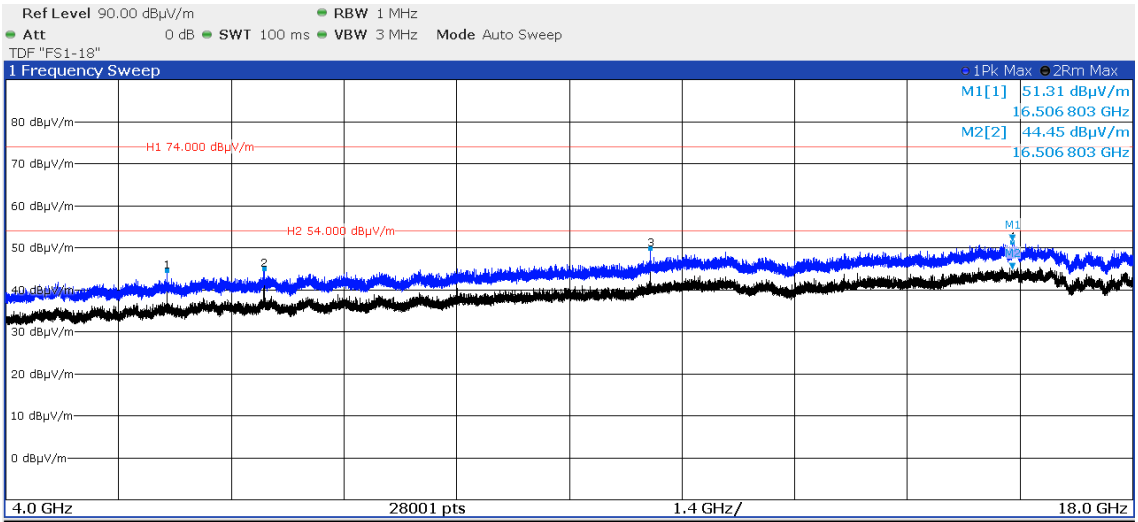


2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	1.311 700 GHz	52.912 dBµV/m	6	2.418 010 GHz	58.637 dBµV/m
2	2.385 520 GHz	50.816 dBµV/m	7	2.433 510 GHz	53.442 dBµV/m
3	2.386 520 GHz	47.438 dBµV/m	8	2.450 010 GHz	49.226 dBµV/m
4	2.392 020 GHz	46.856 dBµV/m	9	2.466 010 GHz	48.590 dBµV/m
5	2.402 020 GHz	99.795 dBµV/m	10	2.482 000 GHz	47.277 dBµV/m

3 Marker Table

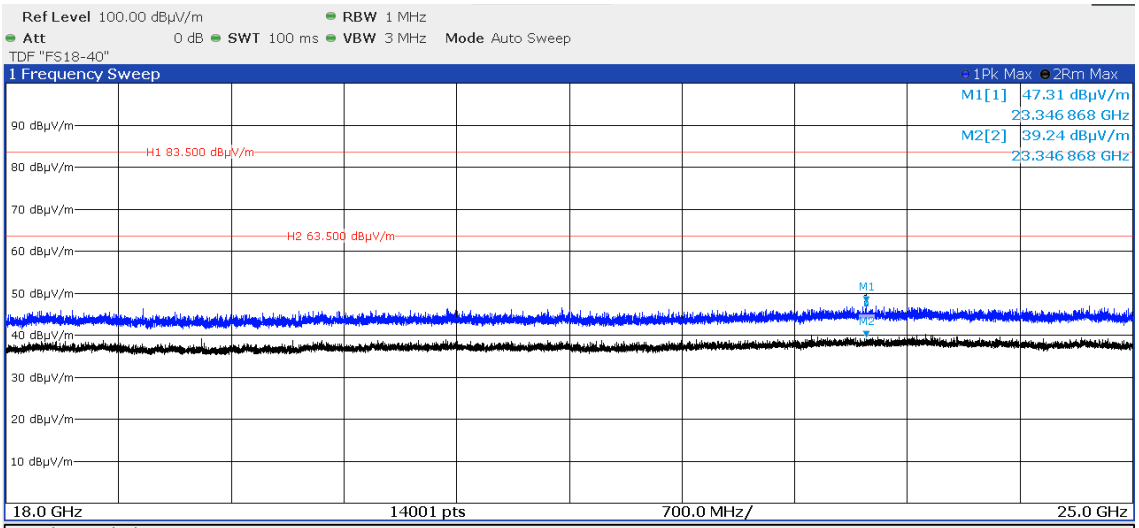
Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**2.402 016 GHz**	**99.80 dBµV/m**		
M2		1	**2.39 GHz**	**40.10 dBµV/m**		
M3		1	**2.483 5 GHz**	**41.02 dBµV/m**		



2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	5.999 180 GHz	44.490 dBµV/m	3	12.008 460 GHz	49.779 dBµV/m
2	7.206 140 GHz	44.923 dBµV/m	4	16.506 800 GHz	51.307 dBµV/m

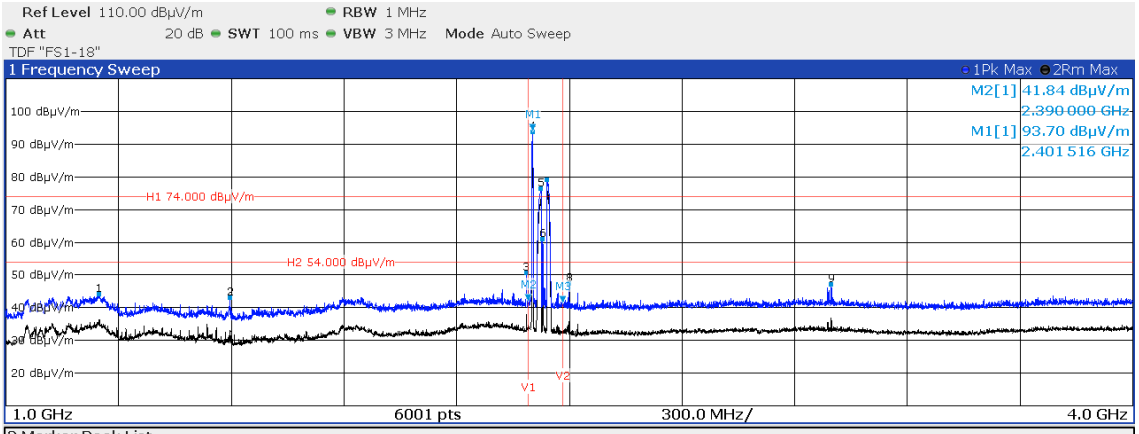
FCC ID: KR5FBD5MY23 IC ID:7812D-FBD5MY23



2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	23.346 870 GHz	47.311 dBµV/m			

Channel 37 (2402 MHz) 500 kbps ver



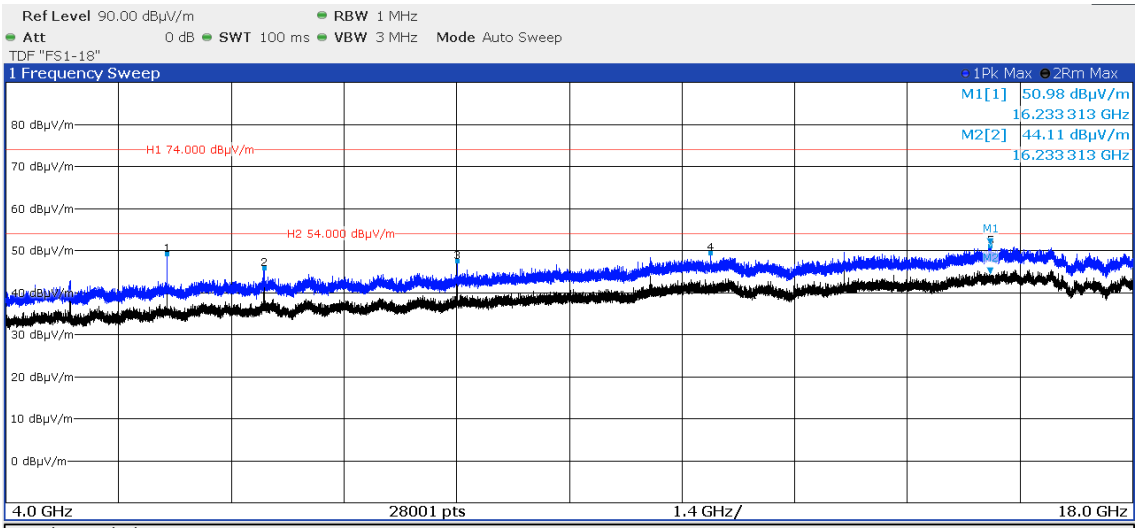
2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	1.247 710 GHz	44.229 dBµV/m	6	2.429 010 GHz	60.815 dBµV/m
2	1.596 650 GHz	43.007 dBµV/m	7	2.440 510 GHz	78.995 dBµV/m
3	2.385 520 GHz	50.728 dBµV/m	8	2.499 500 GHz	47.377 dBµV/m
4	2.401 520 GHz	93.705 dBµV/m	9	3.197 380 GHz	47.151 dBµV/m
5	2.423 510 GHz	76.491 dBµV/m			

3 Marker Table

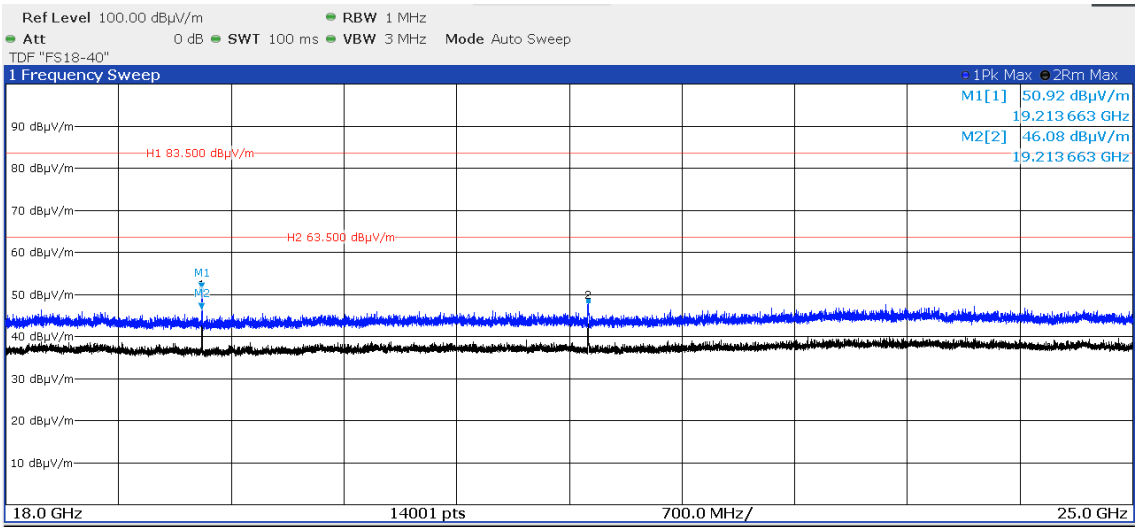
Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**2.401 516 GHz**	**93.70 dBµV/m**		
M2		1	**2.39 GHz**	**41.84 dBµV/m**		
M3		1	**2.483 5 GHz**	**41.26 dBµV/m**		

FCC ID: KR5FBD5MY23 IC ID:7812D-FBD5MY23



2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	6.000 180 GHz	49.210 dBµV/m	4	12.750 440 GHz	49.299 dBµV/m
2	7.206 140 GHz	45.789 dBµV/m	5	16.233 310 GHz	50.976 dBµV/m
3	9.607 050 GHz	47.476 dBµV/m			

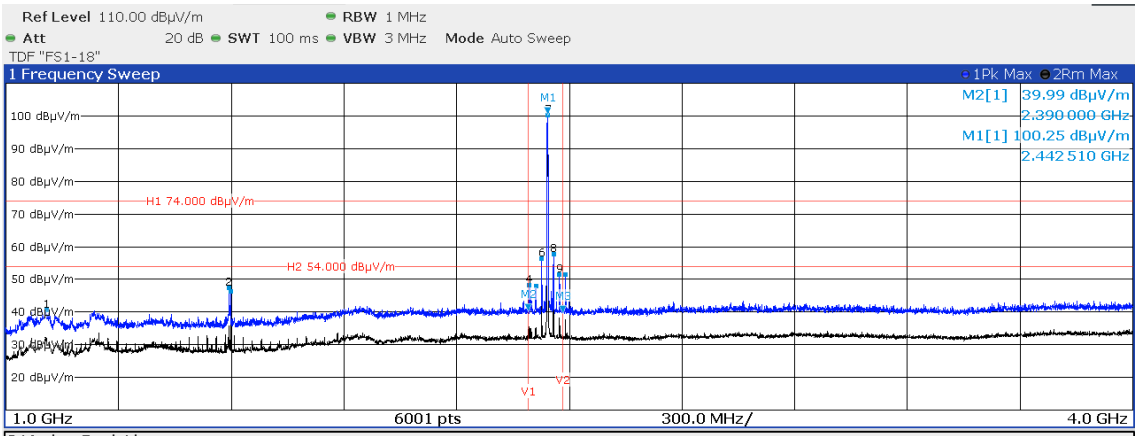


2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	19.213 660 GHz	50.917 dBµV/m	2	21.616 490 GHz	48.362 dBµV/m

FCC ID: KR5FBD5MY23 IC ID:7812D-FBD5MY23

Channel 18 (2442 MHz) 500 kbps hor

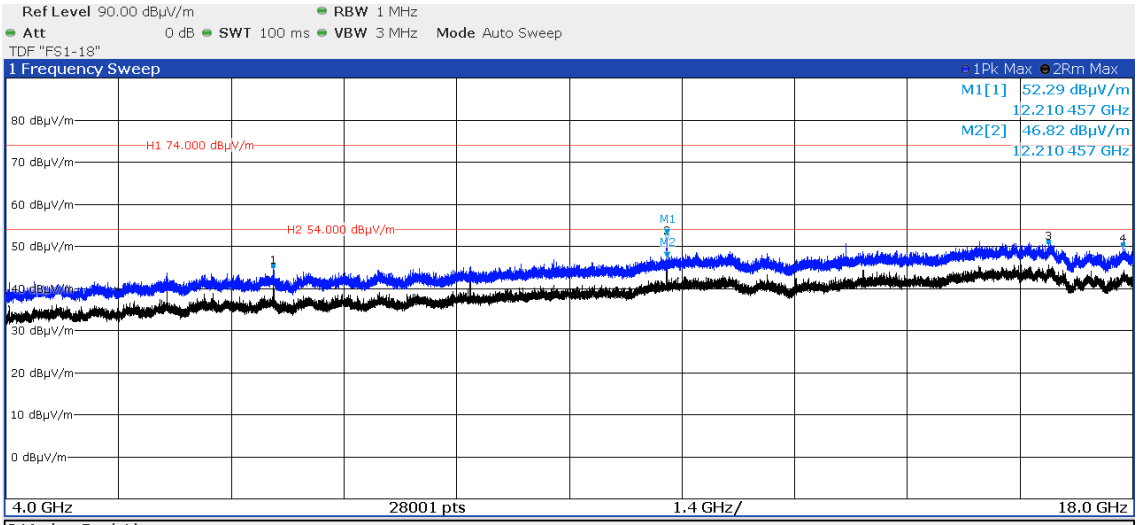


2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	1.107 230 GHz	40.543 dBµV/m	6	2.426 510 GHz	56.382 dBµV/m
2	1.593 650 GHz	47.417 dBµV/m	7	2.442 510 GHz	100.253 dBµV/m
3	1.598 150 GHz	46.364 dBµV/m	8	2.458 010 GHz	57.765 dBµV/m
4	2.393 520 GHz	48.305 dBµV/m	9	2.473 500 GHz	51.590 dBµV/m
5	2.410 510 GHz	47.820 dBµV/m	10	2.490 000 GHz	51.594 dBµV/m

3 Marker Table

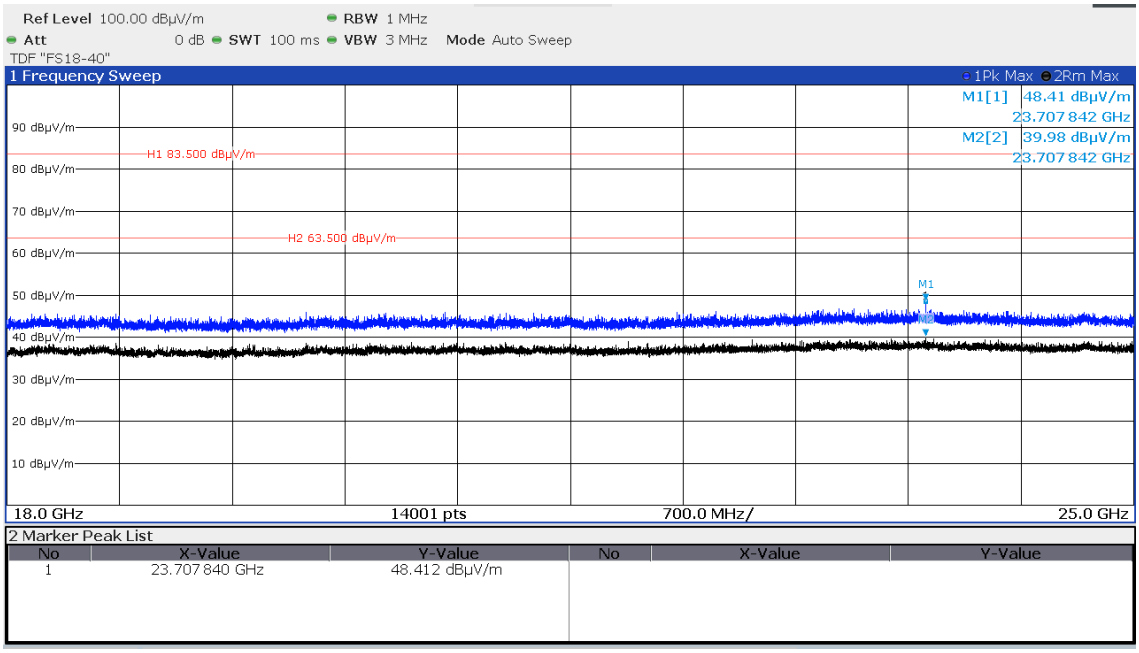
Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**2.442 51 GHz**	**100.25 dBµV/m**		
M2		1	**2.39 GHz**	**39.99 dBµV/m**		
M3		1	**2.483 5 GHz**	**39.63 dBµV/m**		



2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	7.326 630 GHz	45.406 dBµV/m	3	16.953 290 GHz	51.000 dBµV/m
2	12.210 460 GHz	52.293 dBµV/m	4	17.880 250 GHz	50.412 dBµV/m

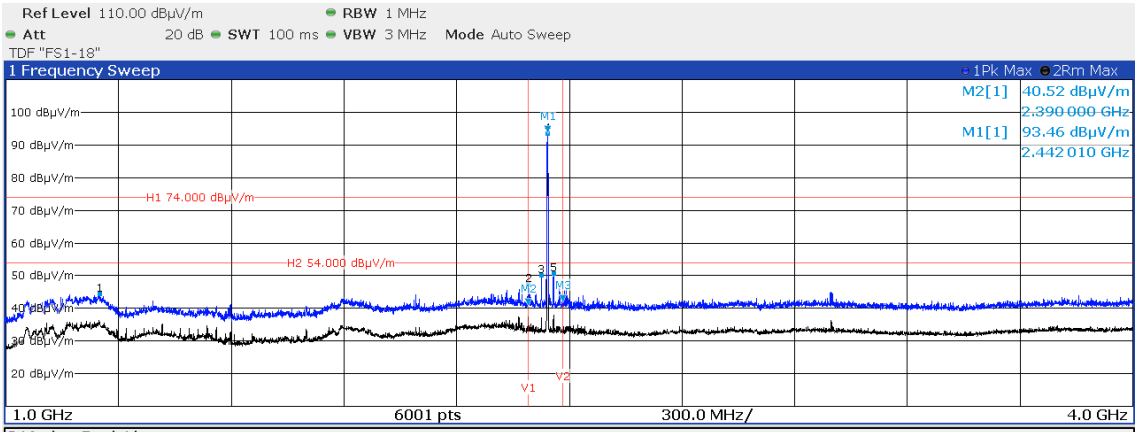
FCC ID: KR5FBD5MY23 IC ID:7812D-FBD5MY23



2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	23.707 840 GHz	48.412 dBµV/m			

Channel 18 (2442 MHz) 500 kbps ver



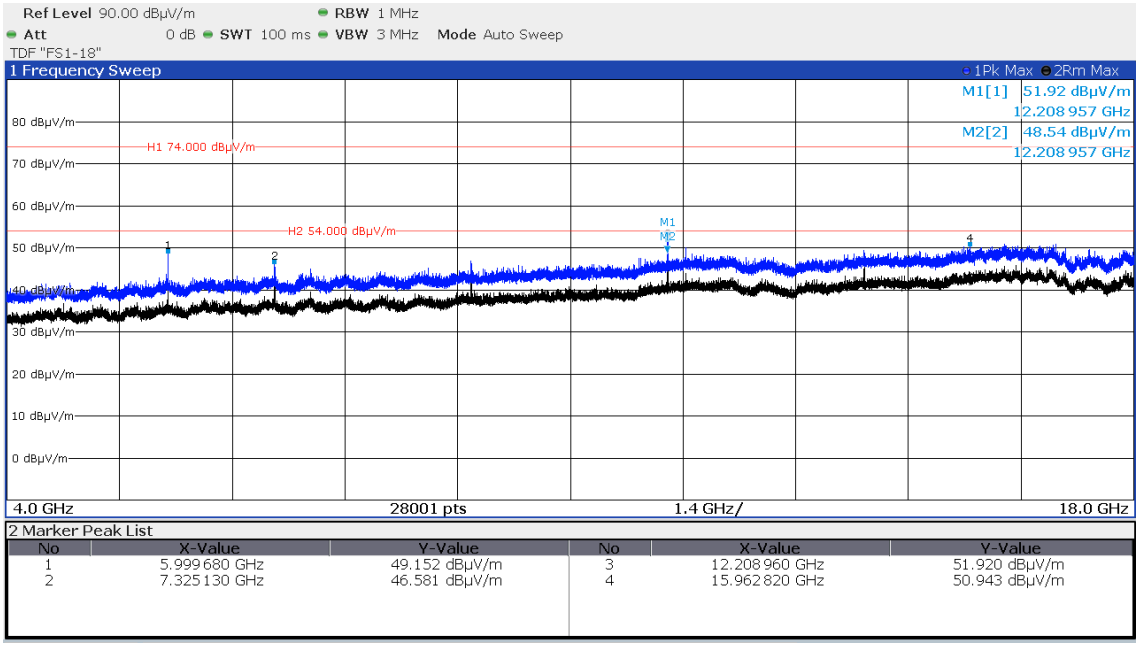
2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	1.250 210 GHz	44.521 dBµV/m	4	2.442 010 GHz	93.462 dBµV/m
2	2.391 520 GHz	47.399 dBµV/m	5	2.458 010 GHz	50.751 dBµV/m
3	2.425 510 GHz	50.031 dBµV/m			

3 Marker Table

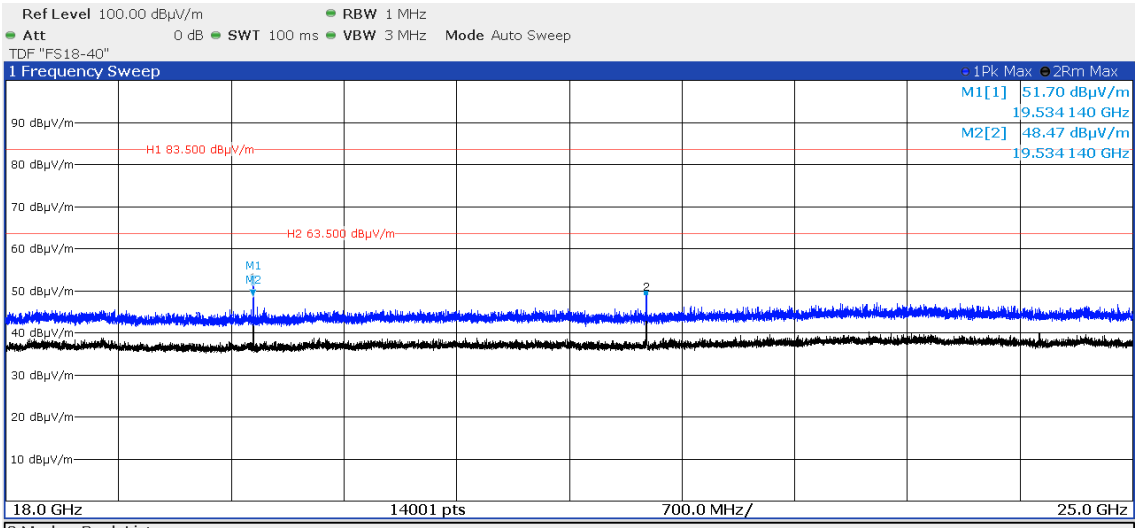
Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**2.442 01 GHz**	**93.46 dBµV/m**		
M2		1	**2.39 GHz**	**40.52 dBµV/m**		
M3		1	**2.483 5 GHz**	**41.70 dBµV/m**		

FCC ID: KR5FBD5MY23 IC ID:7812D-FBD5MY23



2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	5.999 680 GHz	49.152 dBµV/m	3	12.208 960 GHz	51.920 dBµV/m
2	7.325 130 GHz	46.581 dBµV/m	4	15.962 820 GHz	50.943 dBµV/m

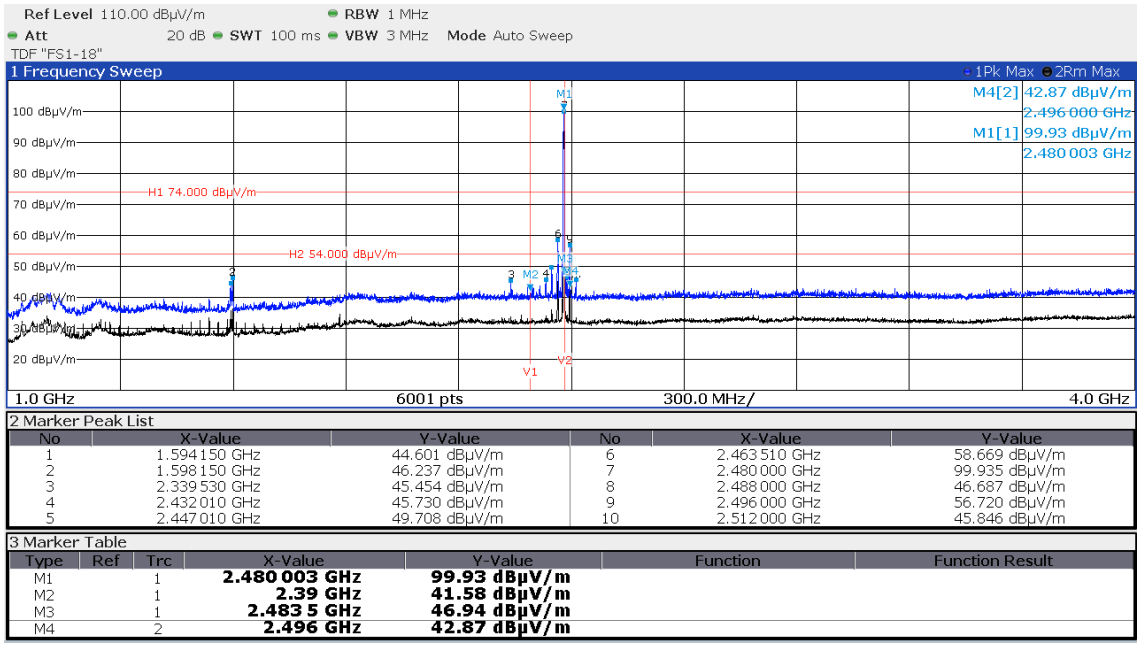


2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	19.534 140 GHz	51.705 dBµV/m	2	21.975 970 GHz	49.515 dBµV/m

FCC ID: KR5FBD5MY23 IC ID:7812D-FBD5MY23

Channel 39 (2480 MHz) 500 kbps hor

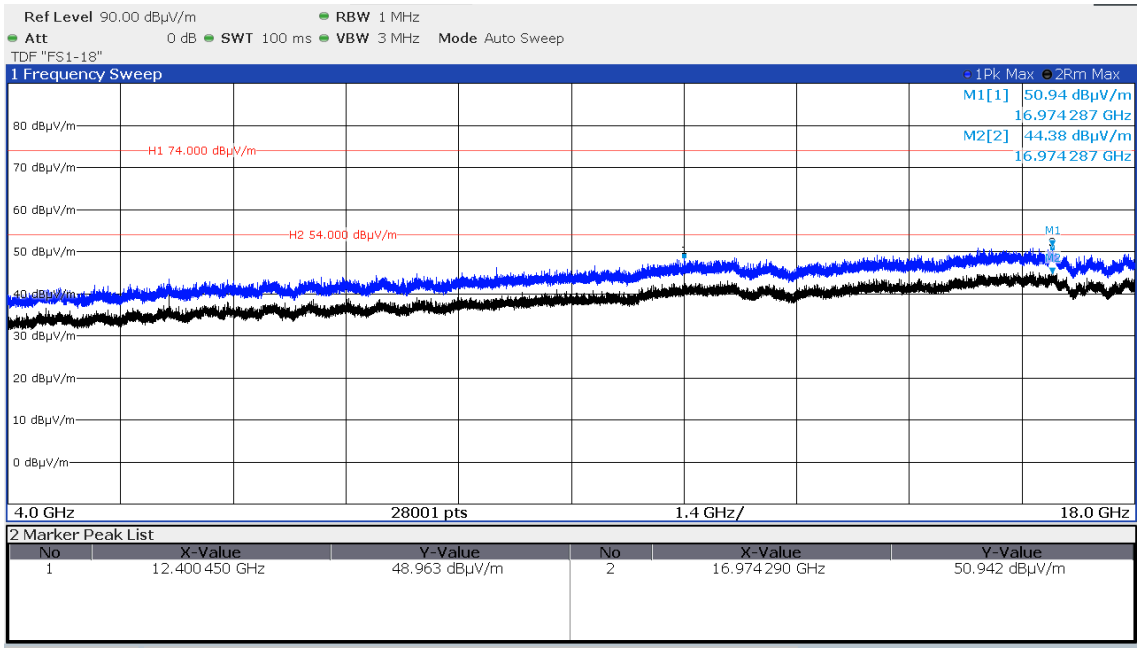


2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	1.594 150 GHz	44.601 dBµV/m	6	2.463 510 GHz	58.669 dBµV/m
2	1.598 150 GHz	46.237 dBµV/m	7	2.480 000 GHz	99.935 dBµV/m
3	2.339 530 GHz	45.454 dBµV/m	8	2.488 000 GHz	46.687 dBµV/m
4	2.432 010 GHz	45.730 dBµV/m	9	2.496 000 GHz	56.720 dBµV/m
5	2.447 010 GHz	49.708 dBµV/m	10	2.512 000 GHz	45.846 dBµV/m

3 Marker Table

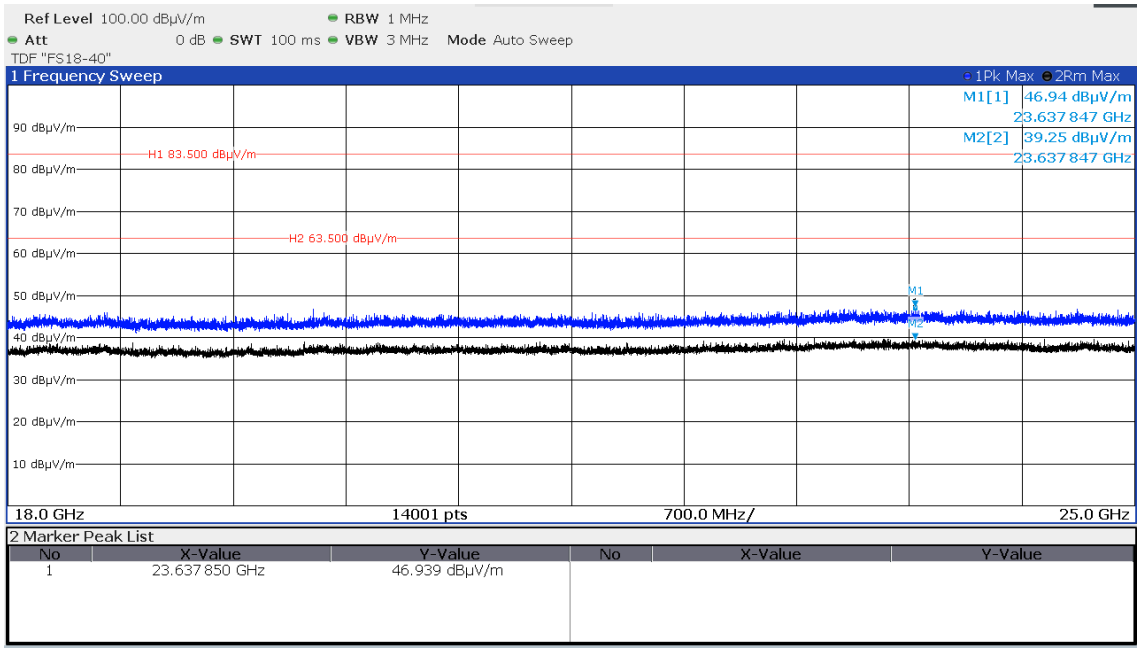
Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**2.480 003 GHz**	**99.93 dBµV/m**		
M2		1	**2.39 GHz**	**41.58 dBµV/m**		
M3		1	**2.483 5 GHz**	**46.94 dBµV/m**		
M4		2	**2.496 GHz**	**42.87 dBµV/m**		



2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	12.400 450 GHz	48.963 dBµV/m	2	16.974 290 GHz	50.942 dBµV/m

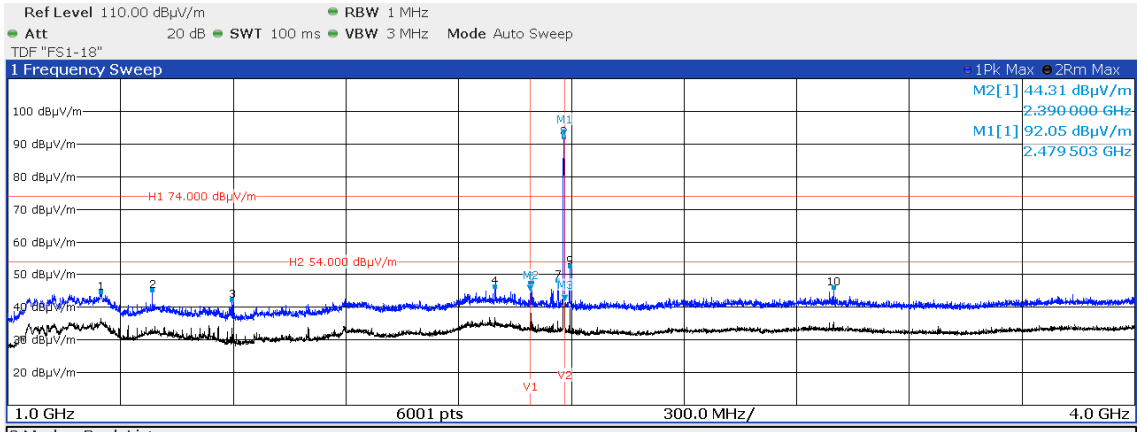
FCC ID: KR5FBD5MY23 IC ID:7812D-FBD5MY23



2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	23.637 850 GHz	46.939 dBµV/m			

Channel 39 (2480 MHz) 500 kbps ver



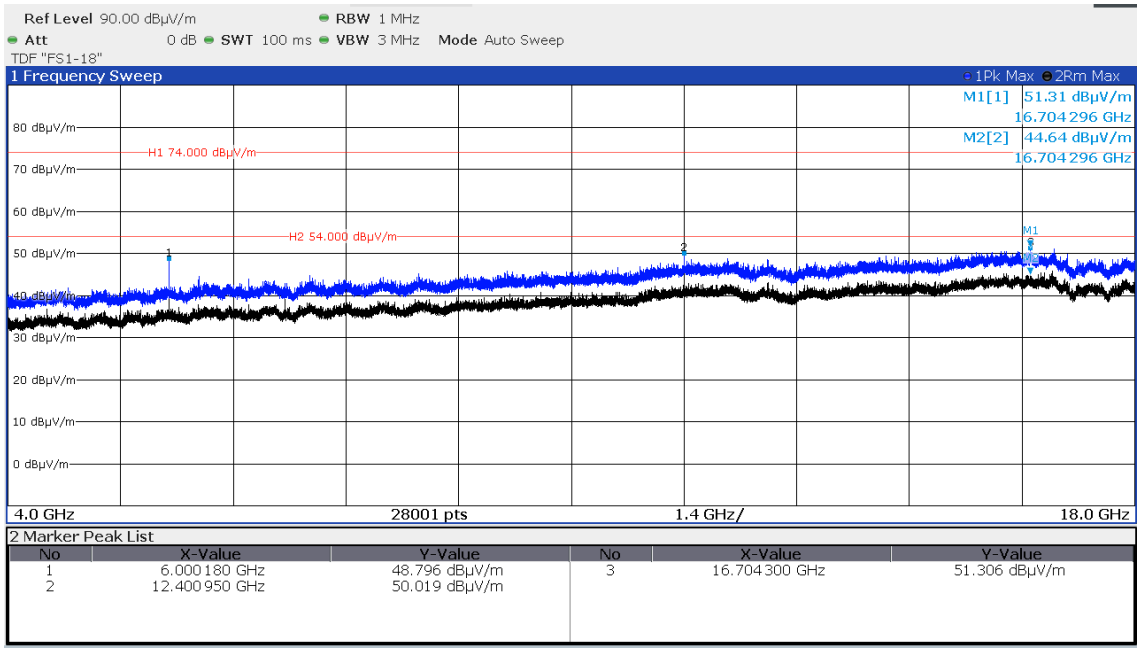
2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	1.248 210 GHz	44.713 dBµV/m	6	2.394 520 GHz	47.766 dBµV/m
2	1.385 190 GHz	45.180 dBµV/m	7	2.464 010 GHz	48.164 dBµV/m
3	1.597 150 GHz	42.236 dBµV/m	8	2.479 500 GHz	92.048 dBµV/m
4	2.296 530 GHz	46.371 dBµV/m	9	2.496 000 GHz	52.628 dBµV/m
5	2.391 520 GHz	47.326 dBµV/m	10	3.198 380 GHz	45.998 dBµV/m

3 Marker Table

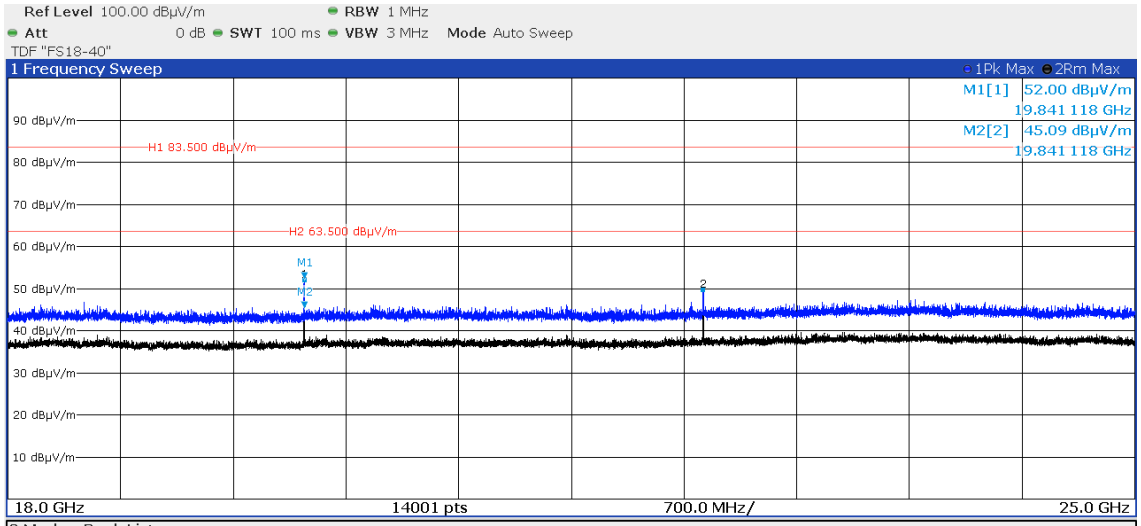
Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**2.479 503 GHz**	**92.05 dBµV/m**		
M2		1	**2.39 GHz**	**44.31 dBµV/m**		
M3		1	**2.483 5 GHz**	**41.47 dBµV/m**		

FCC ID: KR5FBD5MY23 IC ID:7812D-FBD5MY23



2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	6.000180 GHz	48.796 dBµV/m	3	16.704300 GHz	51.306 dBµV/m
2	12.400950 GHz	50.019 dBµV/m			

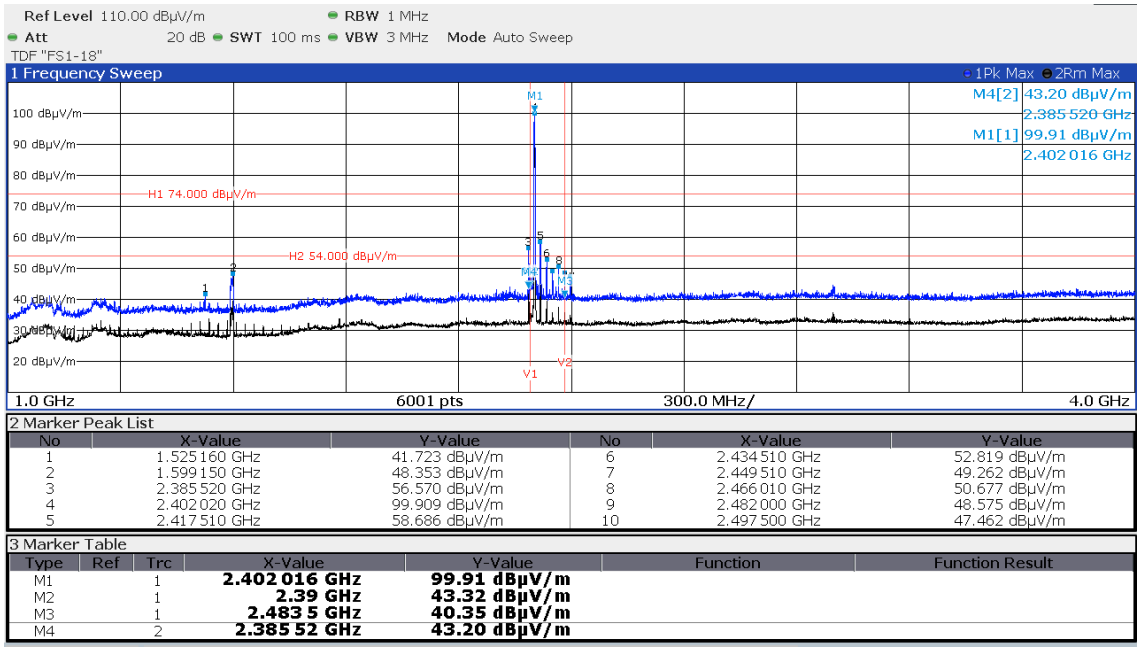


2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	19.841120 GHz	51.999 dBµV/m	2	22.317940 GHz	49.746 dBµV/m

FCC ID: KR5FBD5MY23 IC ID:7812D-FBD5MY23

Channel 37 (2402 MHz) 1000 kbps hor

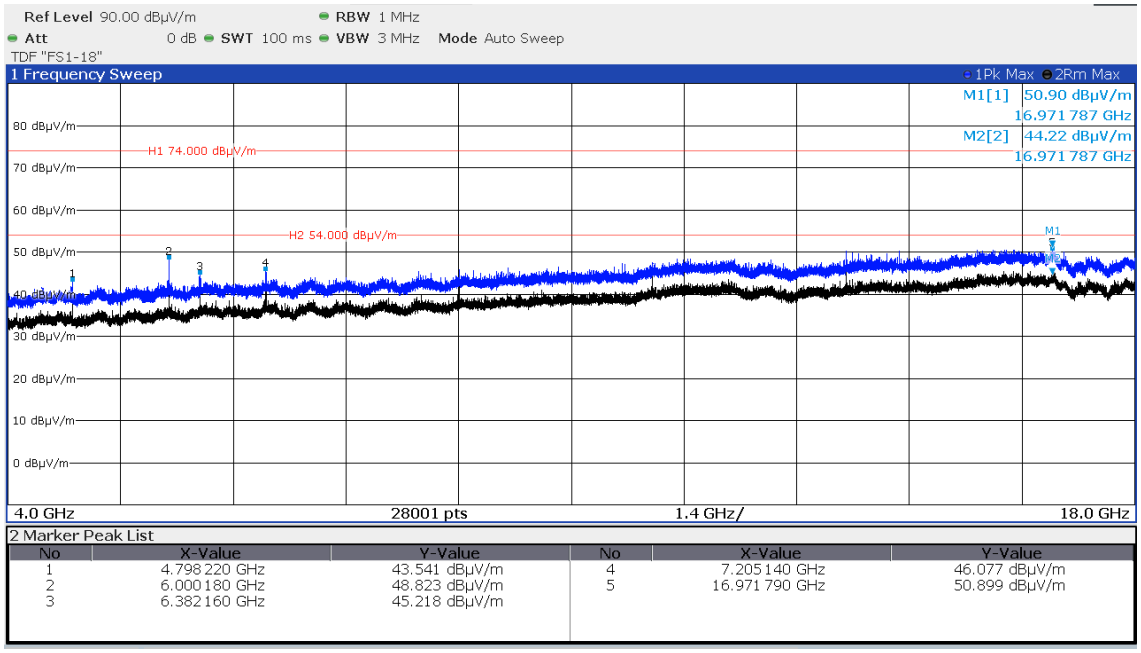


2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	1.525 160 GHz	41.723 dBµV/m	6	2.434 510 GHz	52.819 dBµV/m
2	1.599 150 GHz	48.353 dBµV/m	7	2.449 510 GHz	49.262 dBµV/m
3	2.385 520 GHz	56.570 dBµV/m	8	2.466 010 GHz	50.677 dBµV/m
4	2.402 020 GHz	99.909 dBµV/m	9	2.482 000 GHz	48.575 dBµV/m
5	2.417 510 GHz	58.686 dBµV/m	10	2.497 500 GHz	47.462 dBµV/m

3 Marker Table

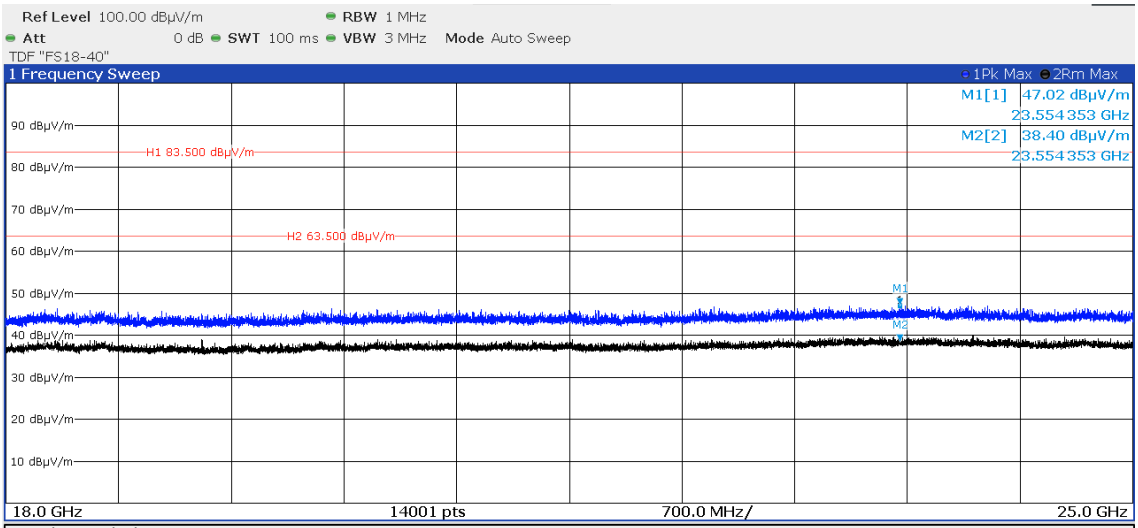
Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**2.402 016 GHz**	**99.91 dBµV/m**		
M2		1	**2.39 GHz**	**43.32 dBµV/m**		
M3		1	**2.483 5 GHz**	**40.35 dBµV/m**		
M4		2	**2.385 52 GHz**	**43.20 dBµV/m**		



2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	4.798 220 GHz	43.541 dBµV/m	4	7.205 140 GHz	46.077 dBµV/m
2	6.000 180 GHz	48.823 dBµV/m	5	16.971 790 GHz	50.899 dBµV/m
3	6.382 160 GHz	45.218 dBµV/m			

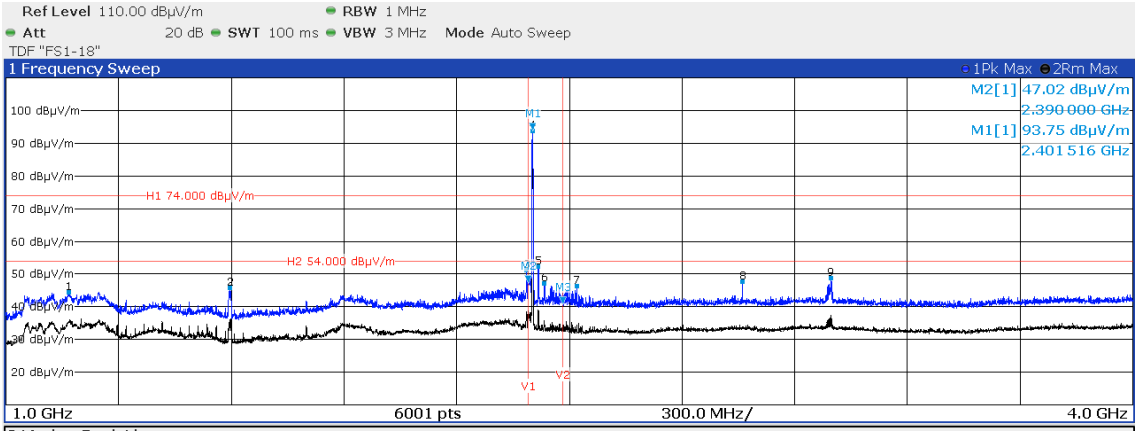
FCC ID: KR5FBD5MY23 IC ID:7812D-FBD5MY23



2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	23.554350 GHz	47.019 dBµV/m			

Channel 37 (2402 MHz) 1000 kbps ver



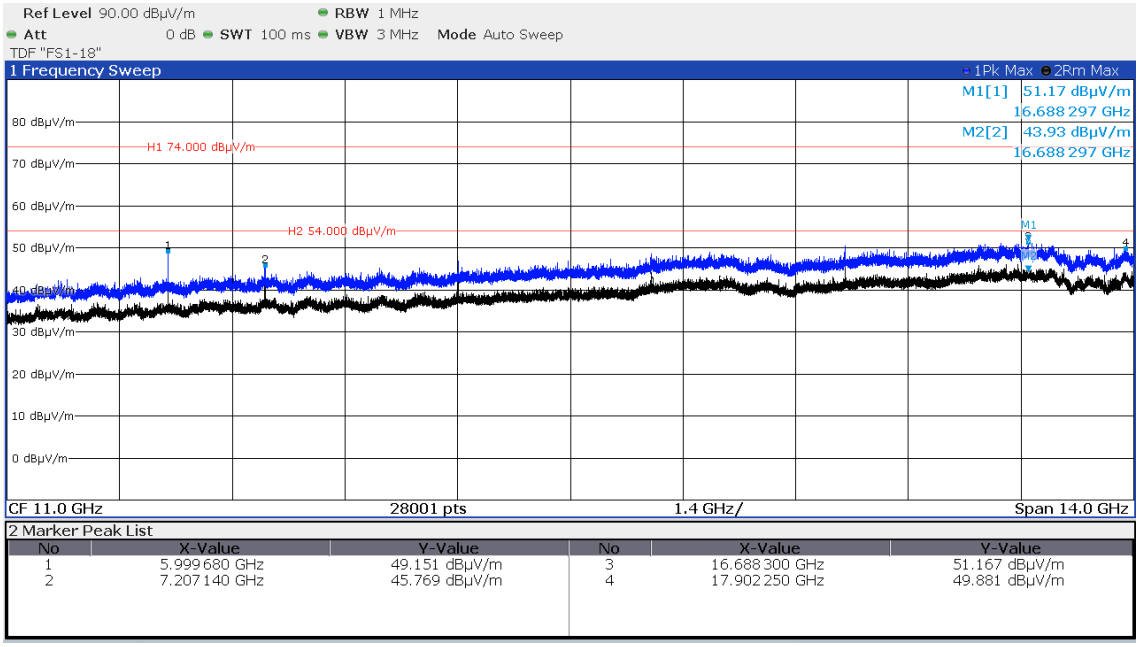
2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	1.167220 GHz	44.420 dBµV/m	6	2.433510 GHz	47.077 dBµV/m
2	1.596650 GHz	45.729 dBµV/m	7	2.520000 GHz	46.242 dBµV/m
3	2.386020 GHz	51.075 dBµV/m	8	2.960920 GHz	47.534 dBµV/m
4	2.401520 GHz	93.755 dBµV/m	9	3.195880 GHz	48.799 dBµV/m
5	2.417510 GHz	52.194 dBµV/m			

3 Marker Table

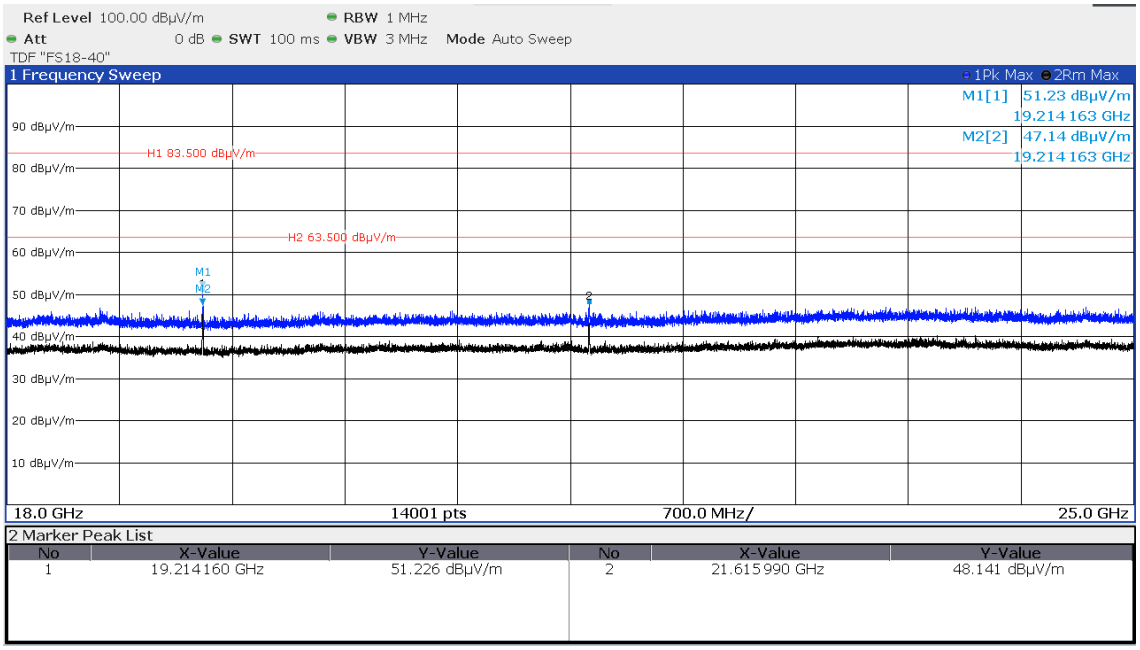
Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**2.401 516 GHz**	**93.75 dBµV/m**		
M2		1	**2.39 GHz**	**47.02 dBµV/m**		
M3		1	**2.483 5 GHz**	**40.66 dBµV/m**		

FCC ID: KR5FBD5MY23 IC ID:7812D-FBD5MY23



2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	5.999 680 GHz	49.151 dBµV/m	3	16.688 300 GHz	51.167 dBµV/m
2	7.207 140 GHz	45.769 dBµV/m	4	17.902 250 GHz	49.881 dBµV/m

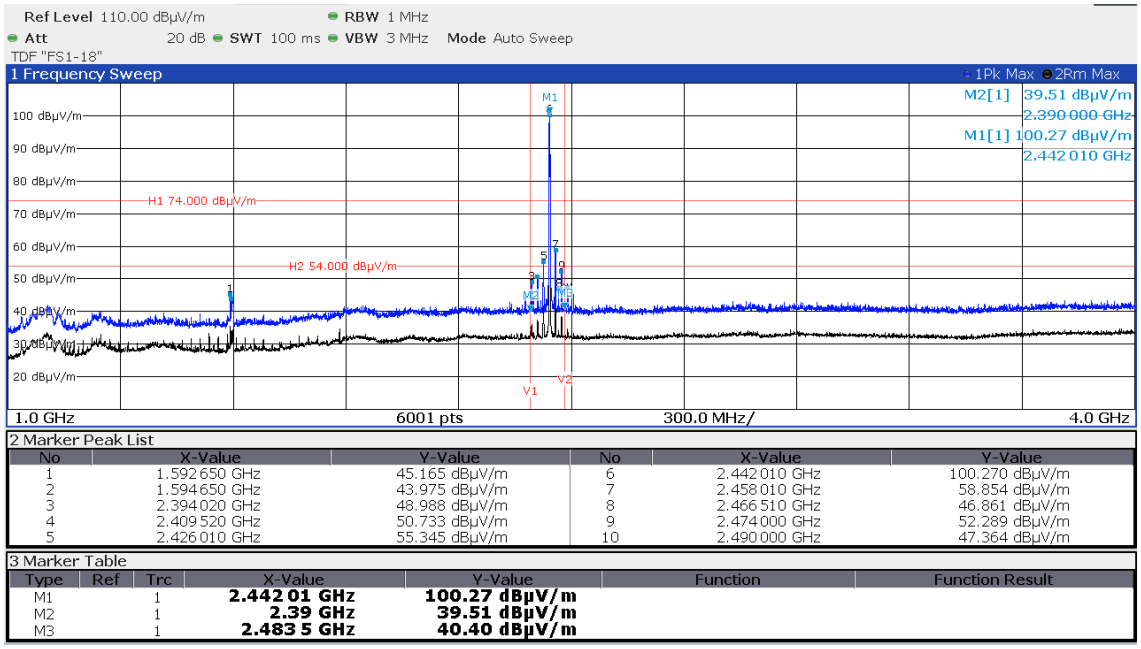


2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	19.214 160 GHz	51.226 dBµV/m	2	21.615 990 GHz	48.141 dBµV/m

FCC ID: KR5FBD5MY23 IC ID:7812D-FBD5MY23

Channel 18 (2442 MHz) 1000 kbps hor

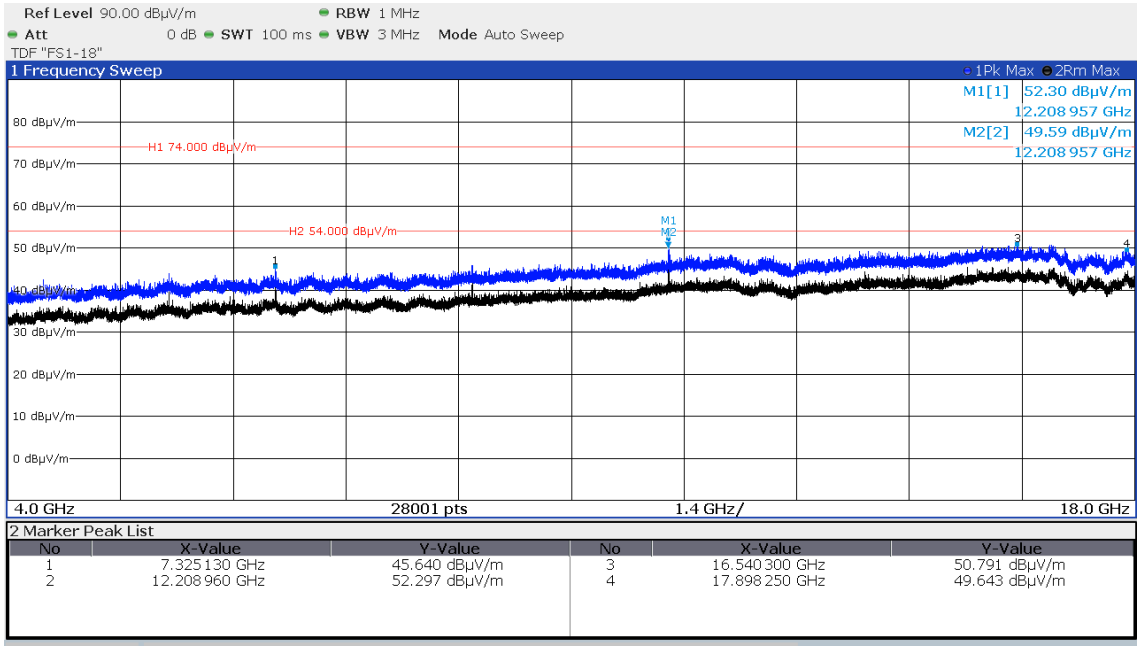


2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	1.592 650 GHz	45.165 dBµV/m	6	2.442 010 GHz	100.270 dBµV/m
2	1.594 650 GHz	43.975 dBµV/m	7	2.458 010 GHz	58.854 dBµV/m
3	2.394 020 GHz	48.988 dBµV/m	8	2.466 510 GHz	46.861 dBµV/m
4	2.409 520 GHz	50.733 dBµV/m	9	2.474 000 GHz	52.289 dBµV/m
5	2.426 010 GHz	55.345 dBµV/m	10	2.490 000 GHz	47.364 dBµV/m

3 Marker Table

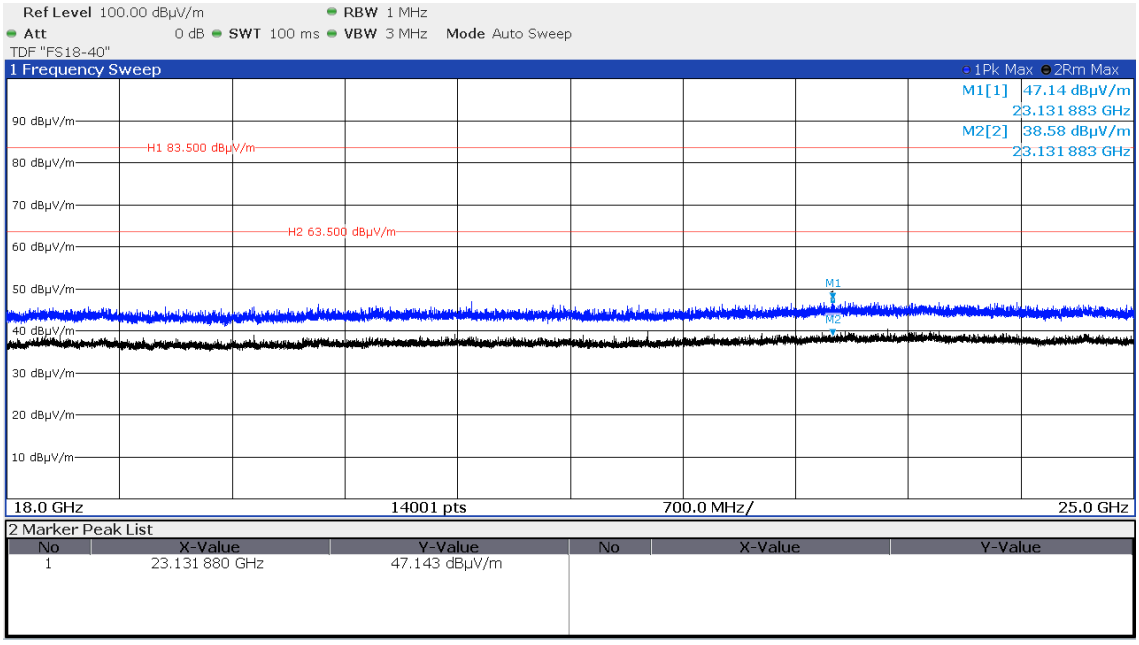
Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**2.442 01 GHz**	**100.27 dBµV/m**		
M2		1	**2.39 GHz**	**39.51 dBµV/m**		
M3		1	**2.483 5 GHz**	**40.40 dBµV/m**		



2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	7.325 130 GHz	45.640 dBµV/m	3	16.540 300 GHz	50.791 dBµV/m
2	12.208 960 GHz	52.297 dBµV/m	4	17.898 250 GHz	49.643 dBµV/m

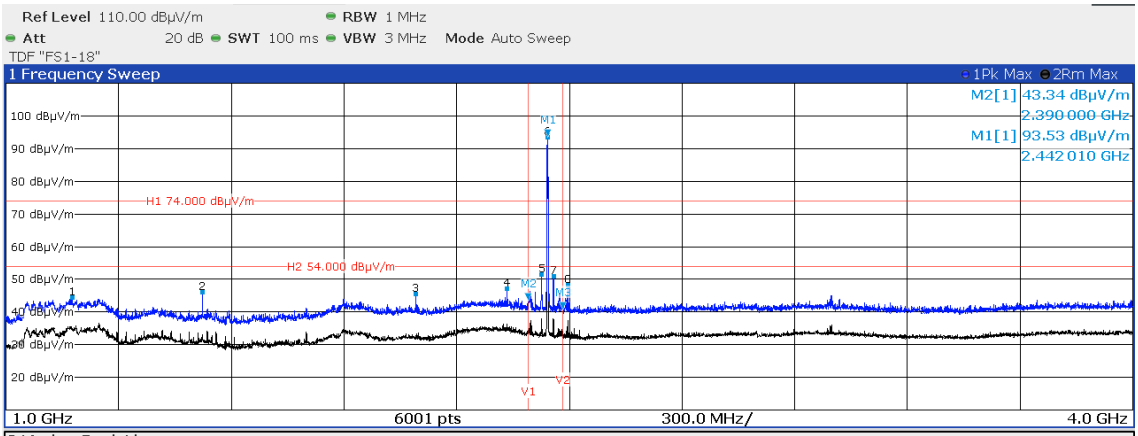
FCC ID: KR5FBD5MY23 IC ID:7812D-FBD5MY23



2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	23.131 880 GHz	47.143 dBµV/m			

Channel 18 (2442 MHz) 1000 kbps ver



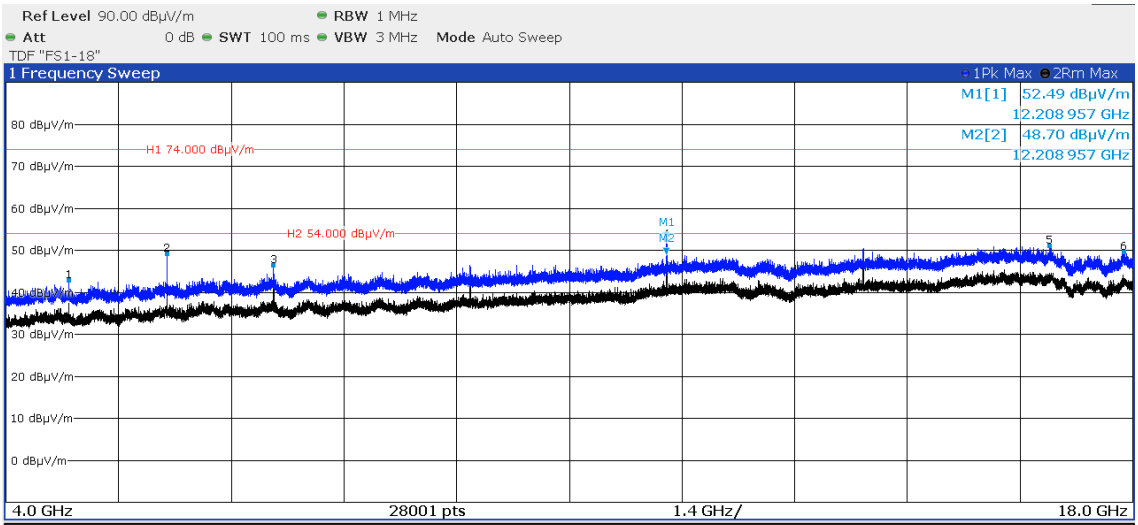
2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	1.175 720 GHz	44.336 dBµV/m	5	2.426 010 GHz	51.503 dBµV/m
2	1.522 660 GHz	46.035 dBµV/m	6	2.442 010 GHz	93.528 dBµV/m
3	2.090 570 GHz	45.426 dBµV/m	7	2.458 010 GHz	50.797 dBµV/m
4	2.333 530 GHz	47.161 dBµV/m	8	2.495 500 GHz	48.110 dBµV/m

3 Marker Table

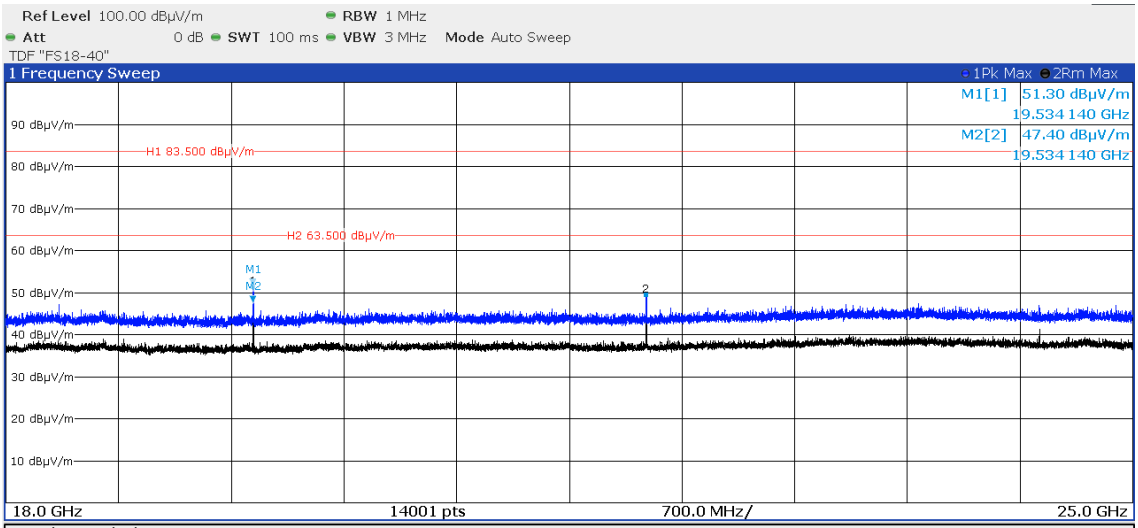
Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**2.442 01 GHz**	**93.53 dBµV/m**		
M2		1	**2.39 GHz**	**43.34 dBµV/m**		
M3		1	**2.483 5 GHz**	**40.58 dBµV/m**		

FCC ID: KR5FBD5MY23 IC ID:7812D-FBD5MY23



2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	4.779 720 GHz	42.820 dBµV/m	4	12.208 960 GHz	52.489 dBµV/m
2	6.000 680 GHz	49.198 dBµV/m	5	16.961 790 GHz	51.081 dBµV/m
3	7.325 130 GHz	46.329 dBµV/m	6	17.889 250 GHz	49.642 dBµV/m

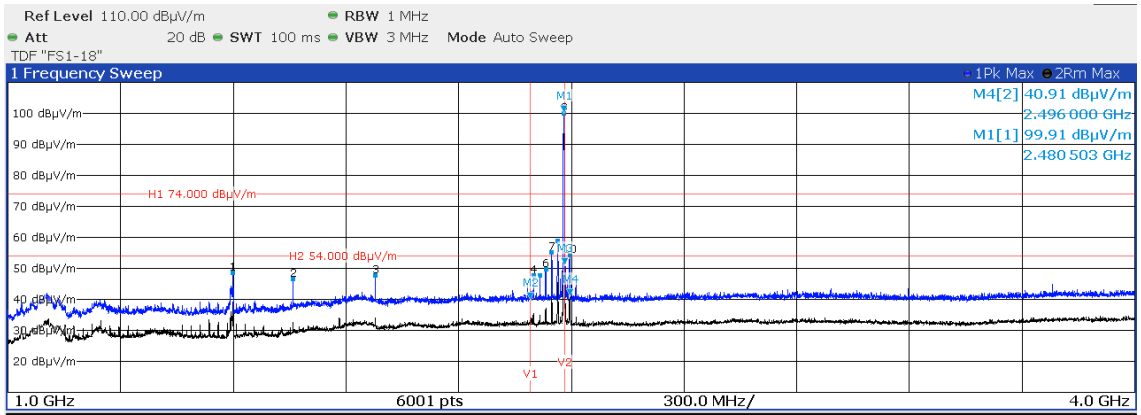


2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	19.534 140 GHz	51.304 dBµV/m	2	21.975 470 GHz	49.536 dBµV/m

FCC ID: KR5FBD5MY23 IC ID:7812D-FBD5MY23

Channel 39 (2480 MHz) 1000 kbps hor

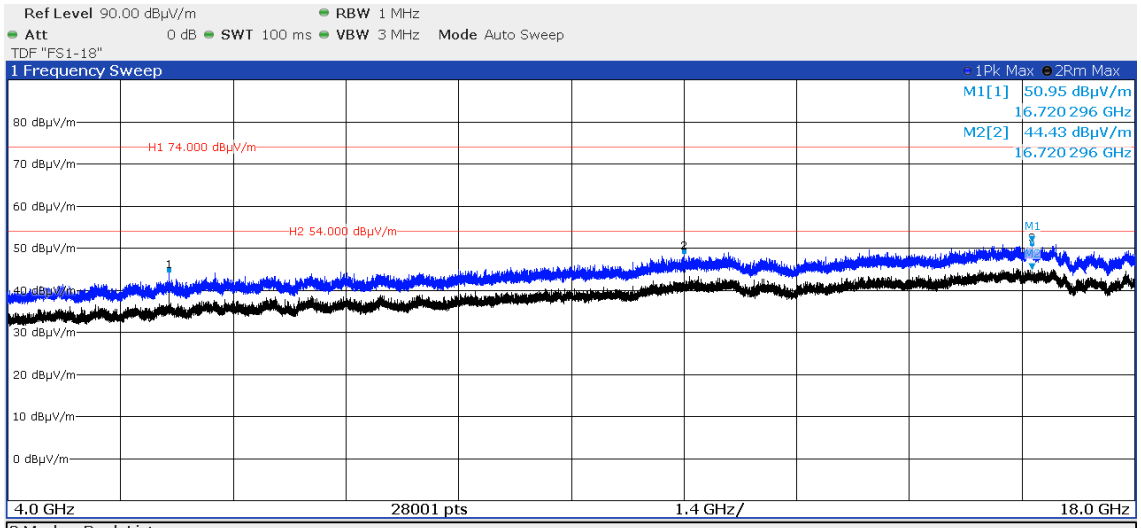


2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	1.599 150 GHz	48.519 dBµV/m	6	2.432 010 GHz	49.673 dBµV/m
2	1.759 120 GHz	46.604 dBµV/m	7	2.447 510 GHz	55.079 dBµV/m
3	1.978 090 GHz	47.793 dBµV/m	8	2.463 510 GHz	58.827 dBµV/m
4	2.399 520 GHz	47.652 dBµV/m	9	2.480 500 GHz	99.911 dBµV/m
5	2.416 010 GHz	47.788 dBµV/m	10	2.496 000 GHz	54.428 dBµV/m

3 Marker Table

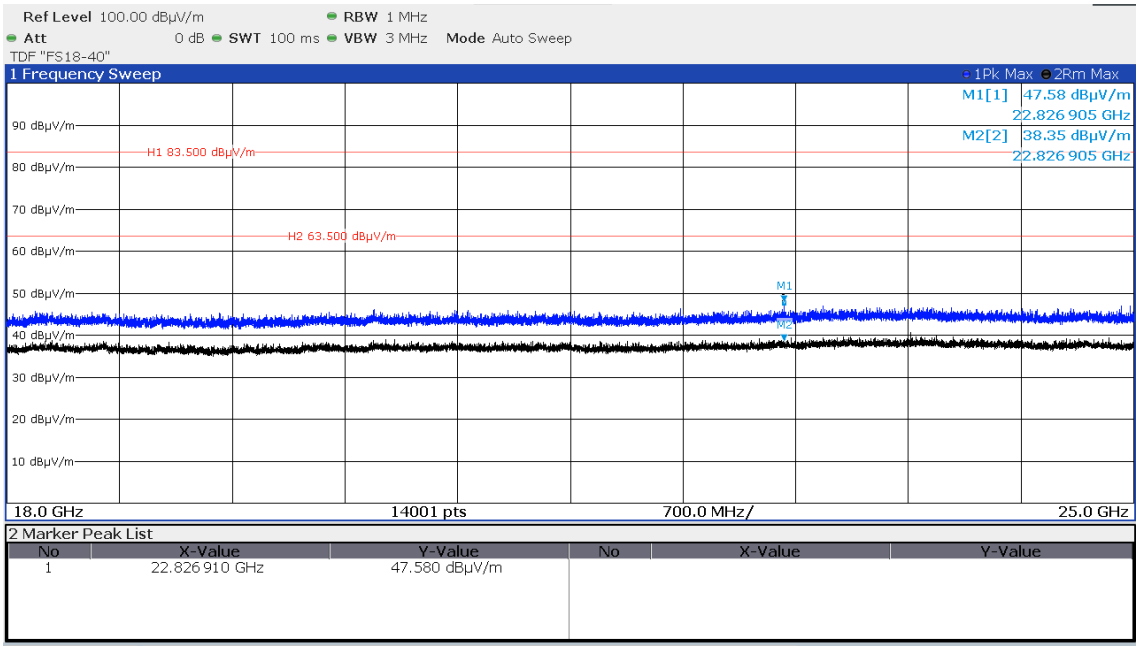
Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**2.480 503 GHz**	**99.91 dBµV/m**		
M2		1	**2.39 GHz**	**39.61 dBµV/m**		
M3		1	**2.483 5 GHz**	**50.99 dBµV/m**		
M4		2	**2.496 GHz**	**40.91 dBµV/m**		



2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	5.999 680 GHz	44.752 dBµV/m	3	16.720 300 GHz	50.948 dBµV/m
2	12.400 450 GHz	49.075 dBµV/m			

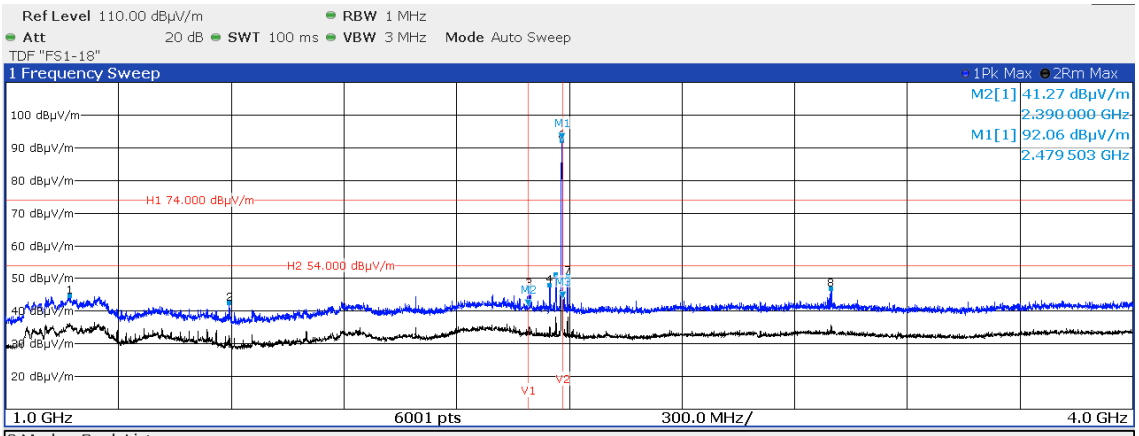
FCC ID: KR5FBD5MY23 IC ID:7812D-FBD5MY23



2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	22.826 910 GHz	47.580 dBµV/m			

Channel 39 (2480 MHz) 1000 kbps ver



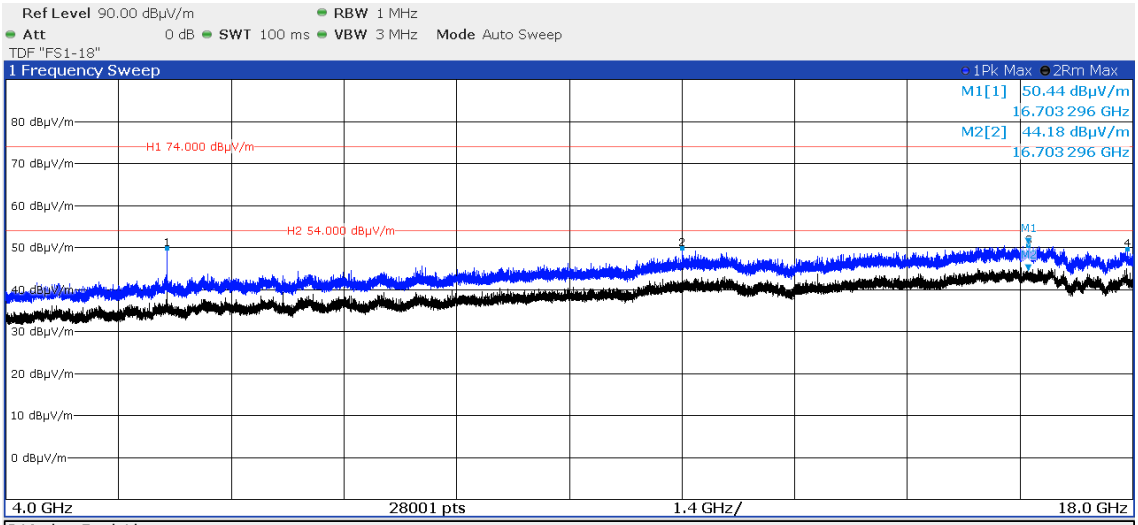
2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	1.168 720 GHz	44.765 dBµV/m	5	2.463 510 GHz	51.256 dBµV/m
2	1.594 150 GHz	42.569 dBµV/m	6	2.479 500 GHz	92.061 dBµV/m
3	2.392 520 GHz	46.910 dBµV/m	7	2.495 500 GHz	50.745 dBµV/m
4	2.448 010 GHz	48.073 dBµV/m	8	3.195 380 GHz	46.979 dBµV/m

3 Marker Table

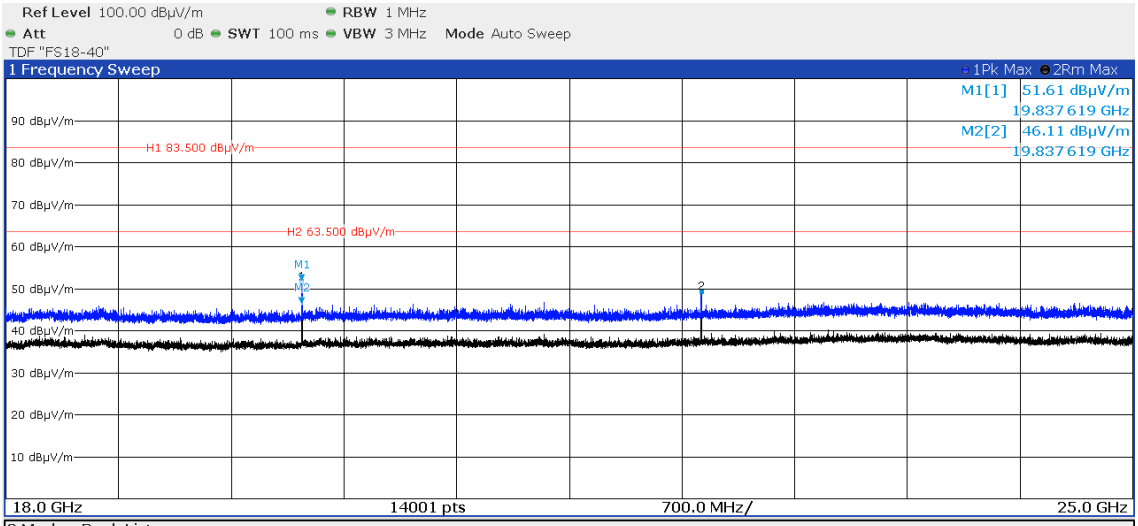
Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**2.479 503 GHz**	**92.06 dBµV/m**		
M2		1	**2.39 GHz**	**41.27 dBµV/m**		
M3		1	**2.483 5 GHz**	**43.74 dBµV/m**		

FCC ID: KR5FBD5MY23 IC ID:7812D-FBD5MY23



2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	6.000 180 GHz	49.691 dBµV/m	3	16.703 300 GHz	50.443 dBµV/m
2	12.399 450 GHz	49.728 dBµV/m	4	17.932 750 GHz	49.606 dBµV/m



2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	19.837 620 GHz	51.609 dBµV/m	2	22.321 940 GHz	49.222 dBµV/m

FCC ID: KR5FBD5MY23 IC ID:7812D-FBD5MY23

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

Frequency	Field strength of spurious emissions		Measurement distance
(MHz)	(µV/m)	dB(µV/m)	(metres)
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: KR5FBD5MY23 IC ID:7812D-FBD5MY23

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. Only the worst-case plots are listed.

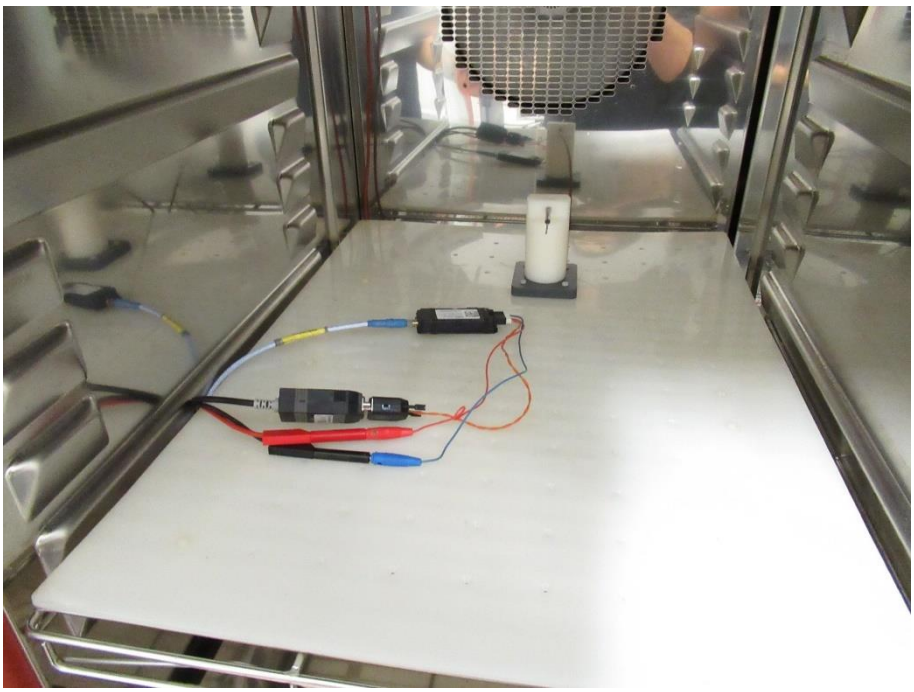
5.6 Spurious emissions

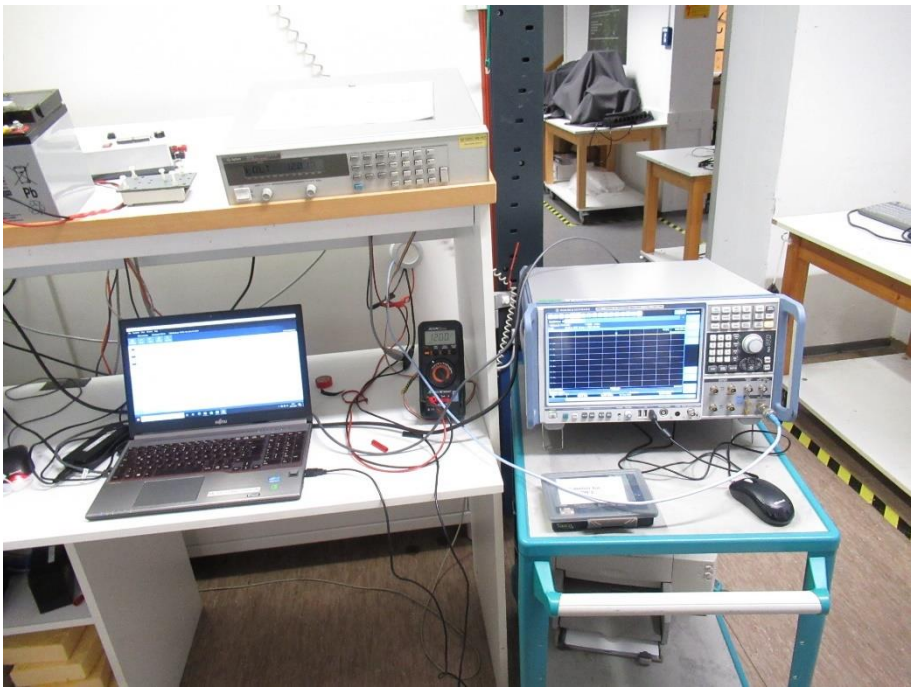
For test instruments and accessories used see section 6 Part **SEC 1-3**.

5.6.1 Description of the test location

Test location: AREA4

5.6.2 Photo documentation of the test set-up





5.6.3 Applicable standard

According to FCC Part 15, Section 15.247(d):
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

5.6.4 Description of Measurement

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

5.6.5 Test result

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 band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. Attenuation below the general limits specified in Section 15.209(a) is not required.

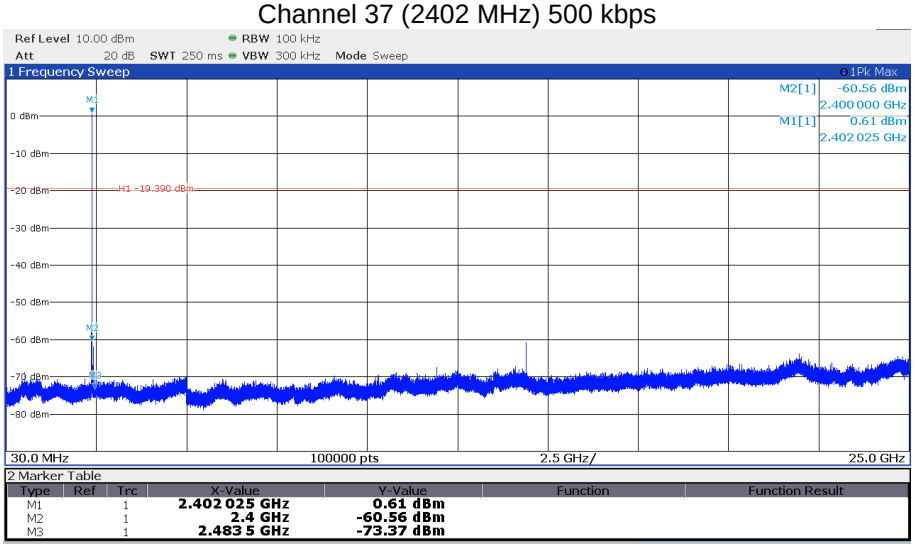
Frequency (MHz)	Spurious emission limit
Below 1000	20 dB below the highest level of the desired power
Above 1000	20 dB below the highest level of the desired power

The requirements are **FULFILLED.**

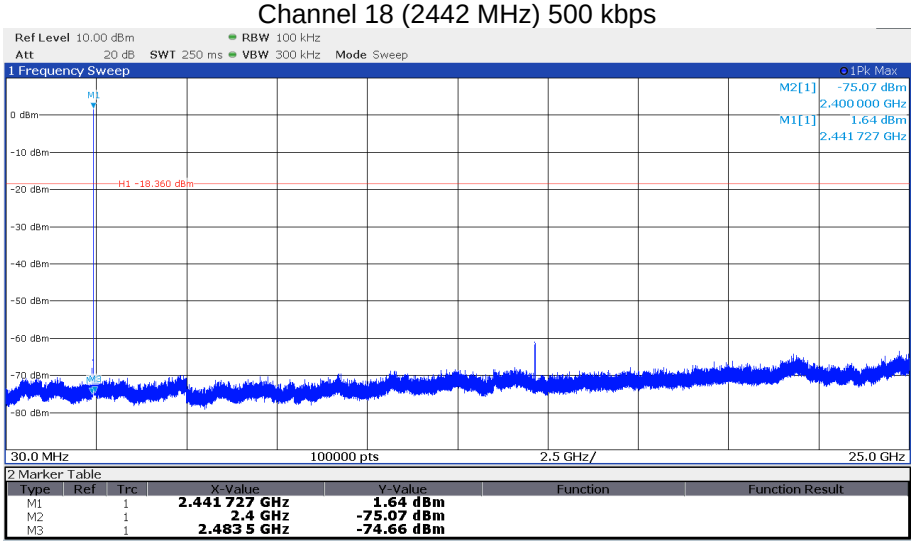
Remarks: For detailed test result please see the following test protocols.

5.6.6 Test protocols

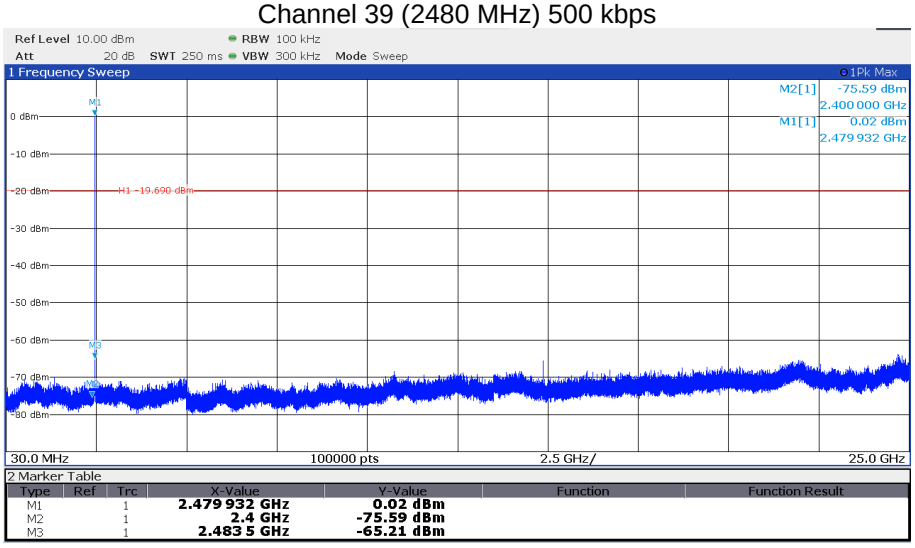
Channel 37 (2402 MHz) 500 kbps



Channel 18 (2442 MHz) 500 kbps

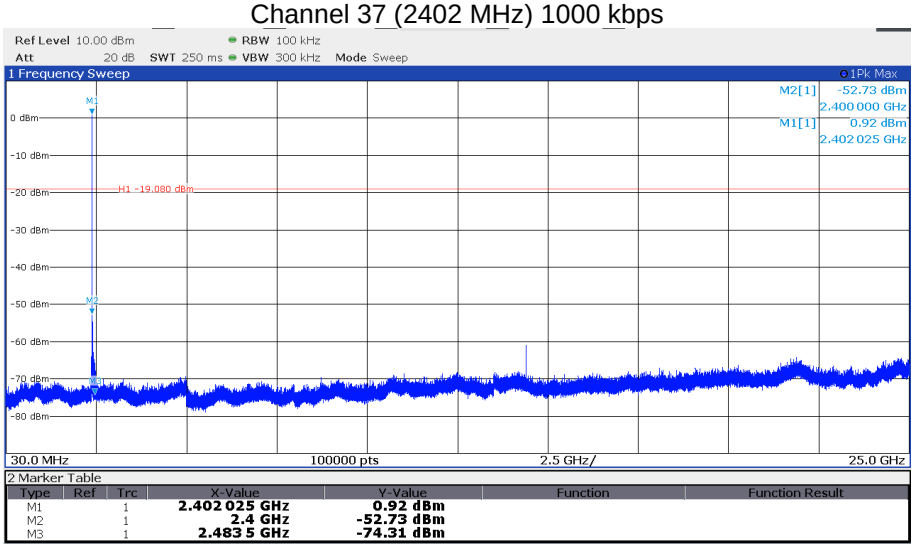


Channel 39 (2480 MHz) 500 kbps



FCC ID: KR5FBD5MY23 IC ID:7812D-FBD5MY23

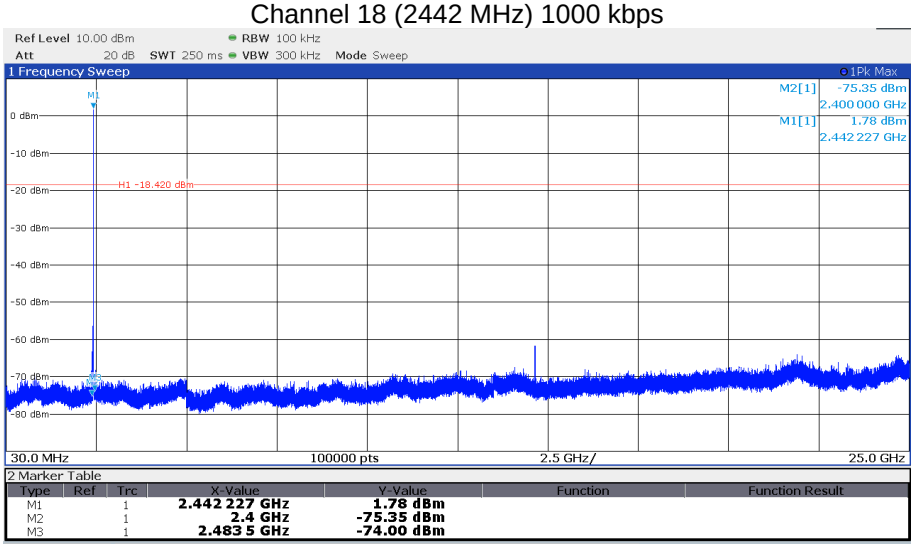
Channel 37 (2402 MHz) 1000 kbps



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	2.402 025 GHz	0.92 dBm		
M2		1	2.4 GHz	-52.73 dBm		
M3		1	2.483 5 GHz	-74.31 dBm		

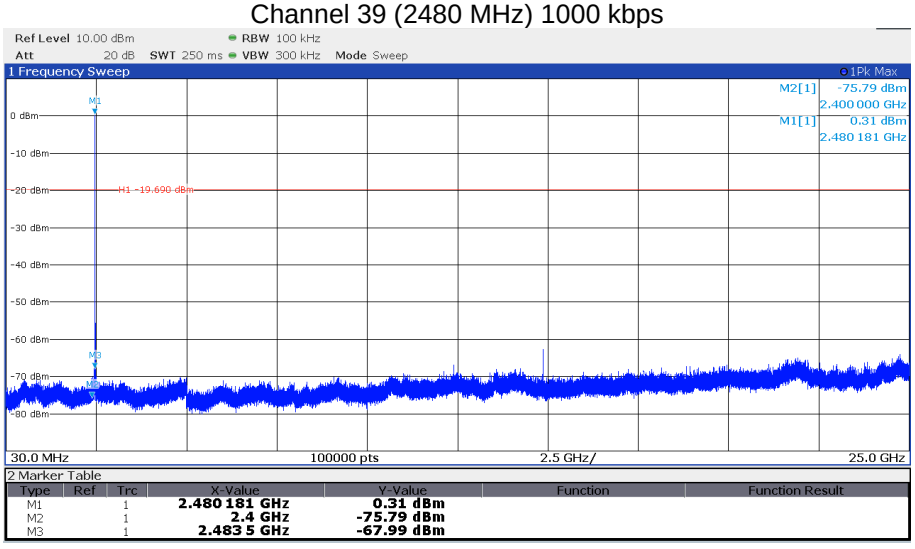
Channel 18 (2442 MHz) 1000 kbps



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	2.442 227 GHz	1.78 dBm		
M2		1	2.4 GHz	-75.35 dBm		
M3		1	2.483 5 GHz	-74.00 dBm		

Channel 39 (2480 MHz) 1000 kbps

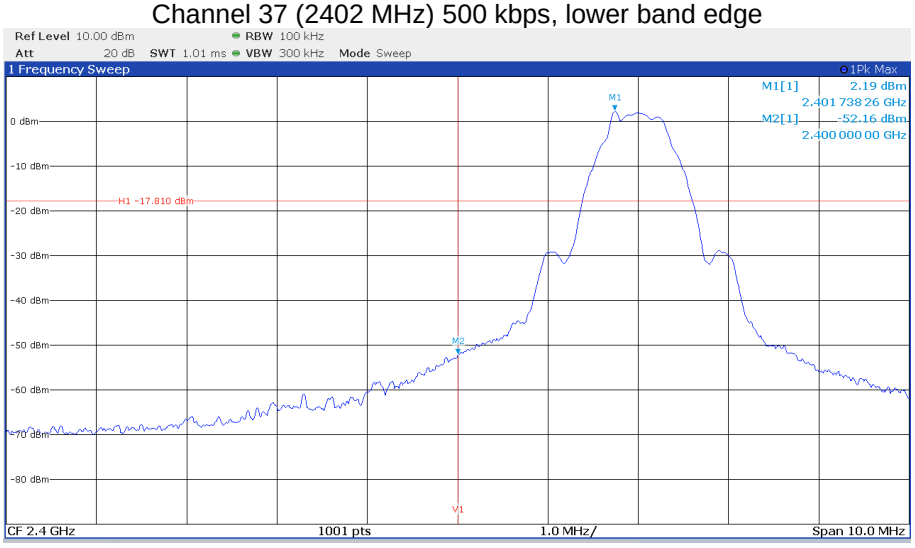


2 Marker Table

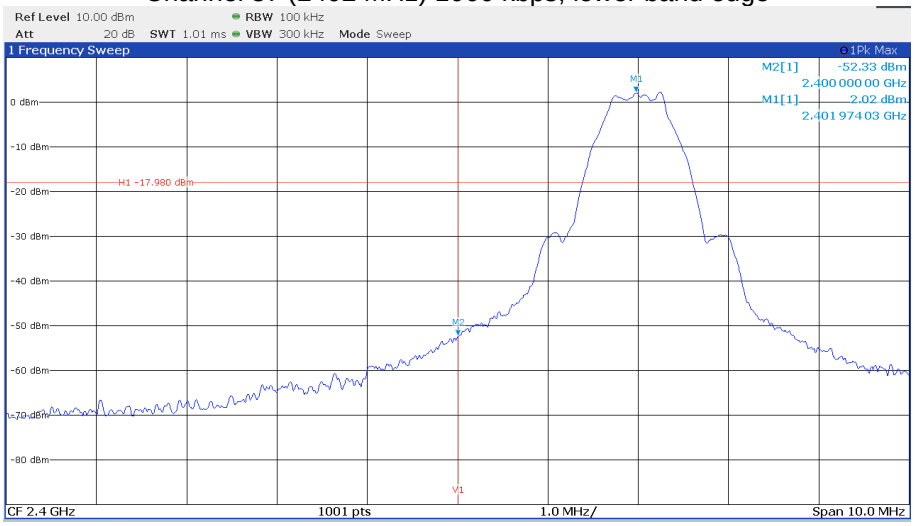
Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	2.480 181 GHz	0.31 dBm		
M2		1	2.4 GHz	-75.79 dBm		
M3		1	2.483 5 GHz	-67.99 dBm		

FCC ID: KR5FBD5MY23 IC ID:7812D-FBD5MY23

Channel 37 (2402 MHz) 500 kbps, lower band edge



Channel 37 (2402 MHz) 1000 kbps, lower band edge



5.7 Antenna application

5.7.1 Description of the test location

Test location: NONE

5.7.2 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.

5.7.3 Test result

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

The requirements are **FULFILLED.**

Remarks: None.

FCC ID: KR5FBD5MY23 IC ID:7812D-FBD5MY23

5.8 Defacto EIRP-Limit

5.8.1 Description of the test location

Test location: NONE

5.8.2 Applicable standard

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.

5.8.3 Test result

Defacto EIRP-Limit:

$$Pout = 30 – (Gx – 6);$$

The antenna gain is < 6 dBi, no Defacto limit applies.

The requirements are **FULFILLED.**

Remarks: None.

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.
A 4	BAT-EMC 3.21.0.24	01-02/68-13-001				
	ESCI	02-02/03-15-001	21/06/2022	21/06/2021		
	ESH 2 - Z 5	02-02/20-05-004	31/10/2022	31/10/2019	19/04/2022	19/10/2021
	N-4000-BNC	02-02/50-05-138				
	ESH 3 - Z 2	02-02/50-05-155	13/11/2022	13/11/2019	12/04/2022	12/10/2021
CPC 3	ESW26	02-02/03-17-002	10/02/2022	10/02/2021		
	FSW43	02-02/11-21-001	08/04/2022	08/04/2021		
	METRAHIT WORLD	02-02/32-15-001	26/11/2022	26/11/2021		
	WK-340/40	02-02/45-05-001	05/08/2022	05/08/2021		
	6543A	02-02/50-05-157				
	KK-SF104-11SMA-11N-2M	02-02/50-14-004				
MB	ESW26	02-02/03-17-002	10/02/2022	10/02/2021		
	FSW43	02-02/11-21-001	08/04/2022	08/04/2021		
	METRAHIT WORLD	02-02/32-15-001	26/11/2022	26/11/2021		
	WK-340/40	02-02/45-05-001	05/08/2022	05/08/2021		
	6543A	02-02/50-05-157				
	KK-SF104-11SMA-11N-2M	02-02/50-14-004				
SEC 1-3	ESW26	02-02/03-17-002	10/02/2022	10/02/2021		
	FSW43	02-02/11-21-001	08/04/2022	08/04/2021		
	METRAHIT WORLD	02-02/32-15-001	26/11/2022	26/11/2021		
	WK-340/40	02-02/45-05-001	05/08/2022	05/08/2021		
	6543A	02-02/50-05-157				
	KK-SF104-11SMA-11N-2M	02-02/50-14-004				
SER 2	ESVS 30	02-02/03-05-006	09/07/2022	09/07/2021		
	VULB 9168	02-02/24-05-005	20/12/2022	20/12/2021	07/07/2022	07/07/2021
	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				
	50F-003 N 3 dB	02-02/50-21-010				
SER 3	FSW43	02-02/11-15-001	06/04/2022	06/04/2021		
	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	28/06/2022	28/06/2021		
	BBHA 9170	02-02/24-05-013	19/05/2023	19/05/2020	04/02/2022	04/02/2021
	WHK 3.0/18G-10EF	02-02/50-05-180				
	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 3.21.0.24	02-02/68-13-001				