

FCC ID: 2ATBZDS02DC02

IC: 25048-DS02DC02

5.6 Radiated emissions in restricted bands

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

5.6.1 Description of the test location

Test location: OATS 1
Test location: Anechoic Chamber 1

Test distance: 3 m (9 kHz – 18 GHz)
Test distance: 1 m (18 GHz – 26 GHz)

5.6.2 Photo documentation of the test set-up

For test setup photos see T44704-00 ATTACHMENT C

5.6.3 Applicable standard

According to FCC Part 15, Section 15.205(a):

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

5.6.4 Description of Measurement

The restricted bands 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. The measurement has been performed at 3 m. In the frequency range 9 kHz to 30 MHz the results have been compared to the limits defined at 30 m or 300 m distances according to FCC Part 15C, Section 15.31(f)(2) using an inverse linear distance extrapolation factor of 40 dB/decade.

Test receiver settings for SER1:

RBW: 200 Hz (9kHz – 150 kHz), 9 kHz (150 kHz – 30 MHz), Detector: Quasi peak (except for the bands 9 – 90 kHz and 110 – 490 kHz, where an average detector is used), Meas. Time: 1 s,

Test receiver settings for SER2:

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

Spectrum analyser settings for SER3:

RBW: 1 MHz, VBW: 3 MHz, Detector: Max. peak, Trace: Max. hold, Sweep: Auto

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5.6.5 Test result

Frequency range: 9 kHz - 1000 MHz
Min. limit margin 19.7 dB at 874.56 MHz

Frequency range: 1 GHz - 26 GHz
Max emission (Peak Detection) 56.8 dBµV/m at 4.686 GHz
Max emission (Average Detection) 53.5 dBµV/m at 4.880 GHz
Min. limit margin (Peak Detection) 17.2 dB at 4.686 GHz
Min. limit margin (Average Detection) 13.1 dB at 4.686 GHz

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

Frequency (MHz)	Field strength of spurious emissions		Measurement distance (metres)
	(µV/m)	dB(µV/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

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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. Pre -measurements showed that there is no influence of transmitting channel on the emissions in the frequency range 9 kHz – 1000 MHz. For final measurement, only CH17 was measured.

During the final measurements, no emissions from the EUT in the frequency range 9 kHz to 1000 MHz could have been detected. The given values only represent the noise floor.

For detailed test results please see the following test protocols.

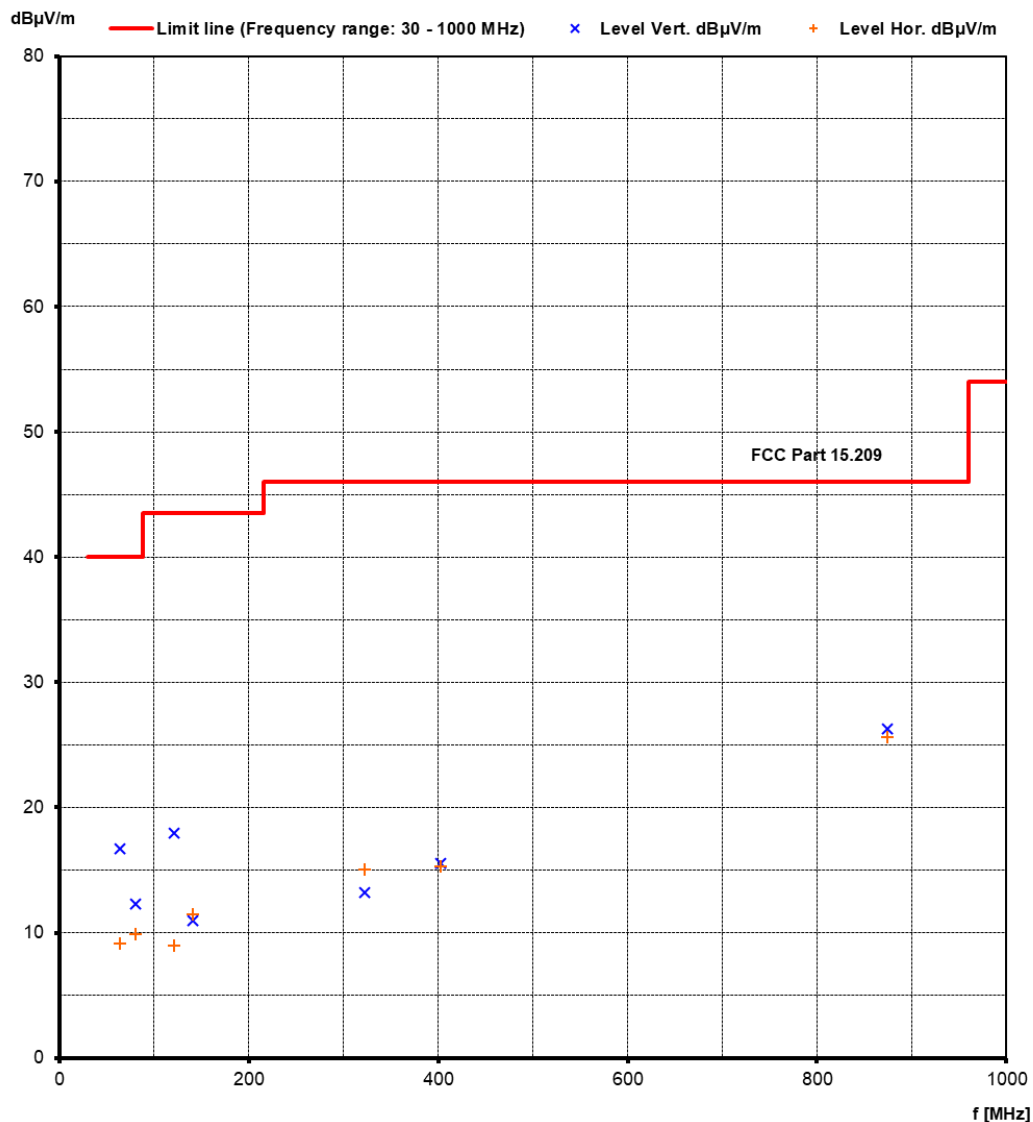
FCC ID: 2ATBZDS02DC02

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5.6.6 Test protocols radiated emissions

30 MHz ≤ 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)
63.99	3.1	-3.6	13.6	12.8	16.7	9.2	40.0	-23.3
80.48	2.0	-0.2	10.3	10.0	12.3	9.8	40.0	-27.7
120.55	6.2	-3.3	11.8	12.2	18.0	8.9	43.5	-25.5
140.82	-1.7	-2.1	12.7	13.6	11.0	11.5	43.5	-32.0
322.12	-3.3	-1.1	16.5	16.1	13.2	15.0	46.0	-31.0
402.43	-3.4	-3.4	18.9	18.7	15.5	15.3	46.0	-30.5
874.56	-2.4	-2.6	28.7	28.2	26.3	25.6	46.0	-19.7

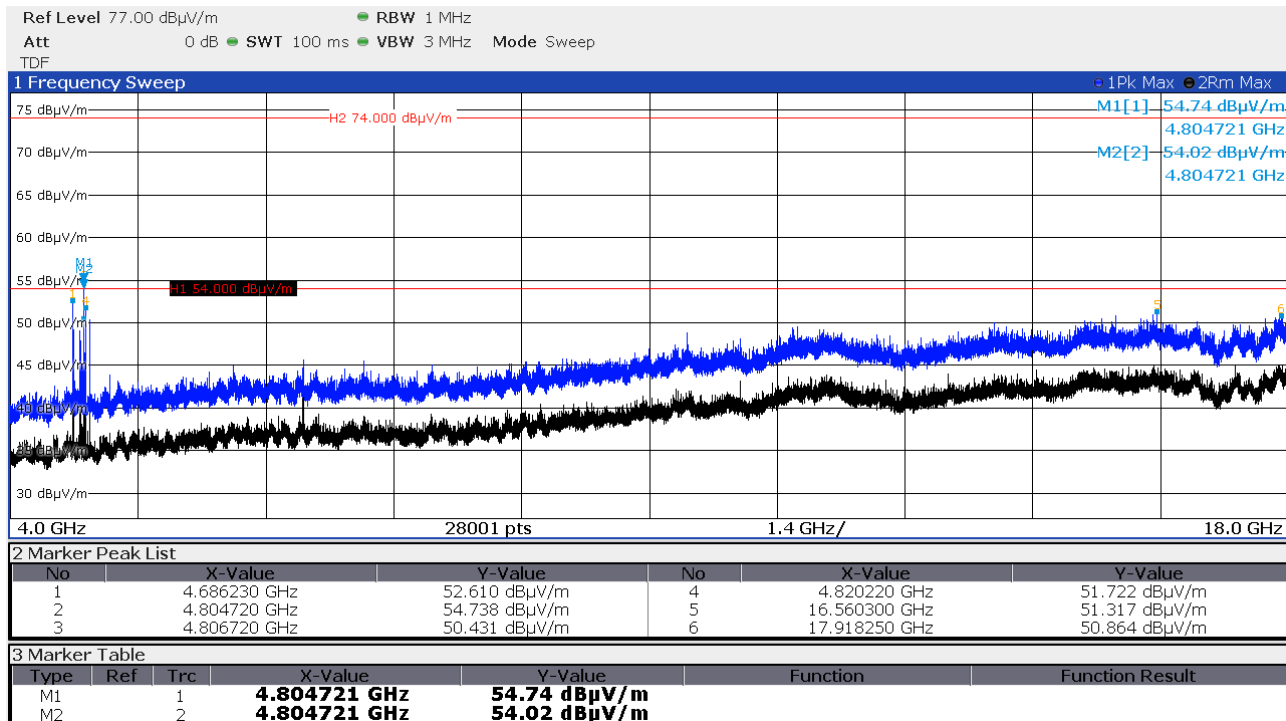
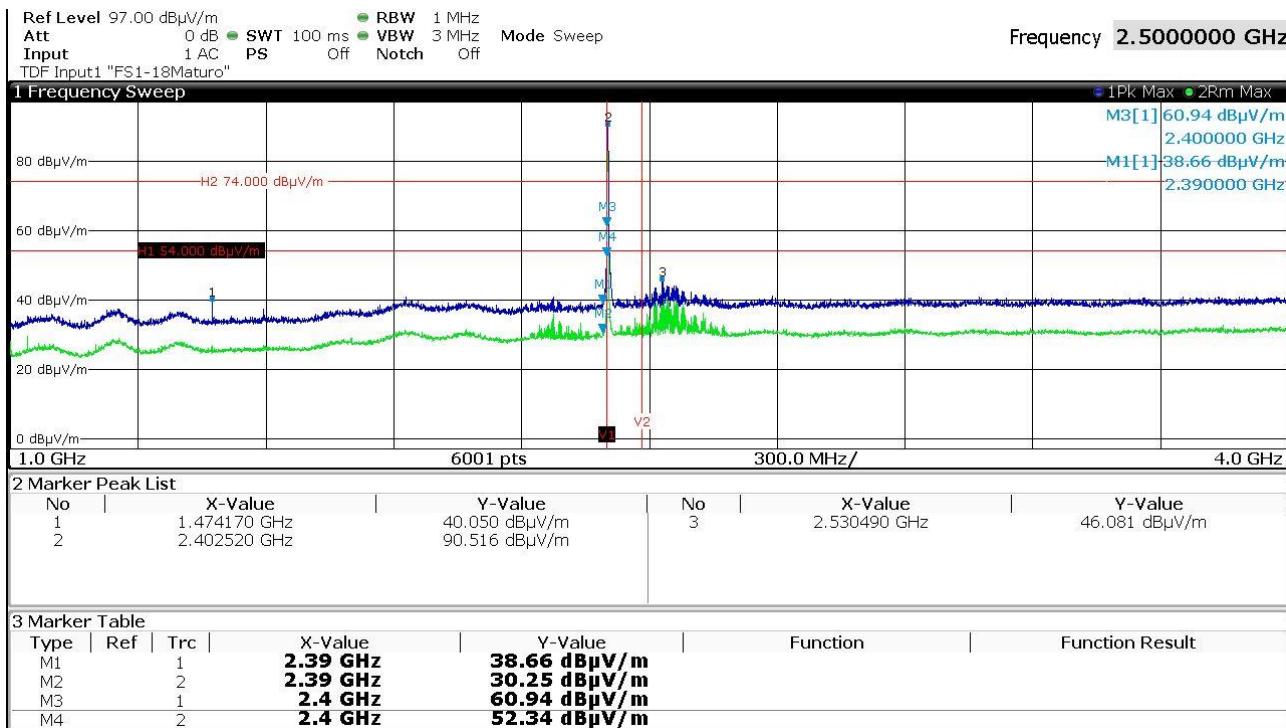


FCC ID: 2ATBZDS02DC02

IC: 25048-DS02DC02

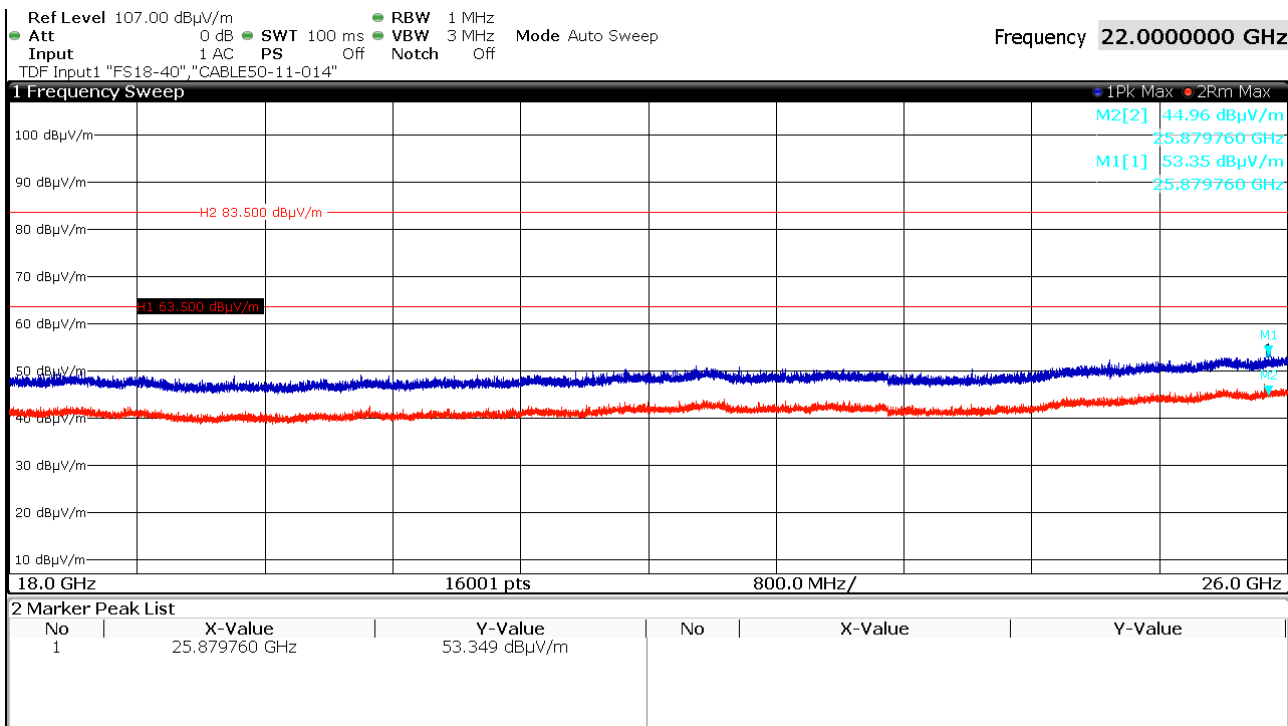
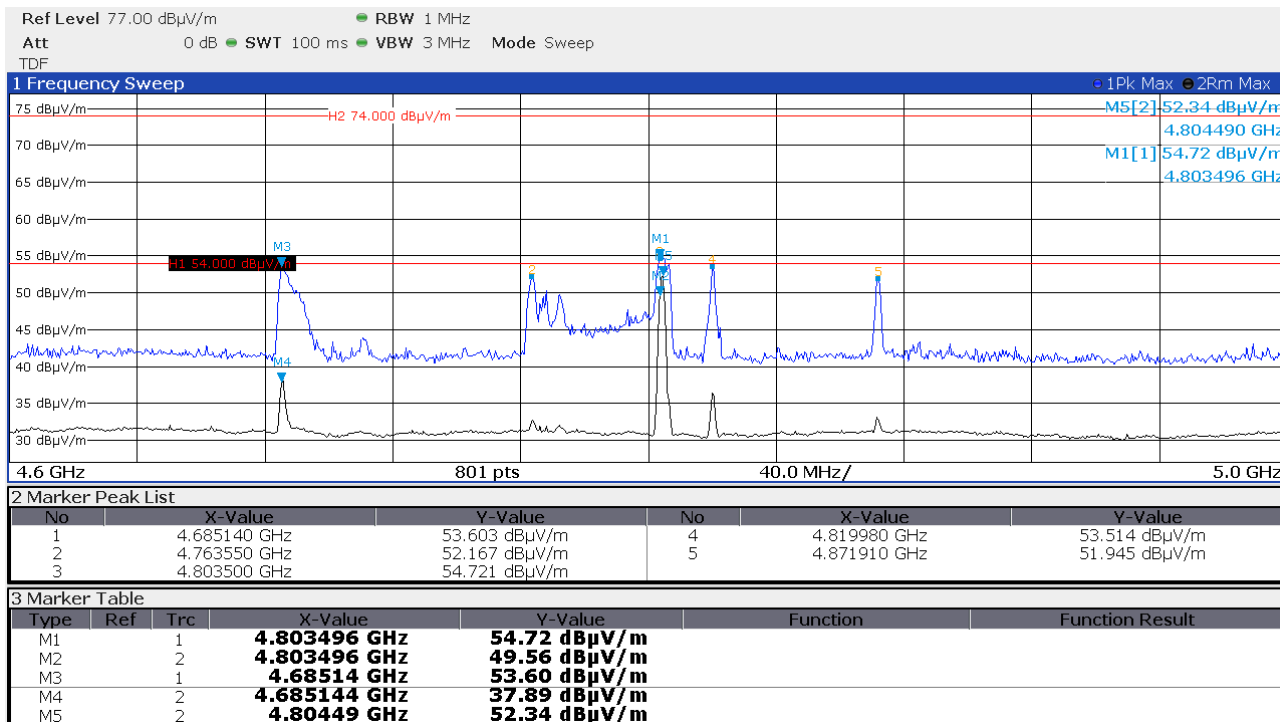
1 GHz ≤ f ≤ 26 GHz

2402 MHz, horizontal polarisation, EUT-X:



FCC ID: 2ATBZDS02DC02

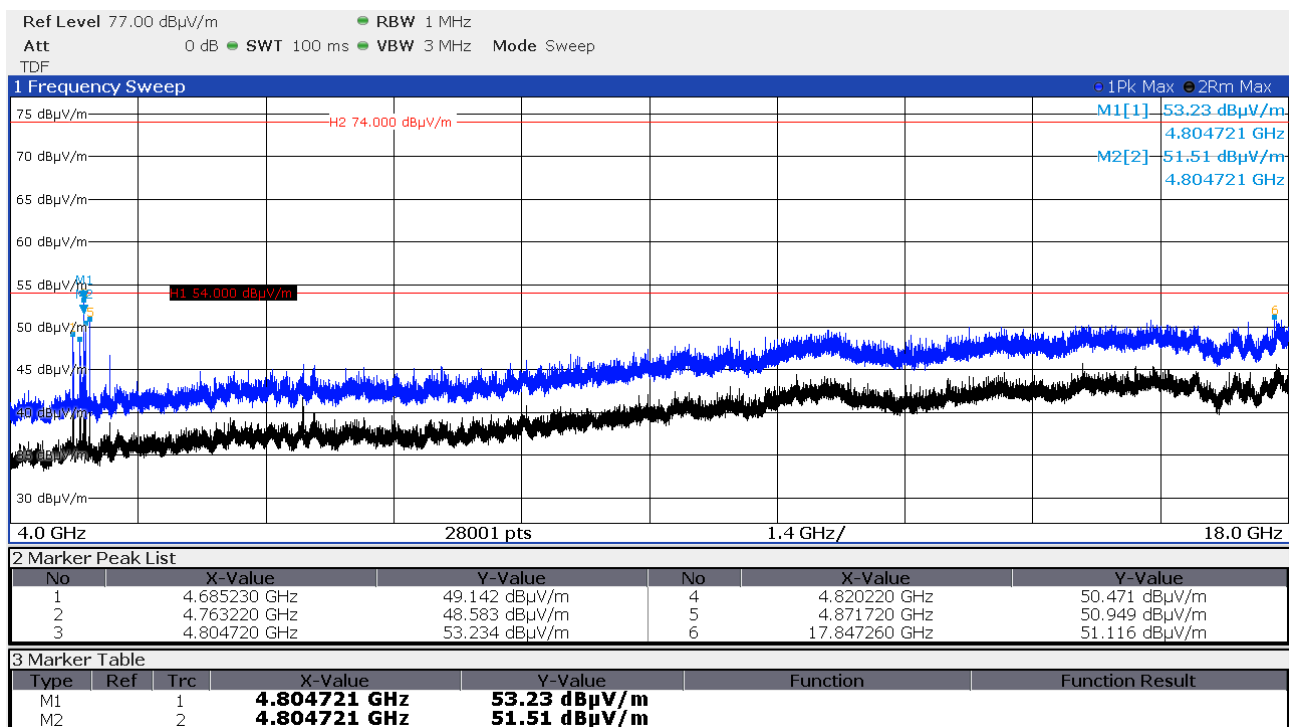
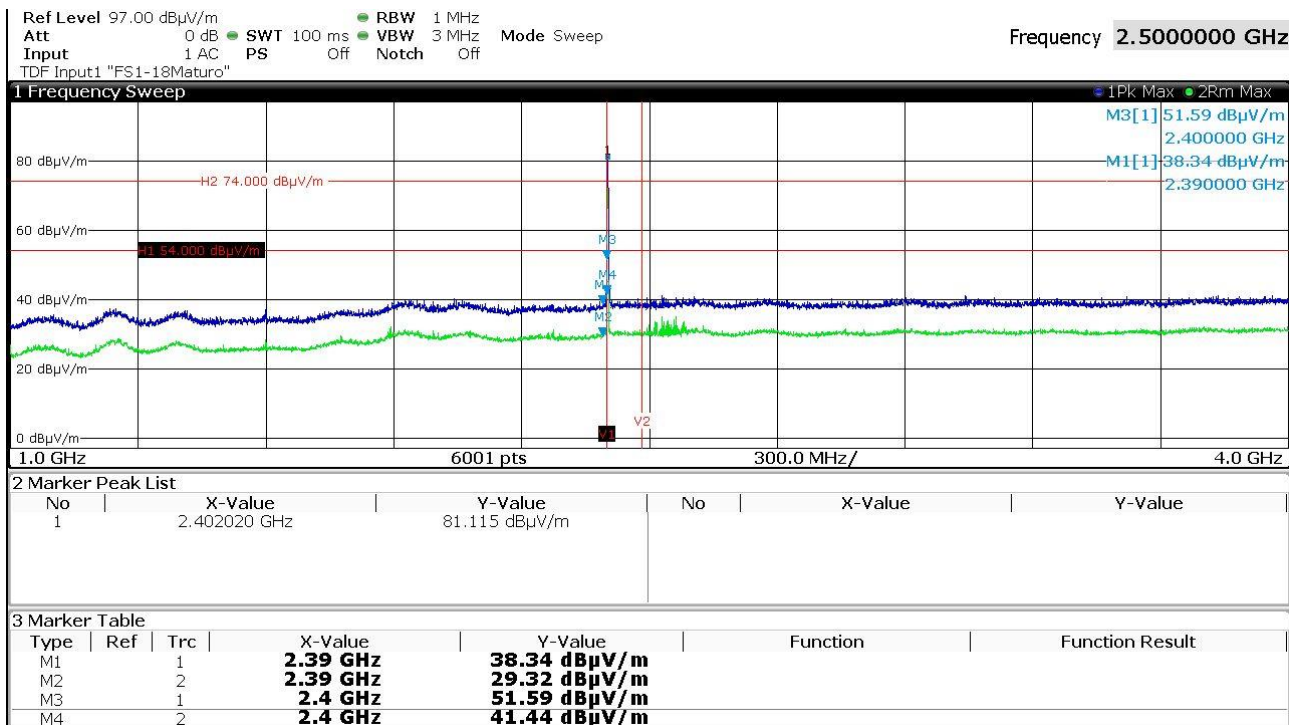
IC: 25048-DS02DC02



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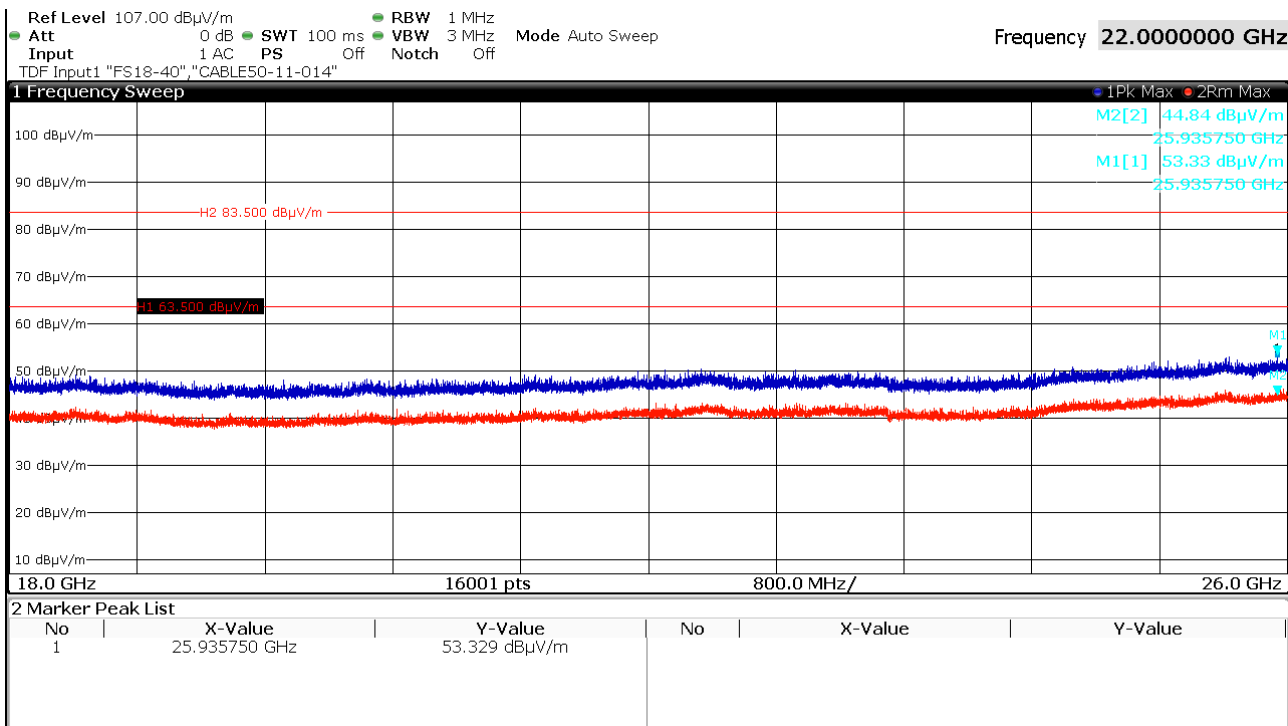
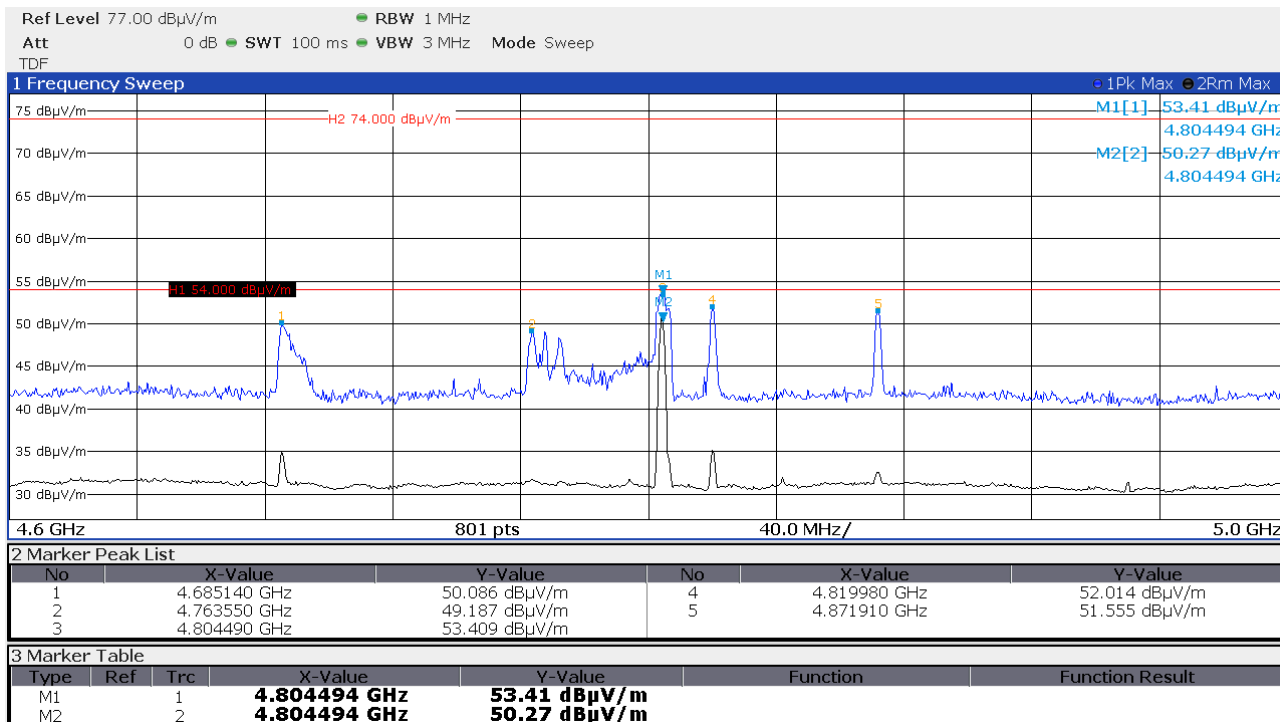
IC: 25048-DS02DC02

2402 MHz, vertical polarisation, EUT-X:



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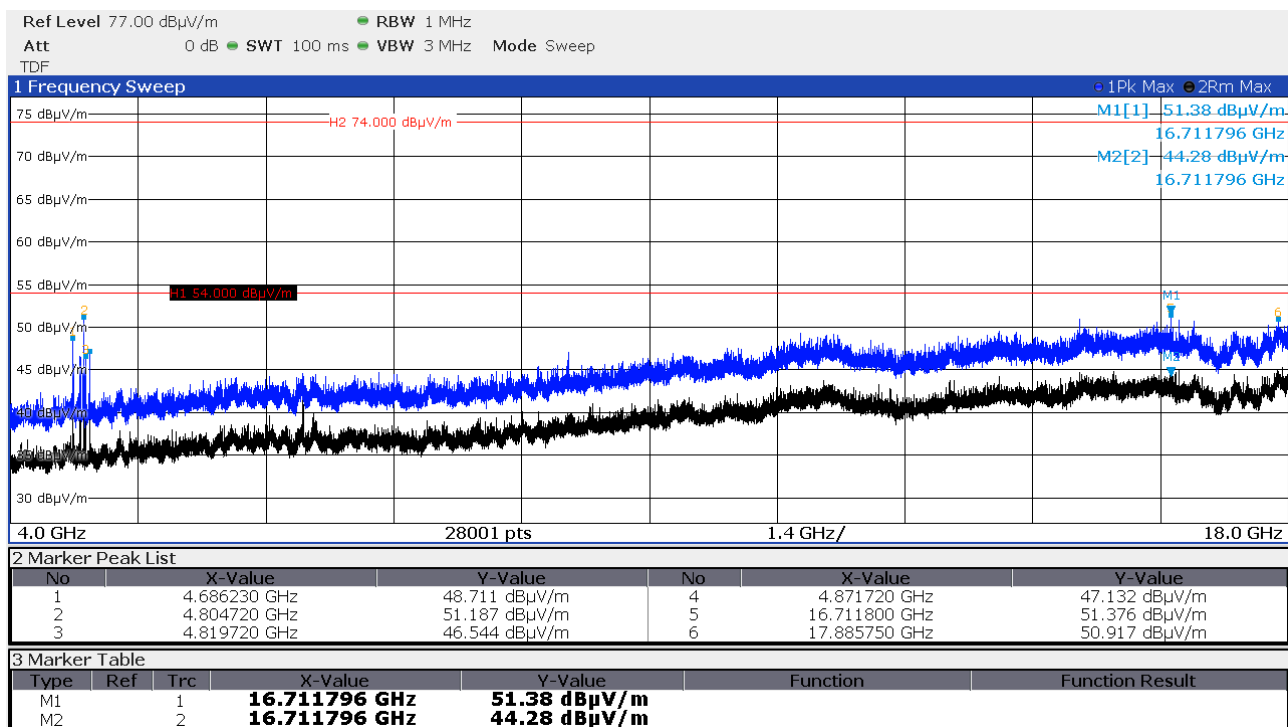
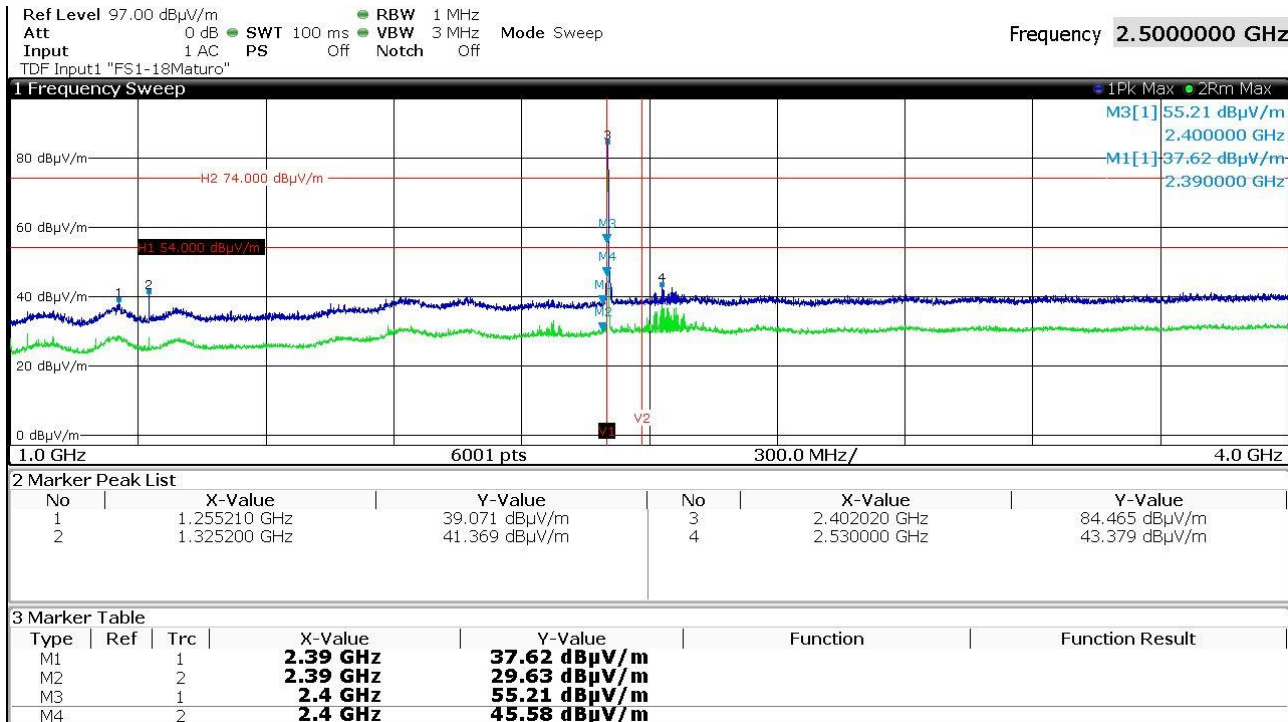
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FCC ID: 2ATBZDS02DC02

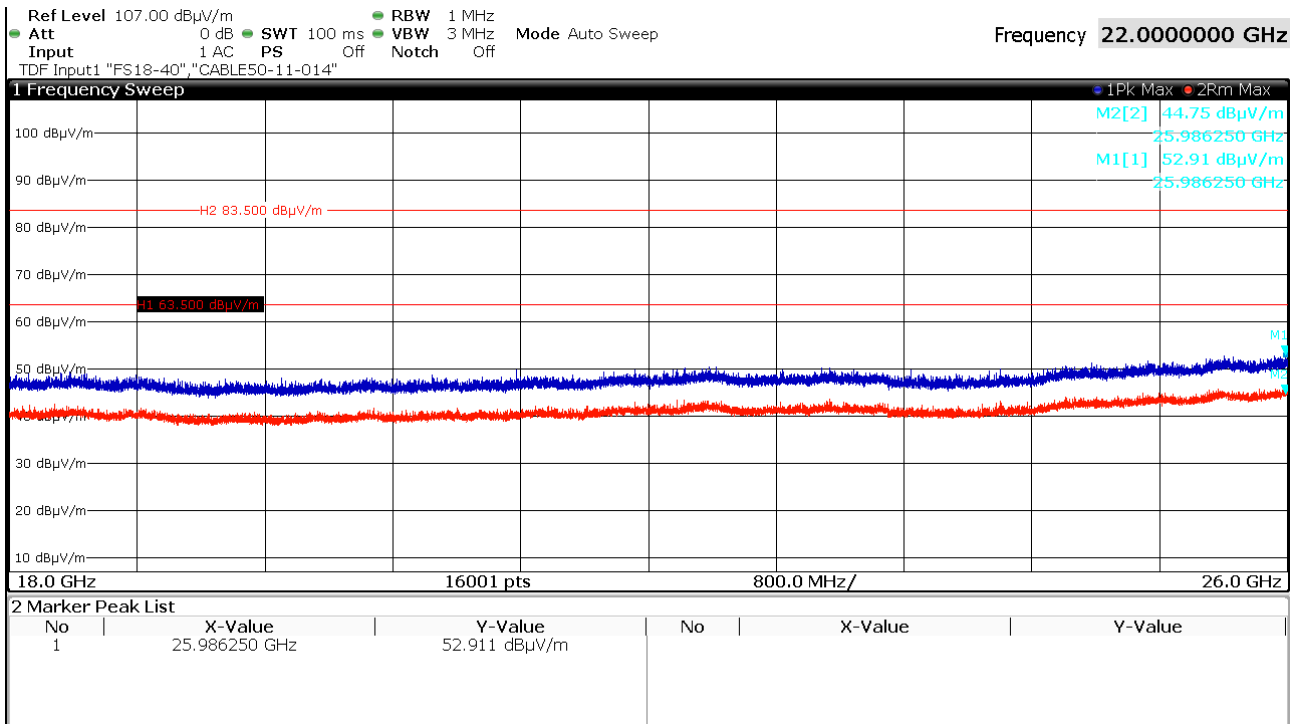
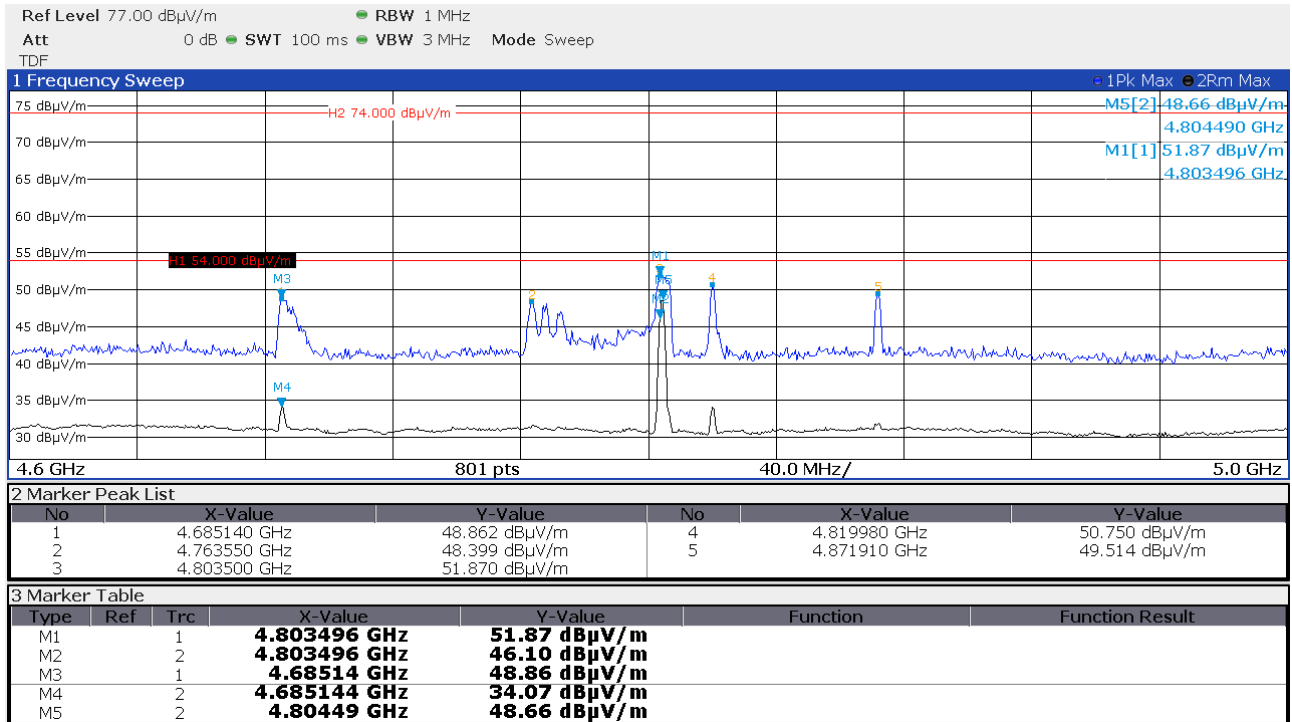
IC: 25048-DS02DC02

2402 MHz, horizontal polarisation, EUT-Y:



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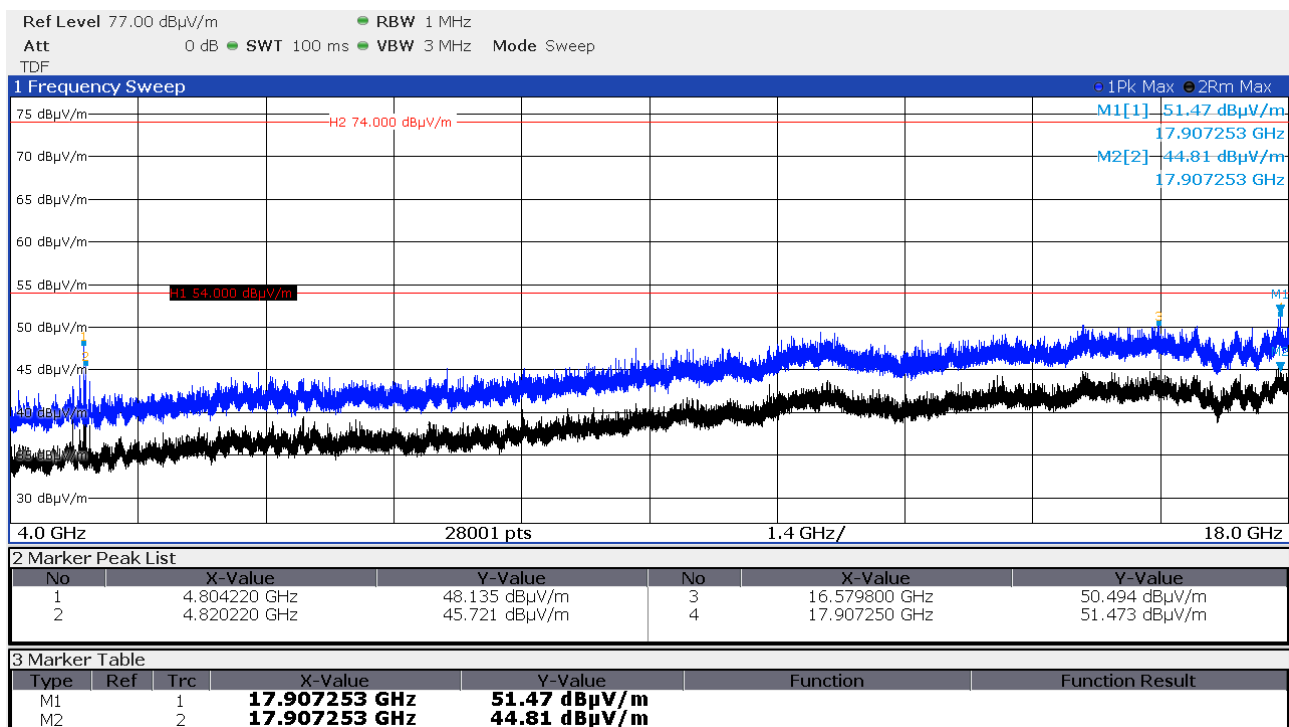
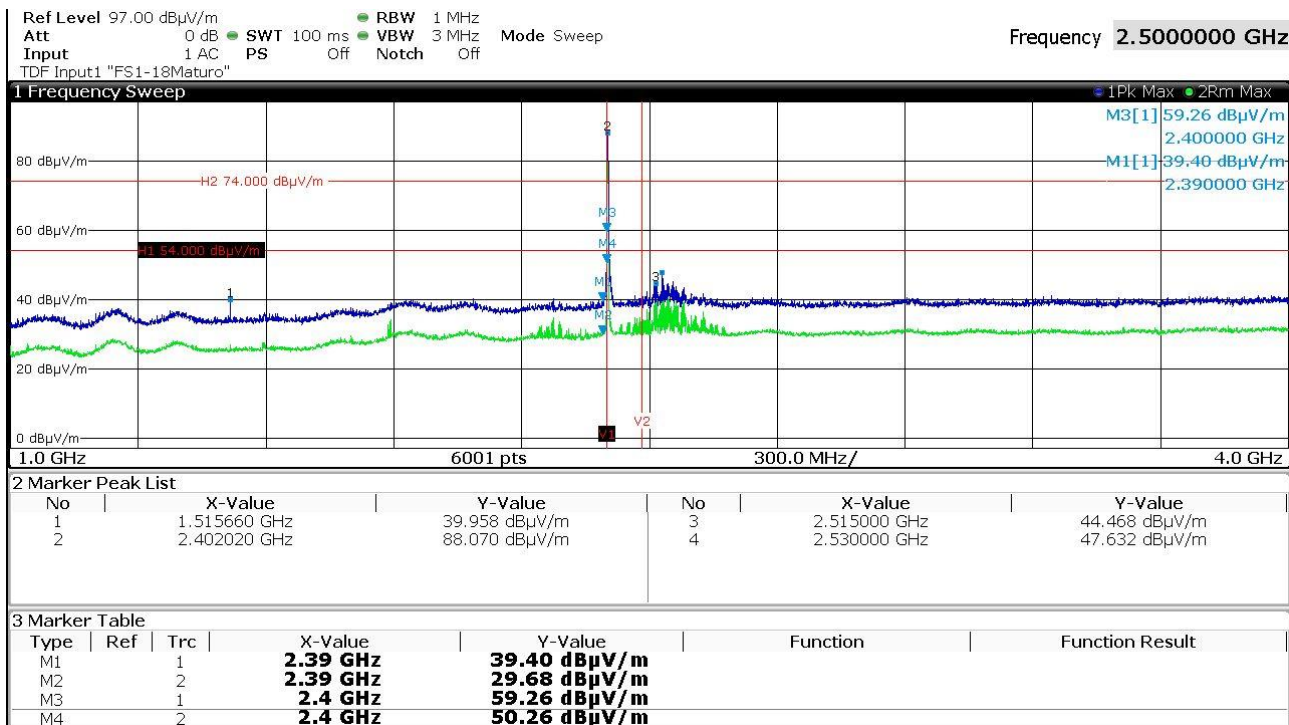
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FCC ID: 2ATBZDS02DC02

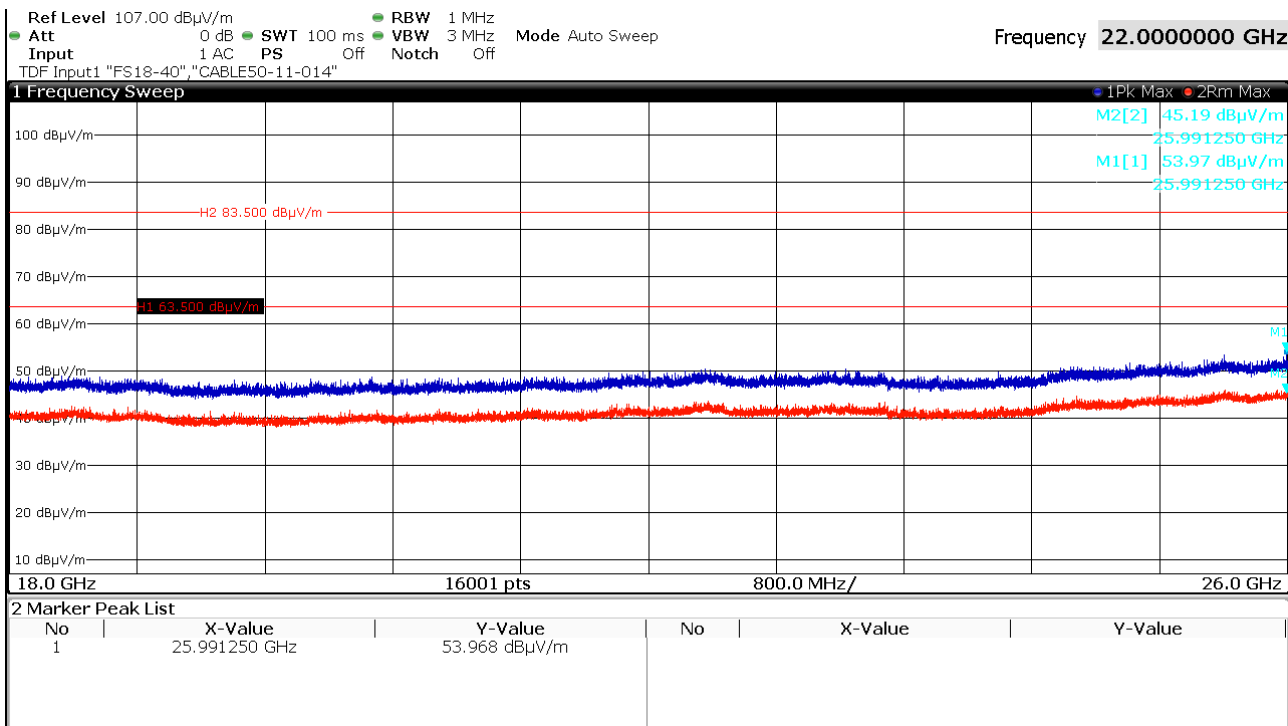
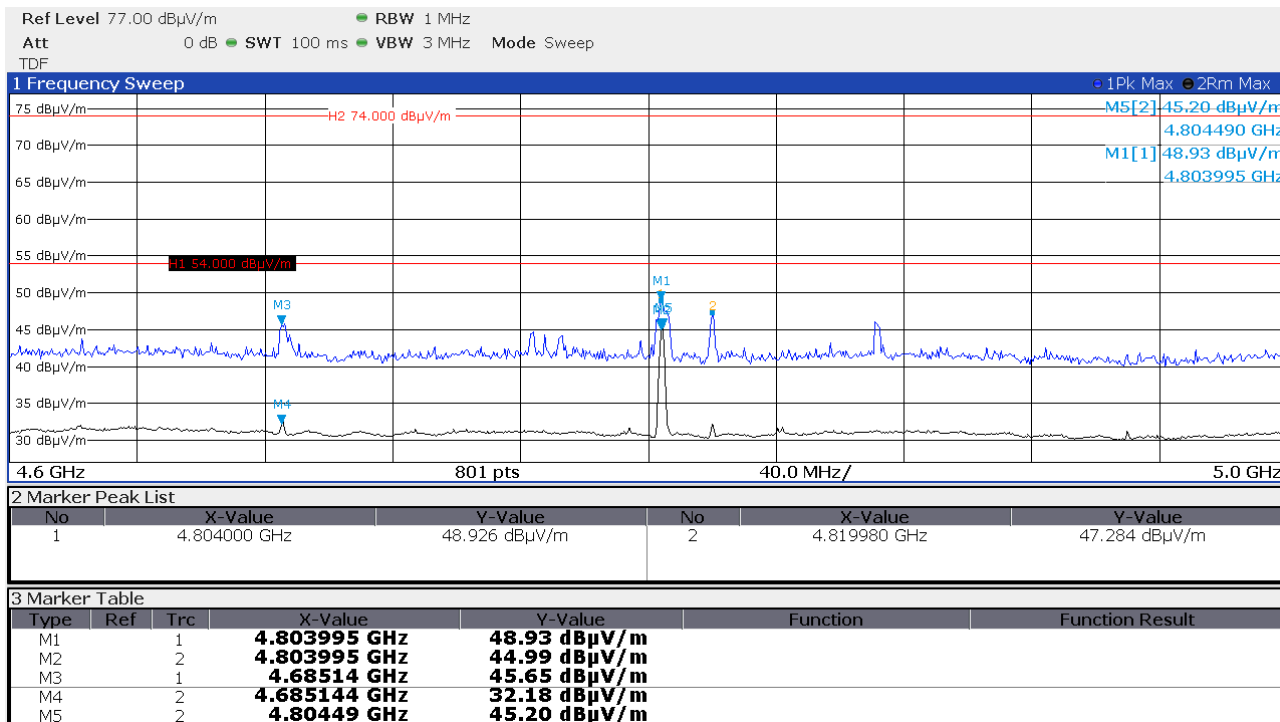
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2402 MHz, vertical polarisation, EUT-Y:



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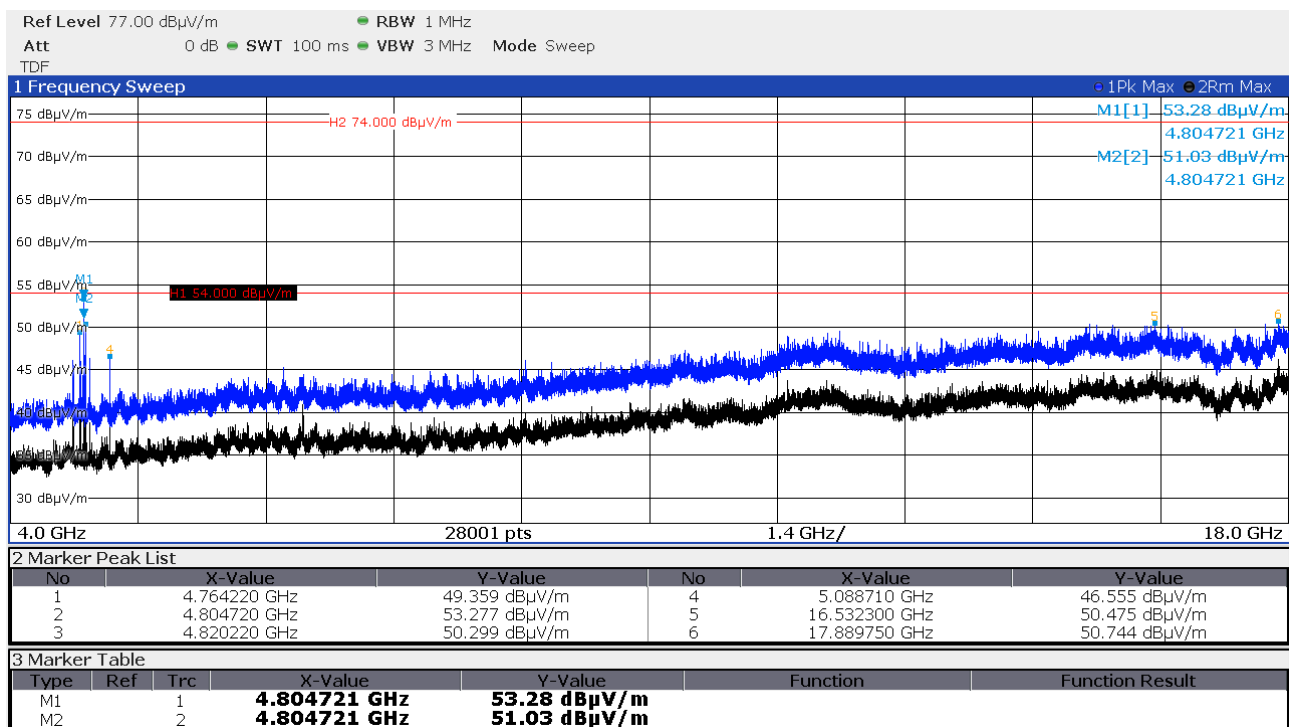
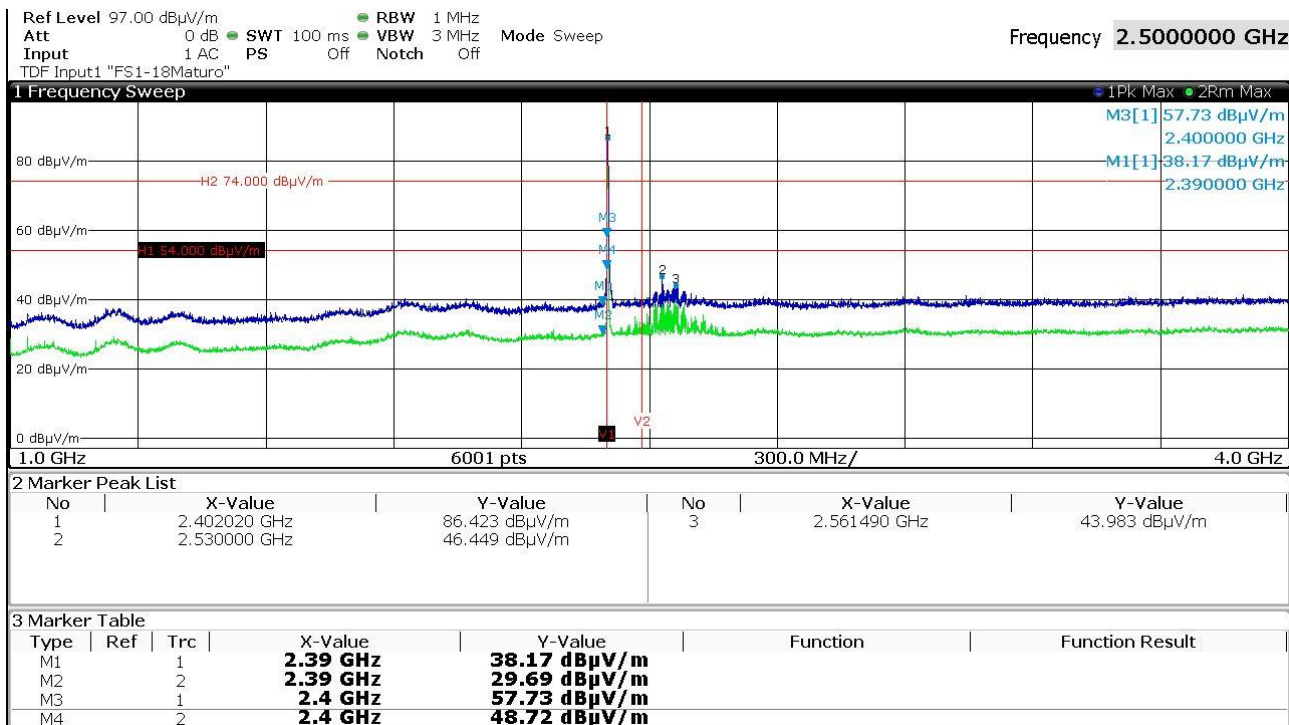
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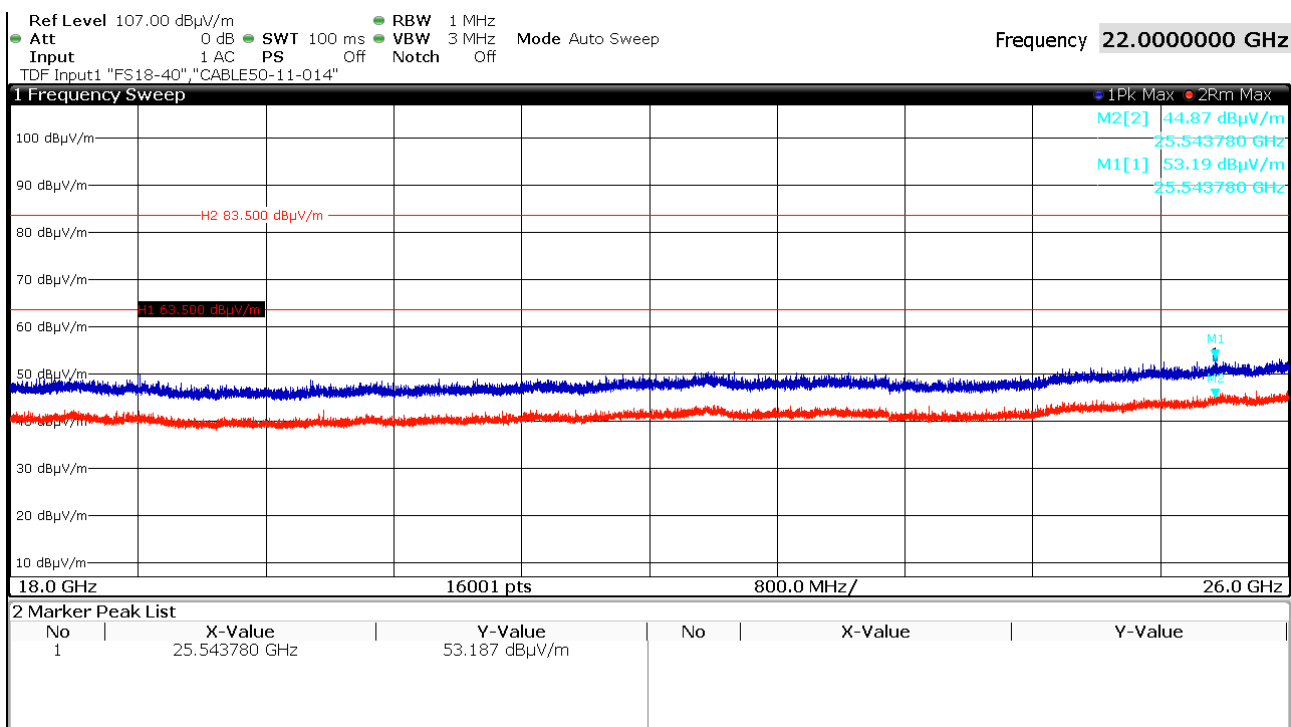
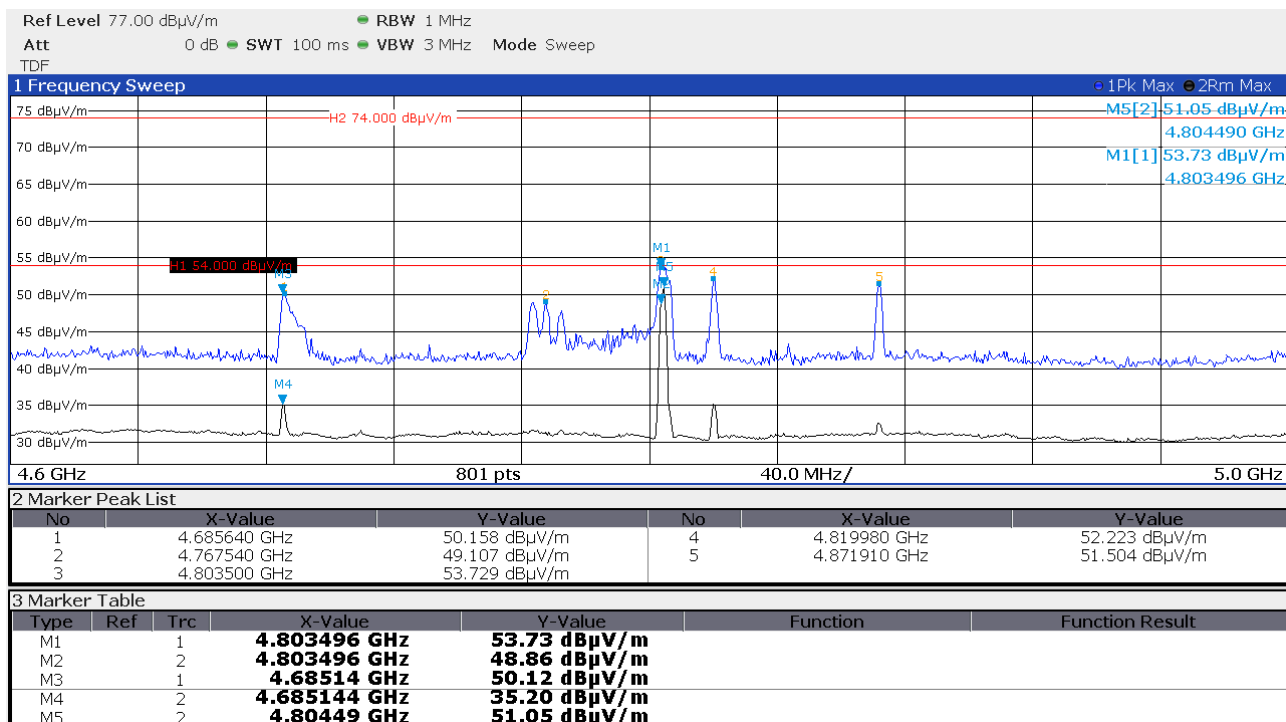
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2402 MHz, horizontal polarisation, EUT-Z:



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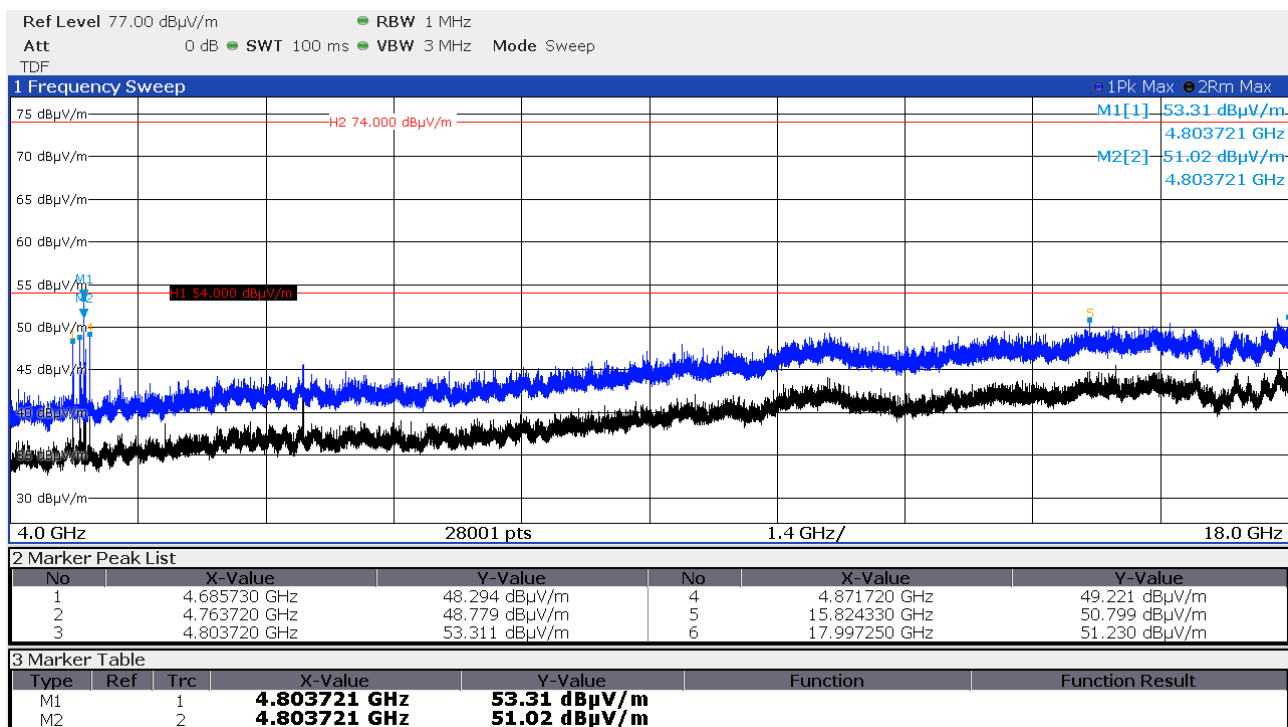
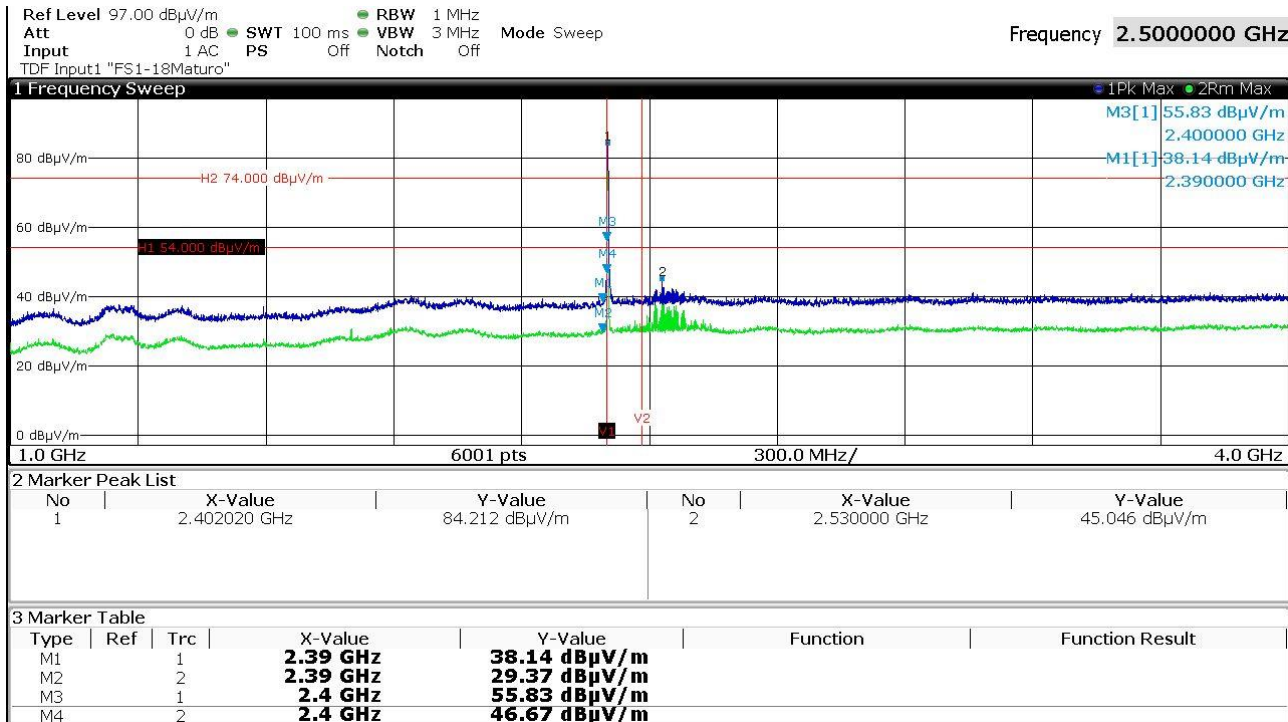
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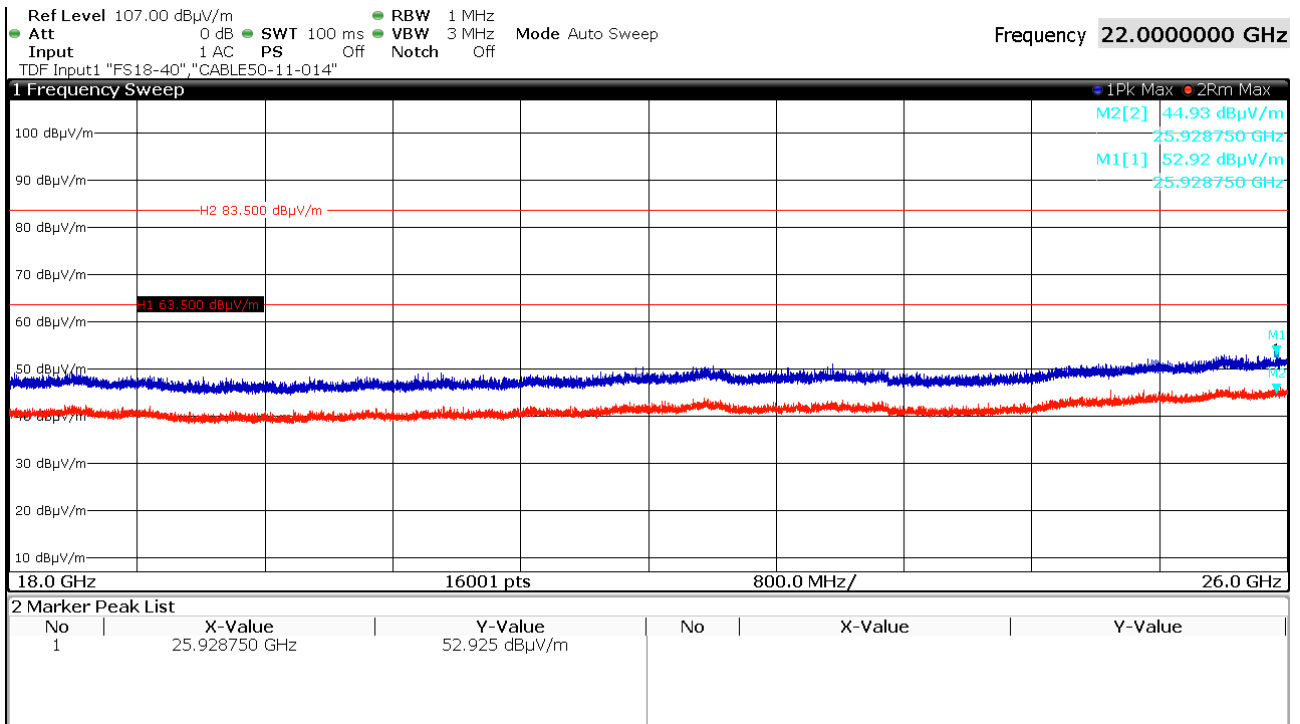
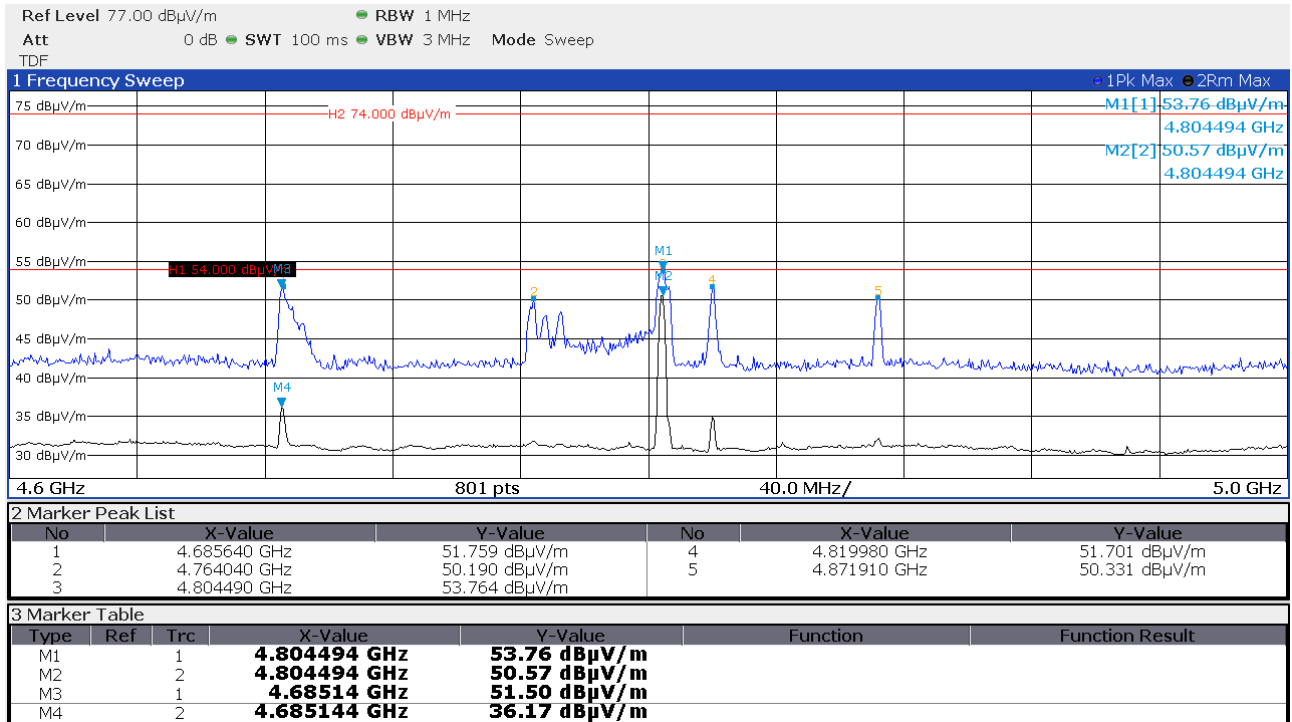
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2402 MHz, vertical polarisation, EUT-Z:



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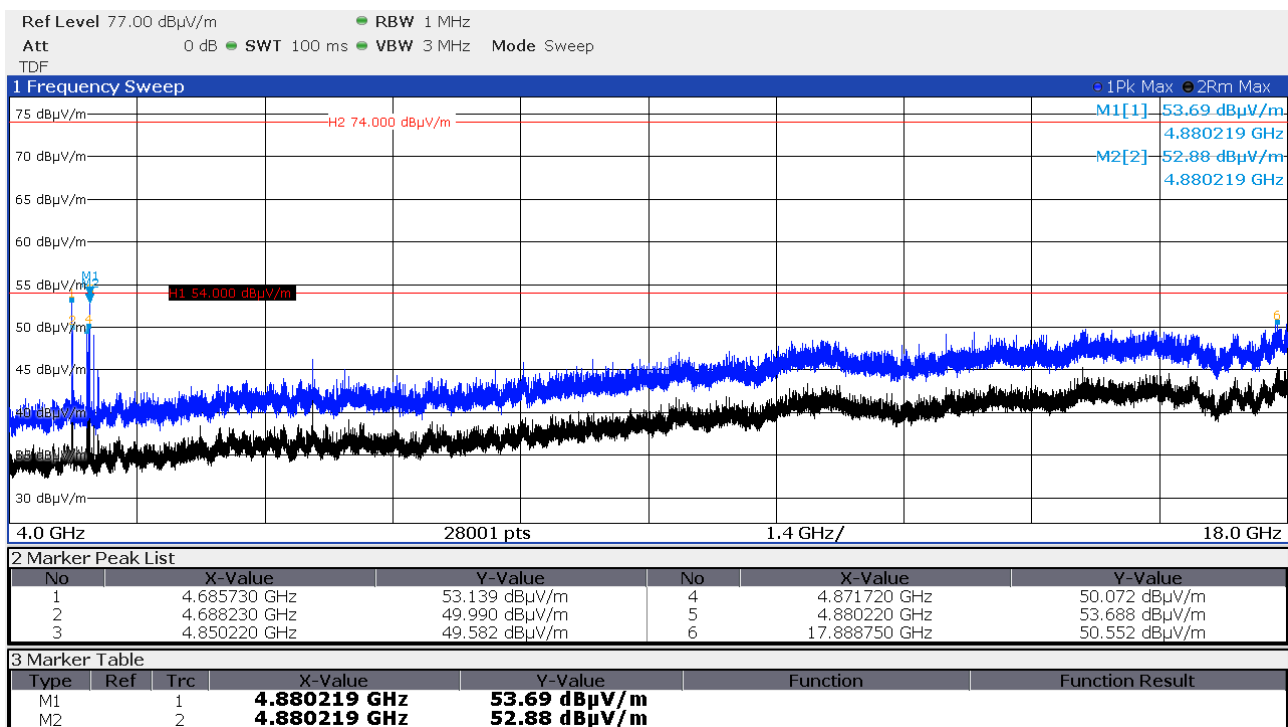
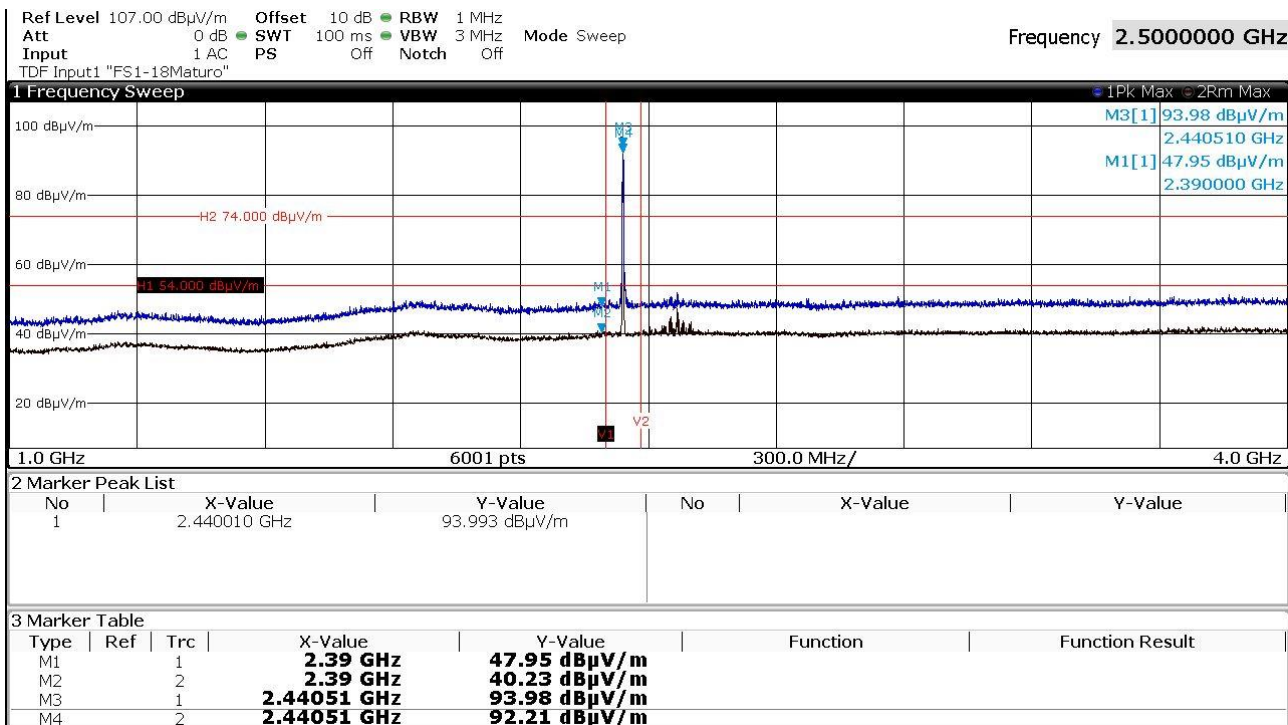
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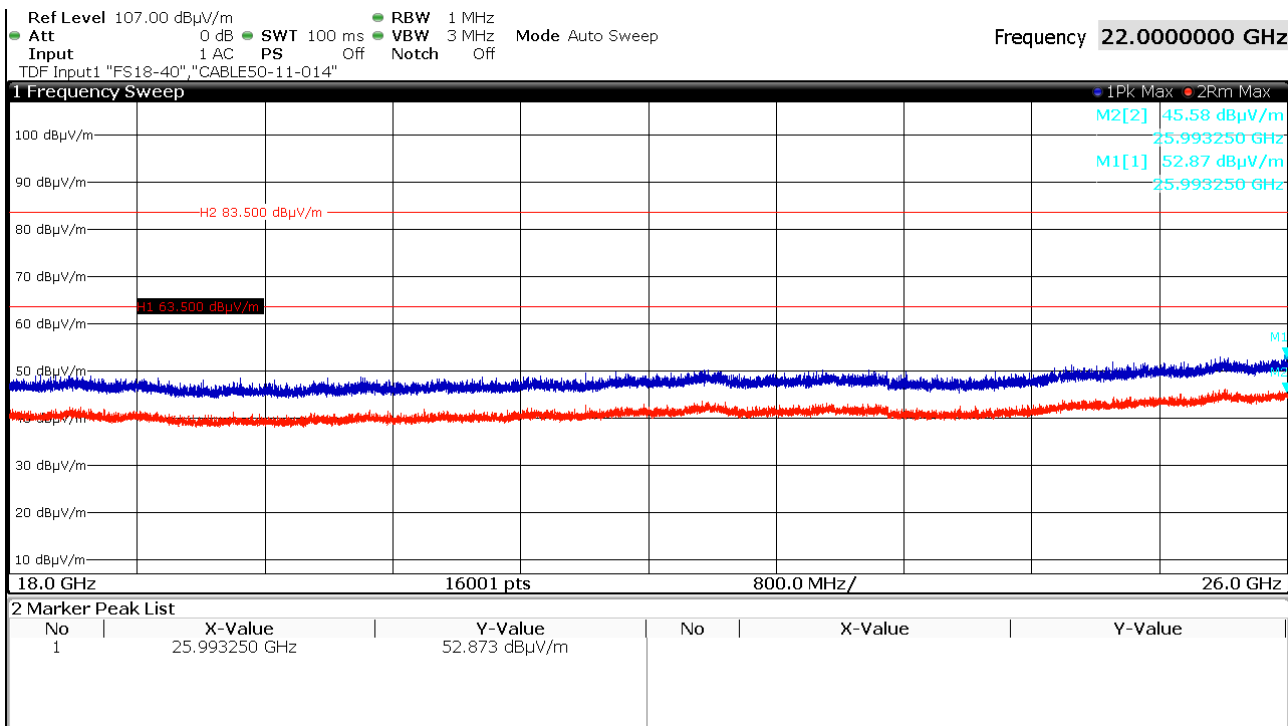
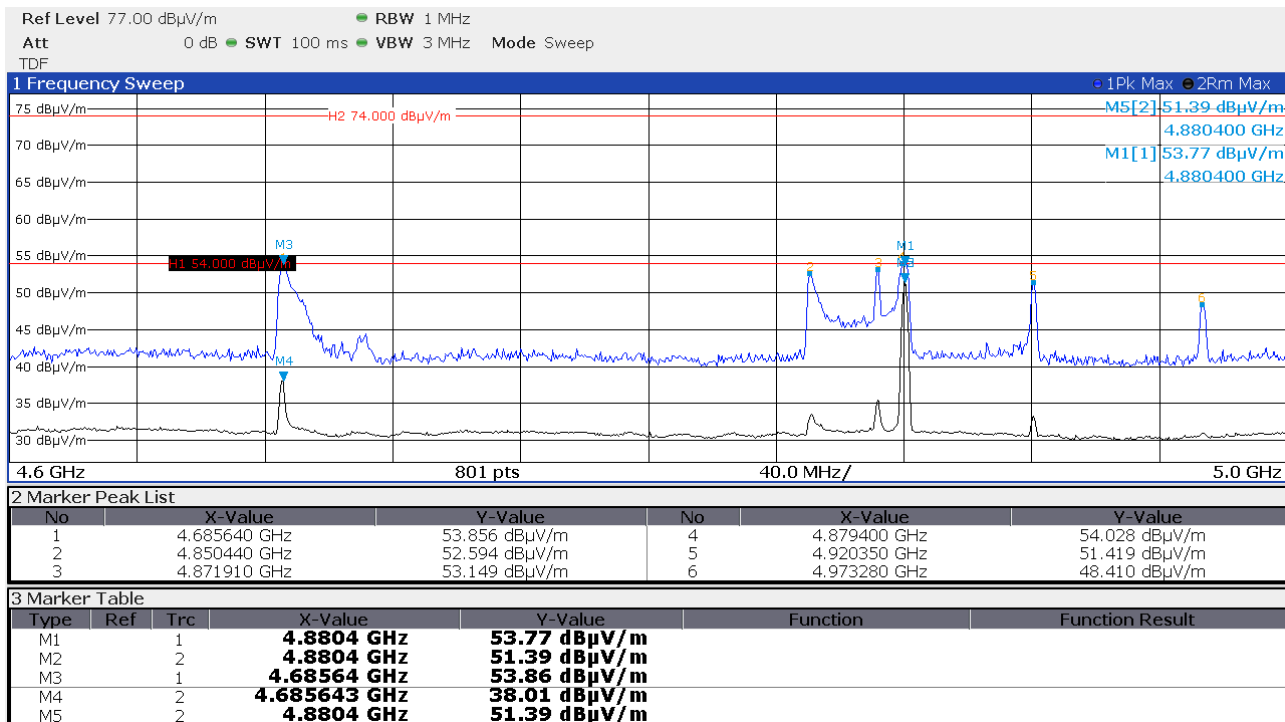


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IC: 25048-DS02DC02

2440 MHz, horizontal polarisation, EUT-X:

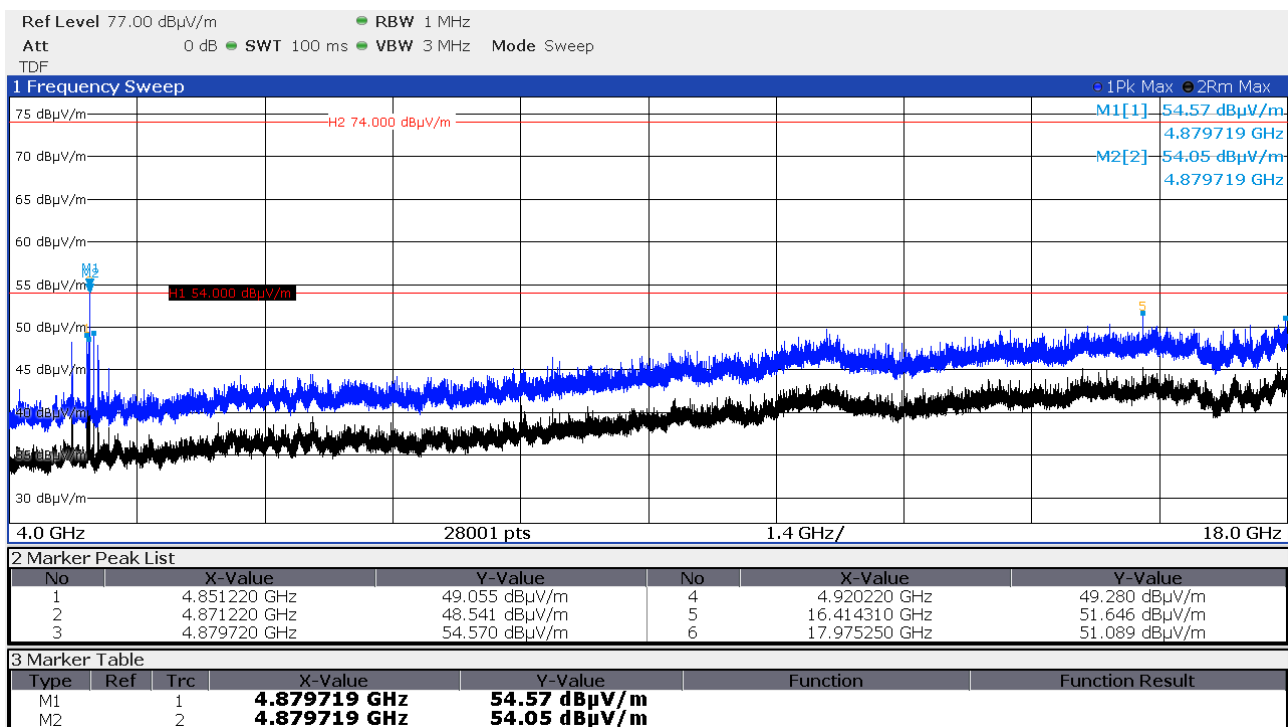
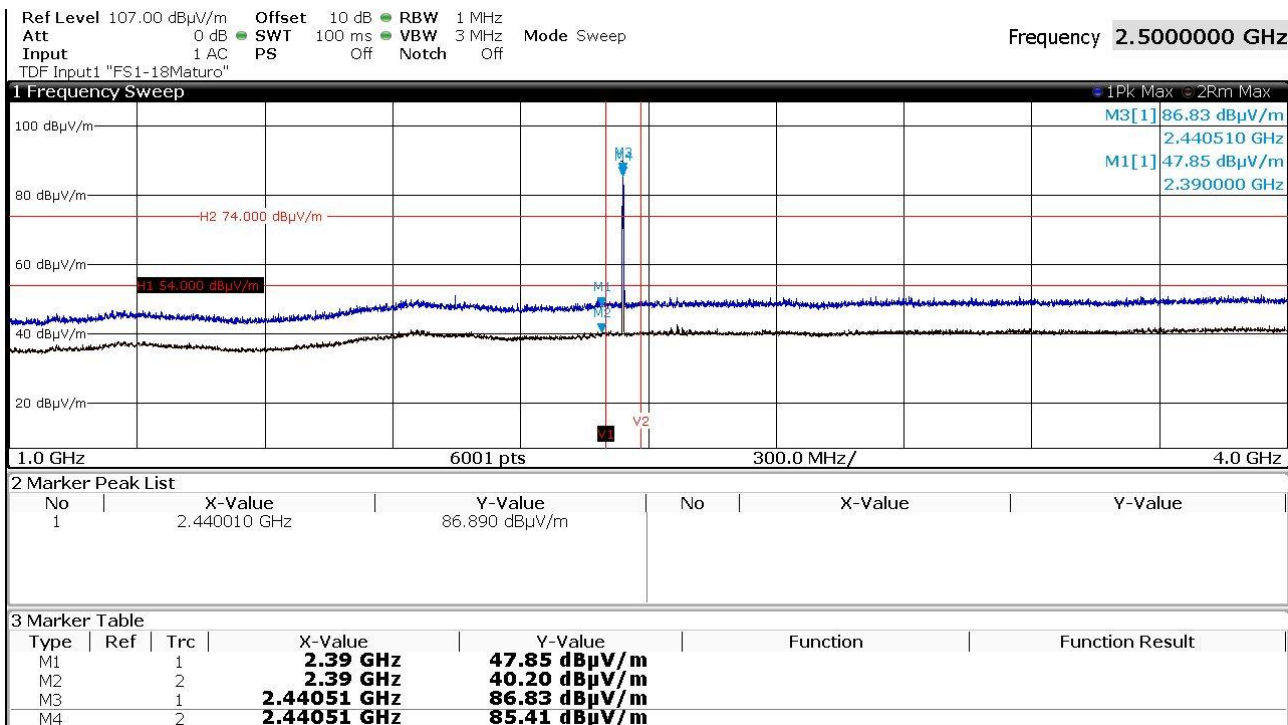


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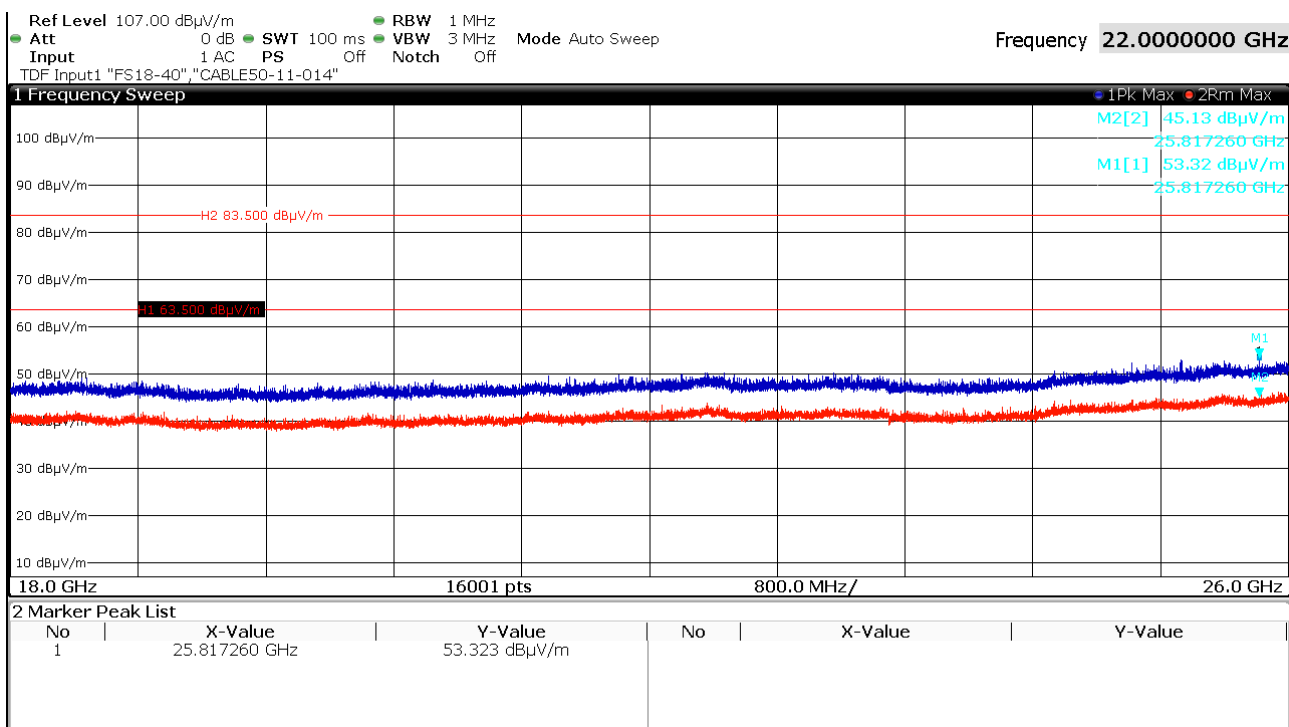
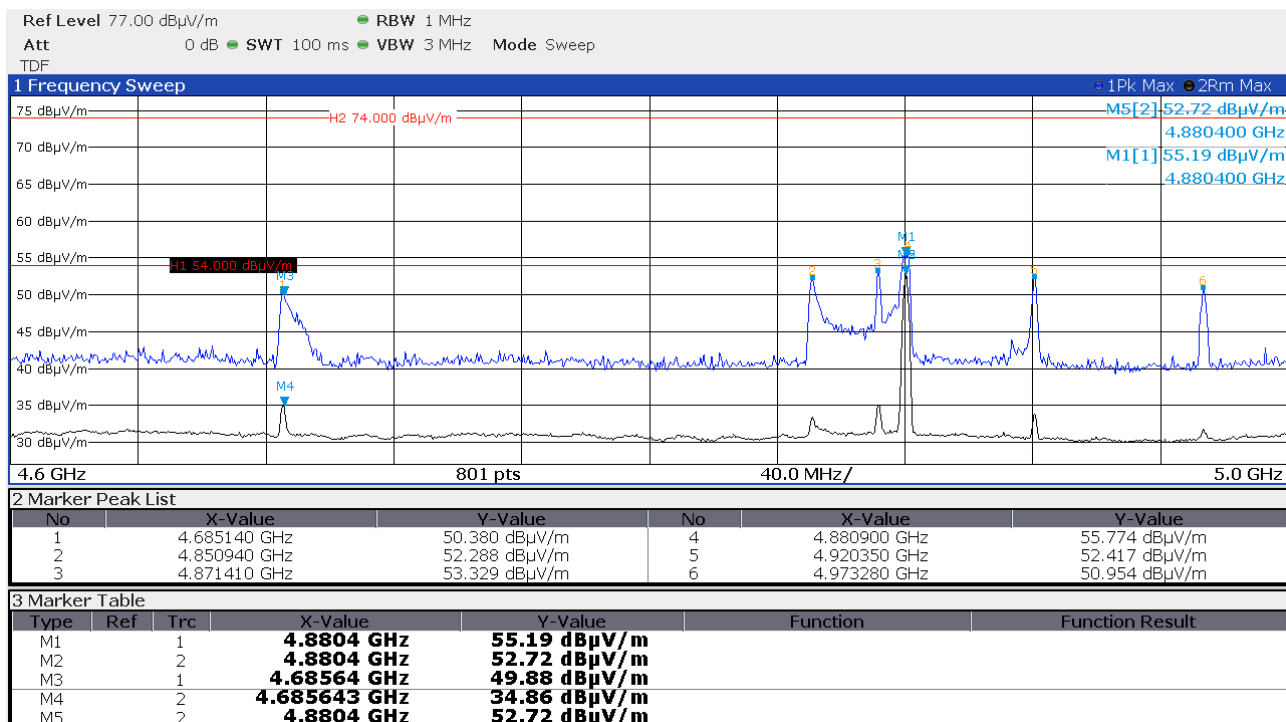
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2440 MHz, vertical polarisation, EUT-X:



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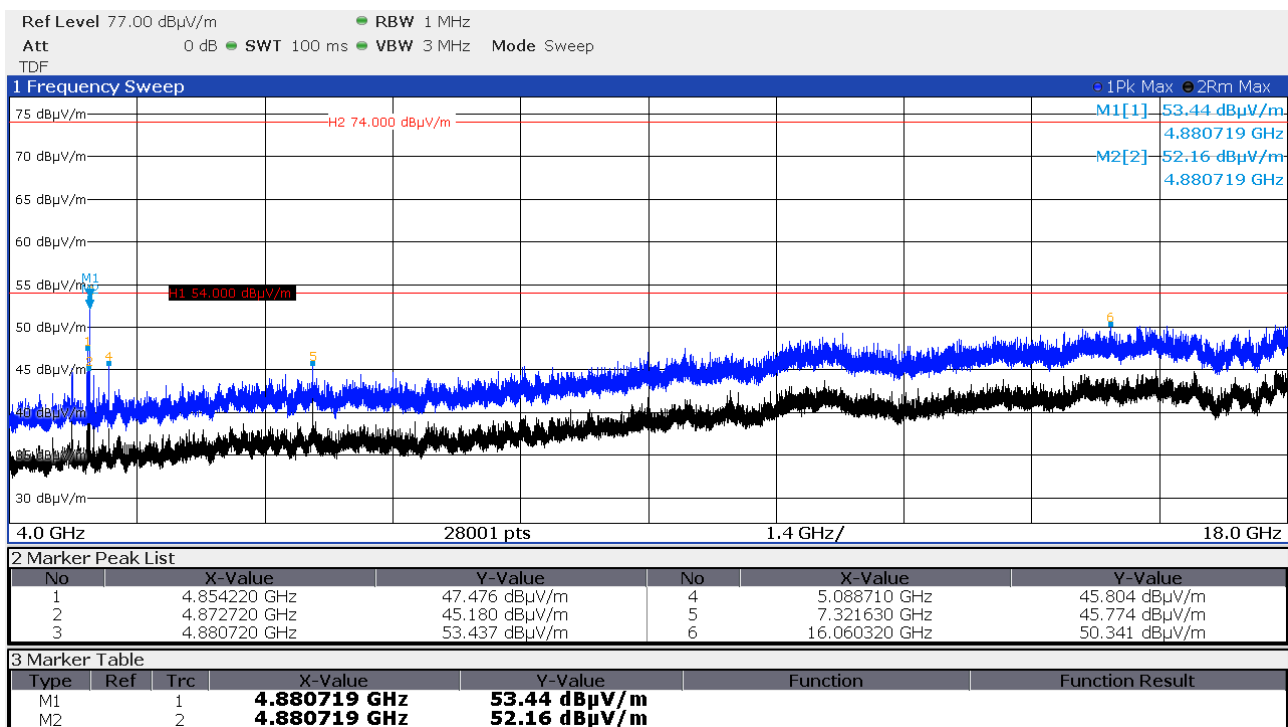
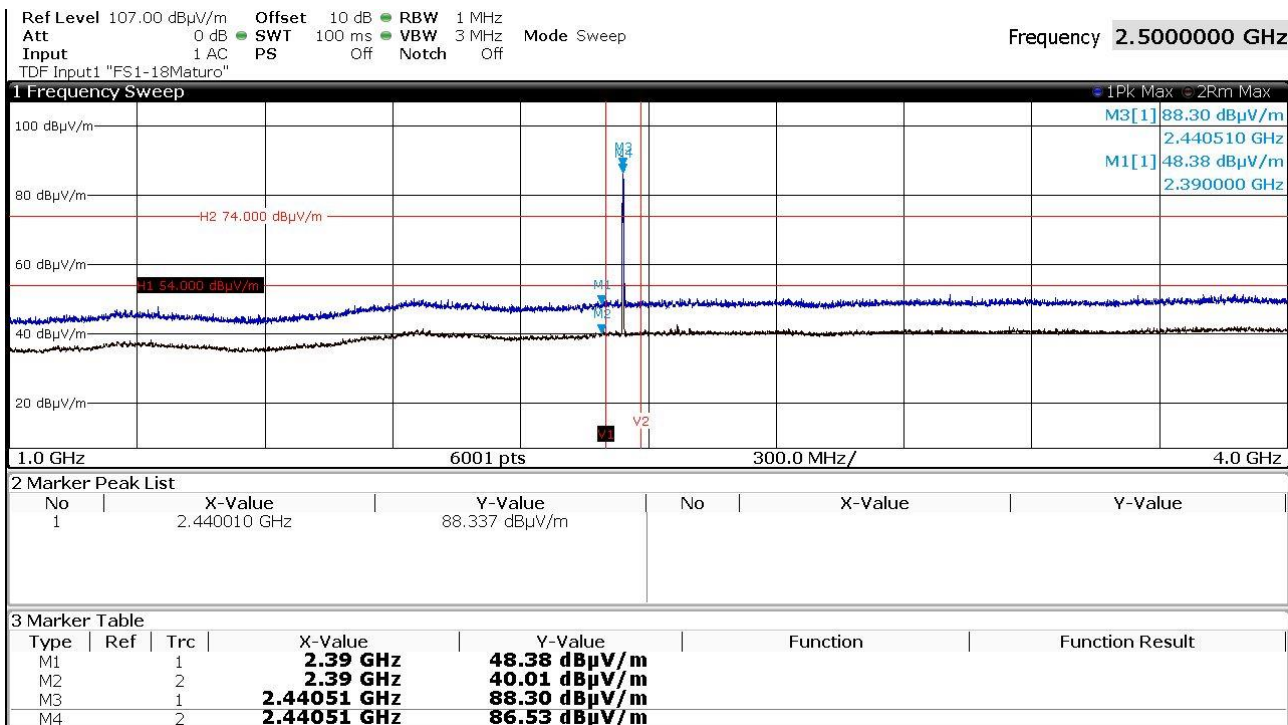
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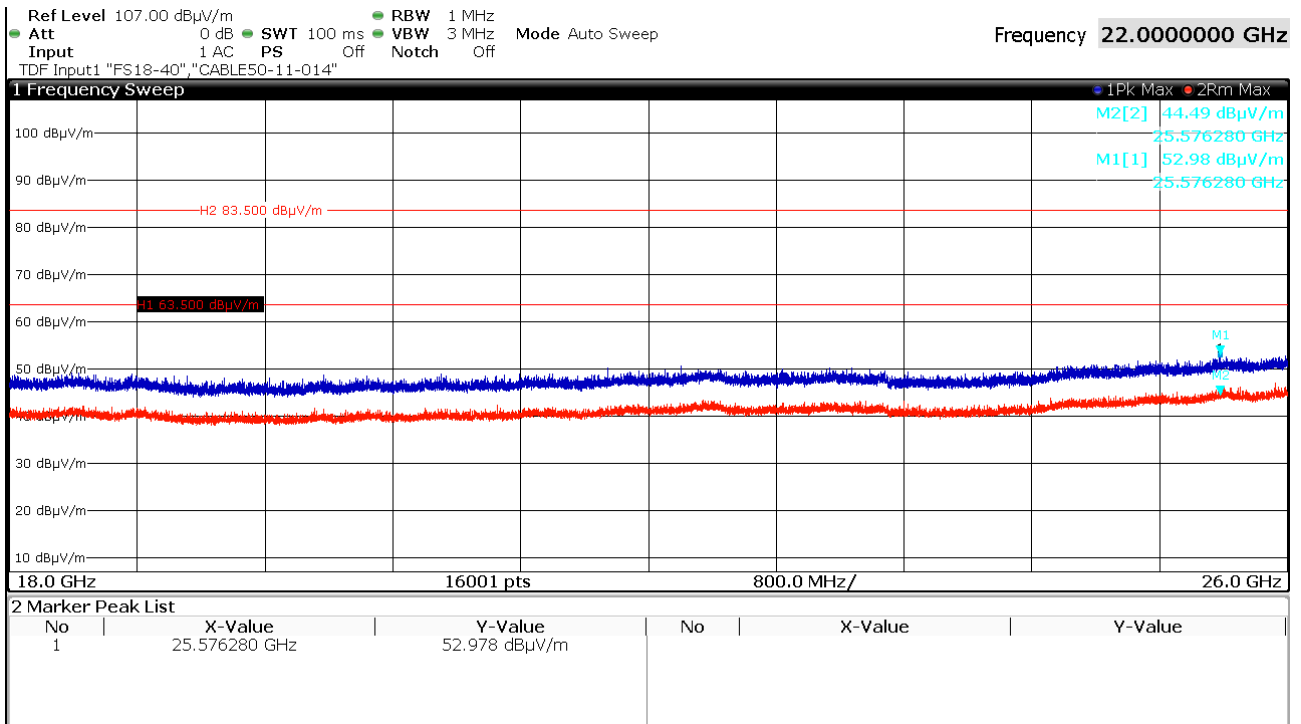
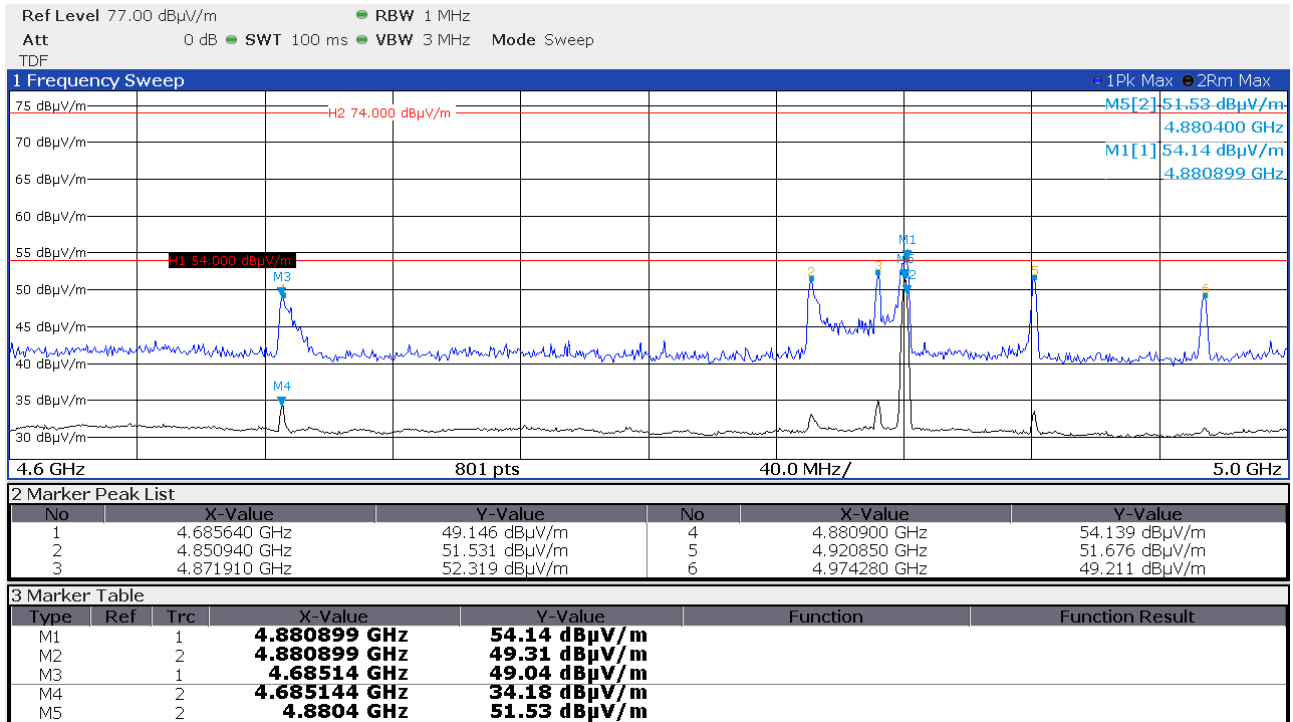


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IC: 25048-DS02DC02

2440 MHz, horizontal polarisation, EUT-Y:

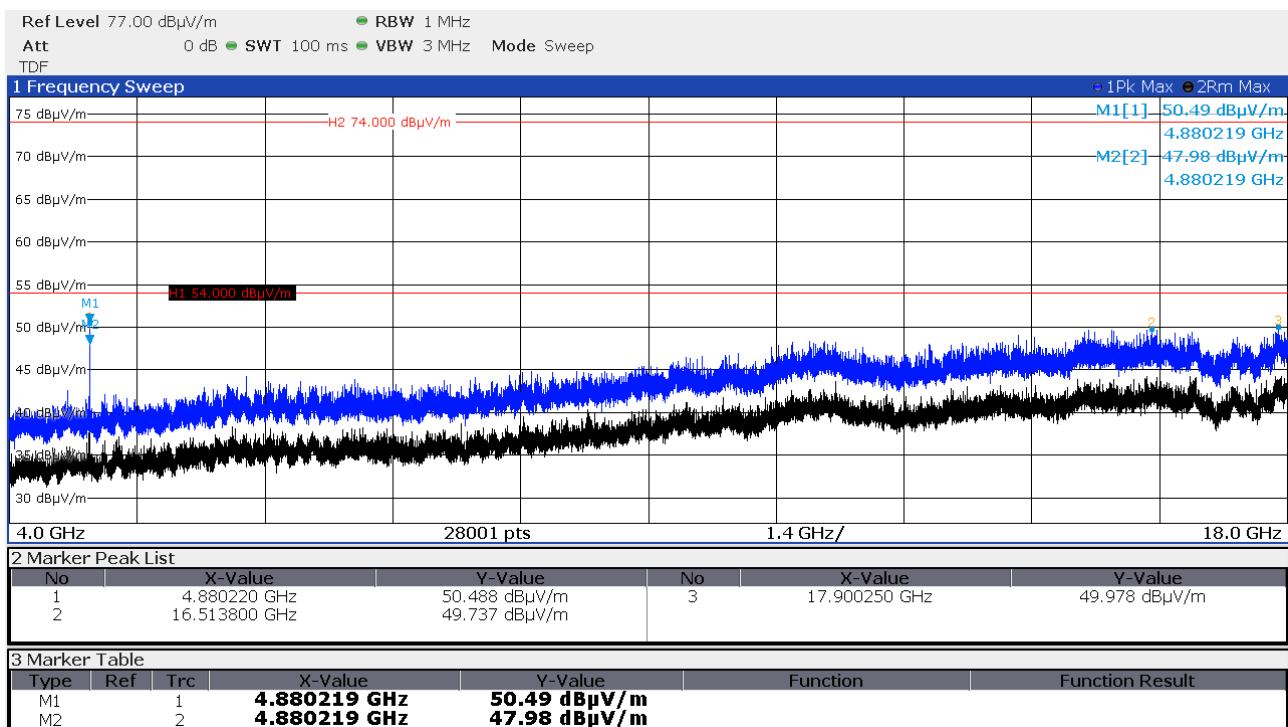
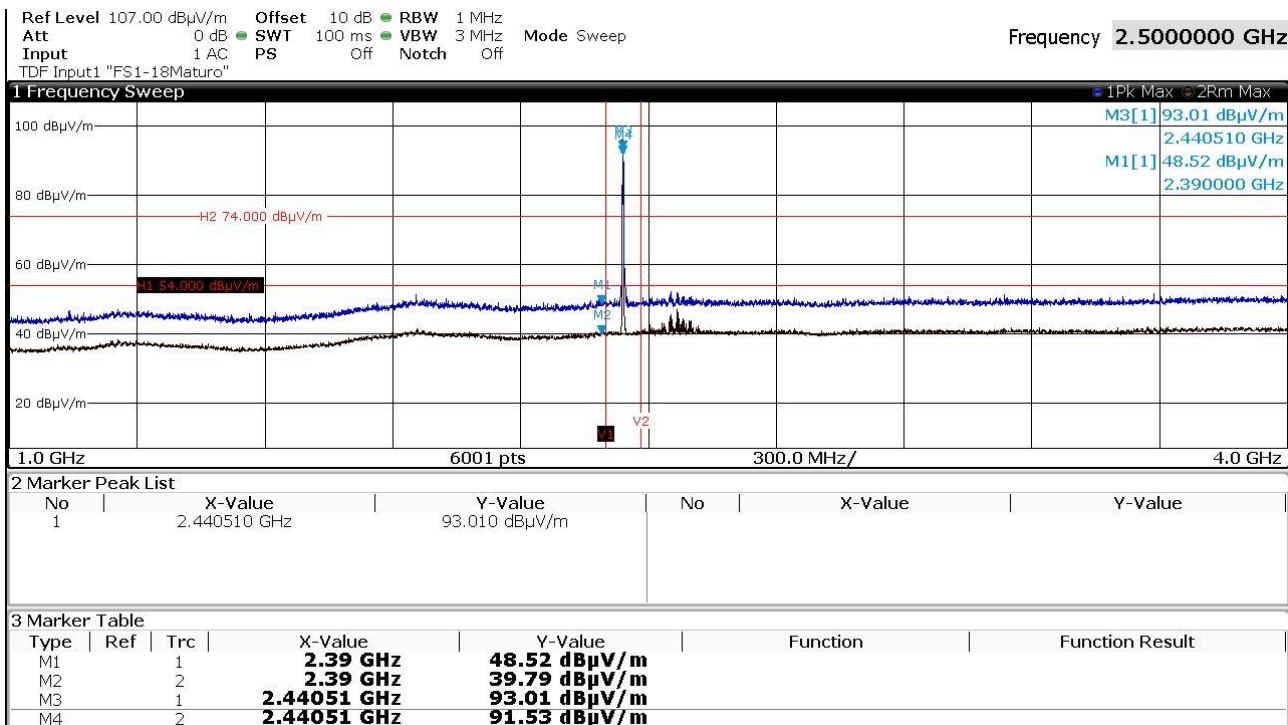


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IC: 25048-DS02DC02


FCC ID: 2ATBZDS02DC02

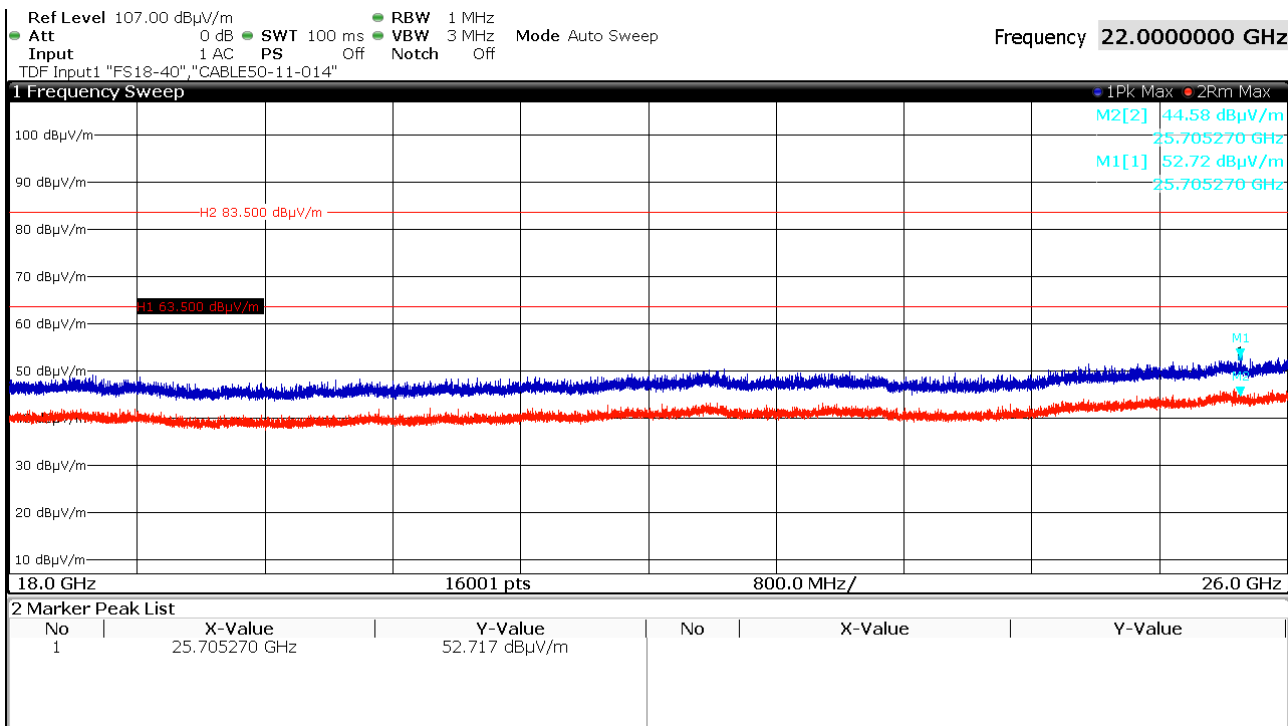
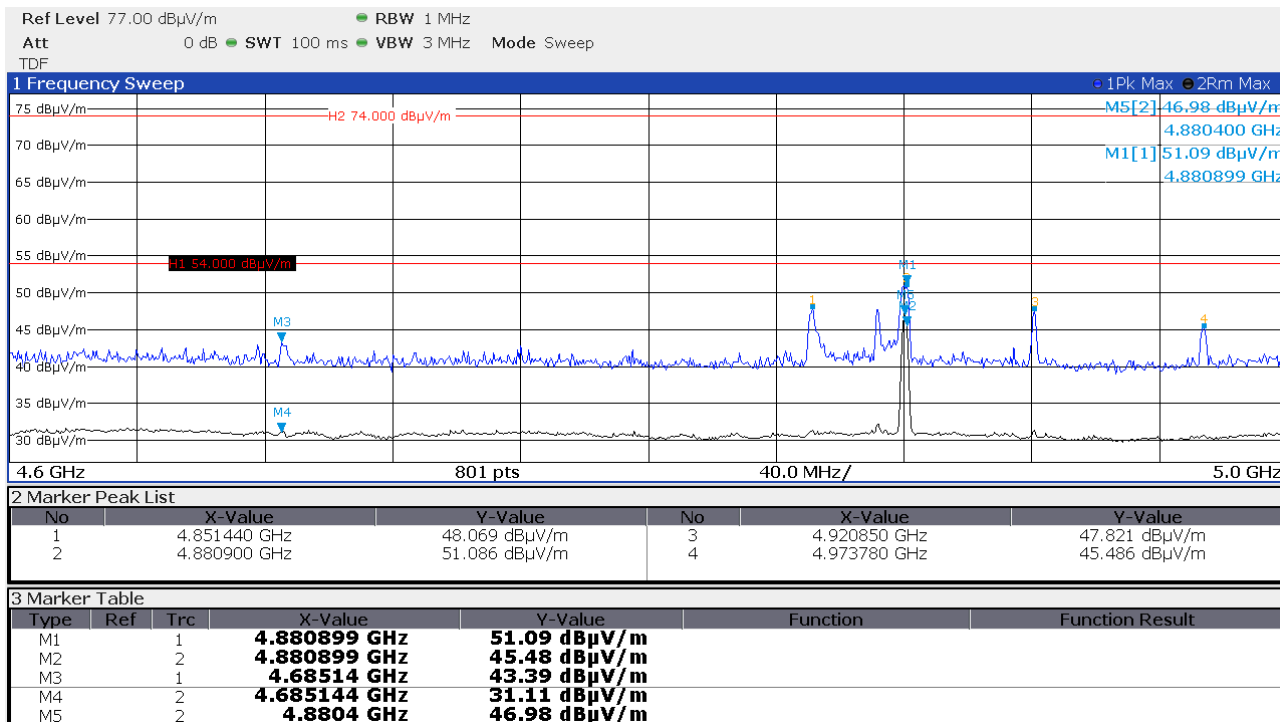
IC: 25048-DS02DC02

2440 MHz, vertical polarisation, EUT-Y:



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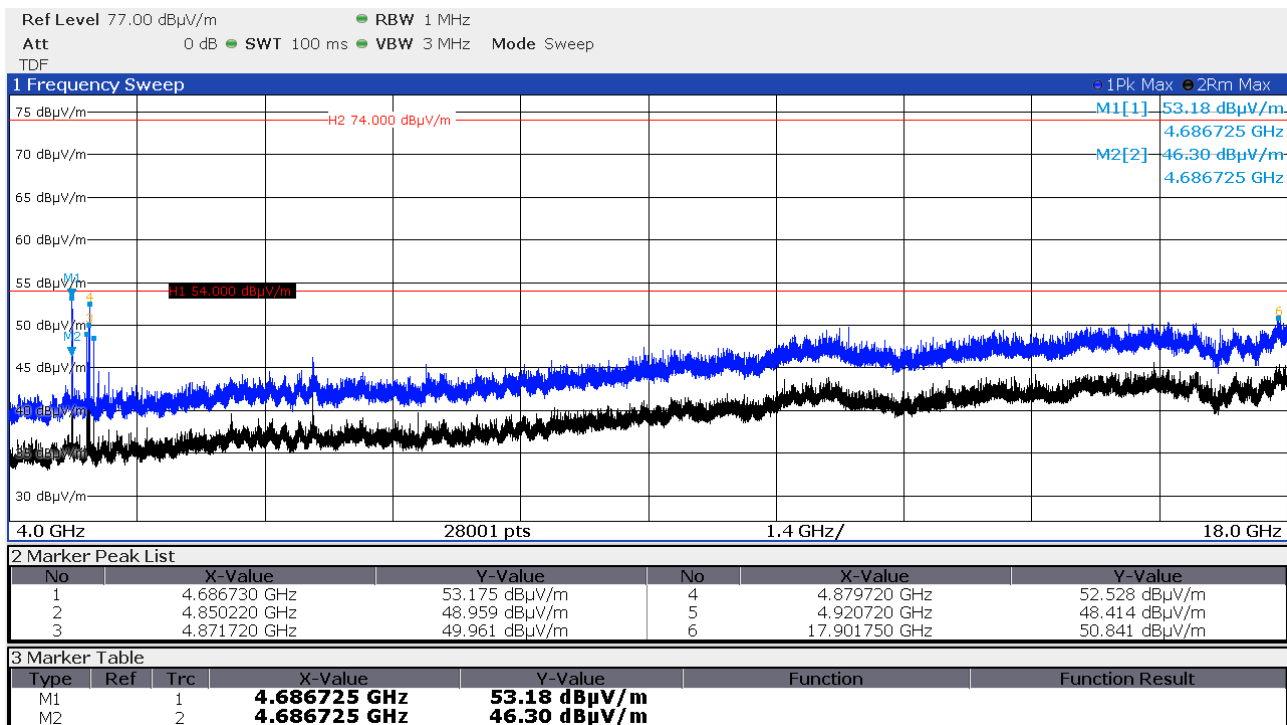
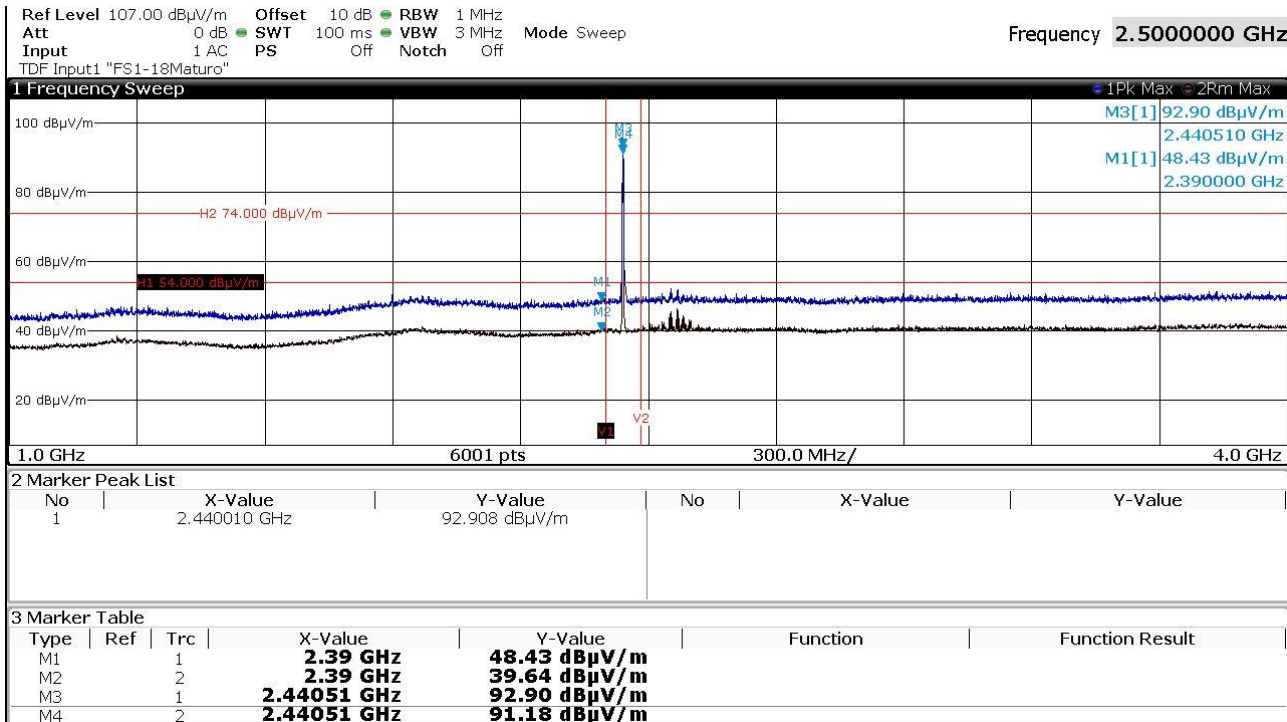
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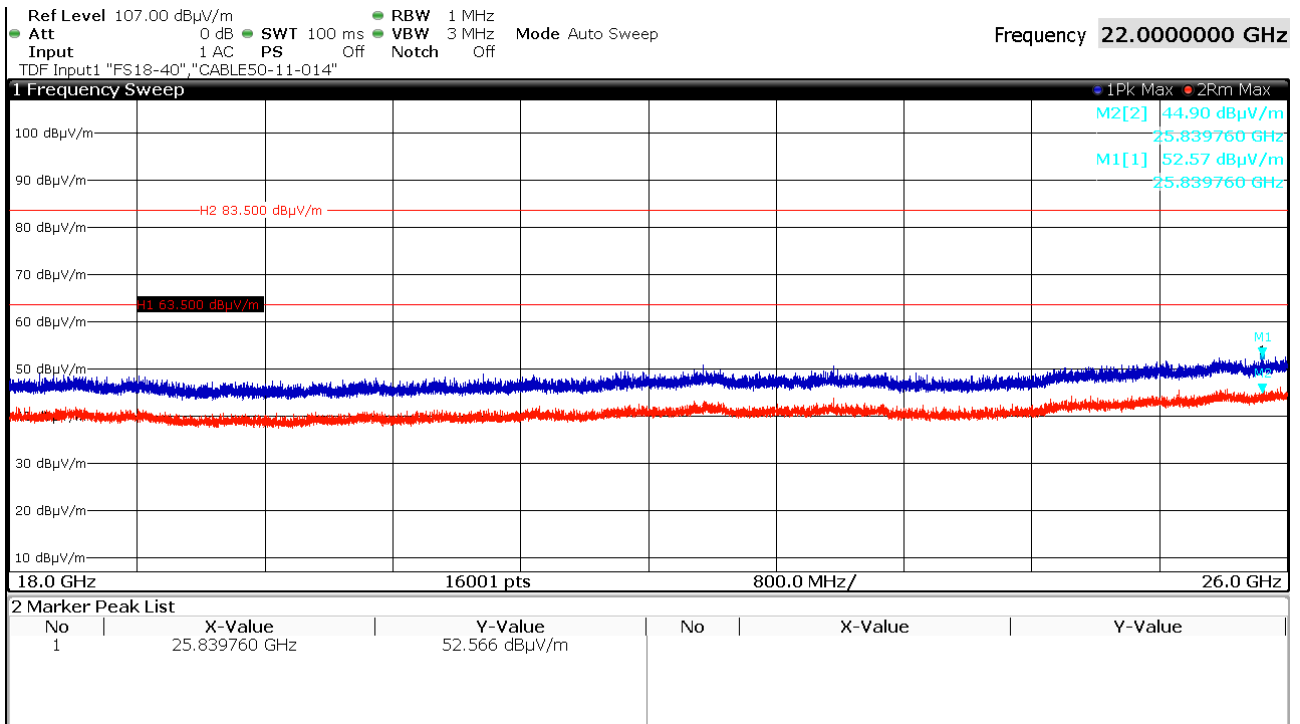
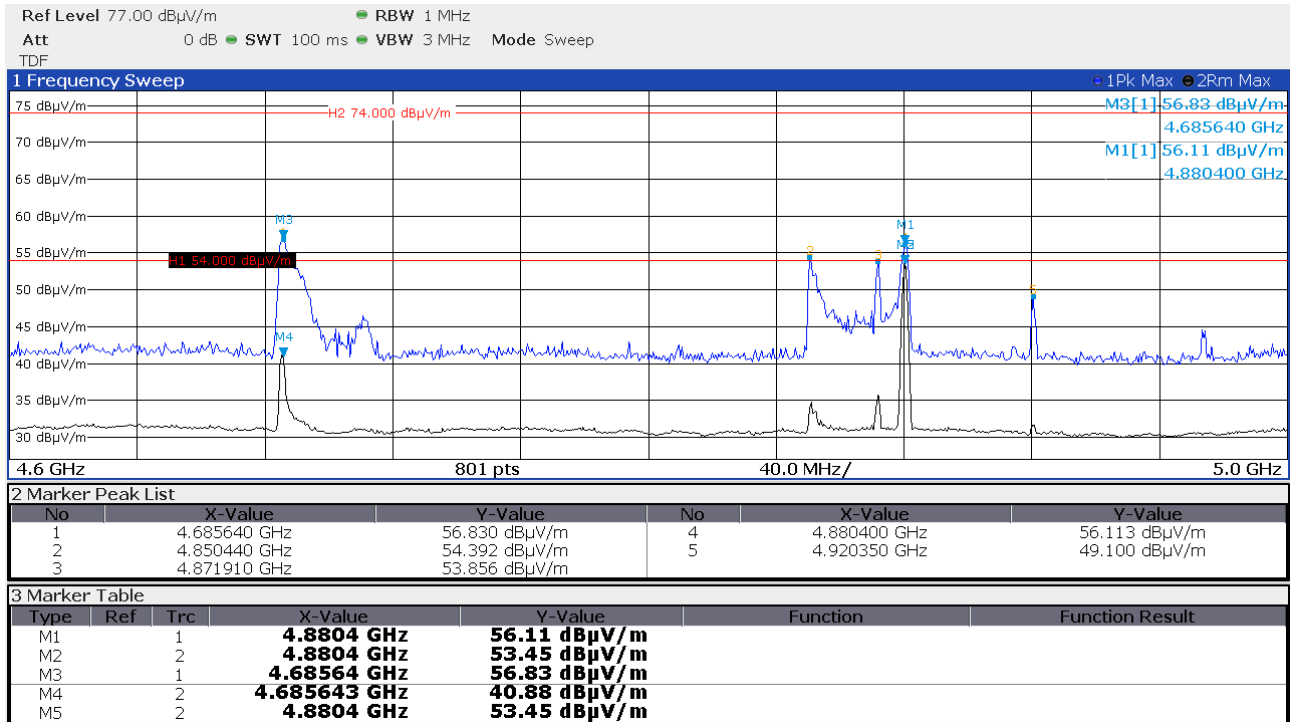
IC: 25048-DS02DC02

2440 MHz, horizontal polarisation, EUT-Z:



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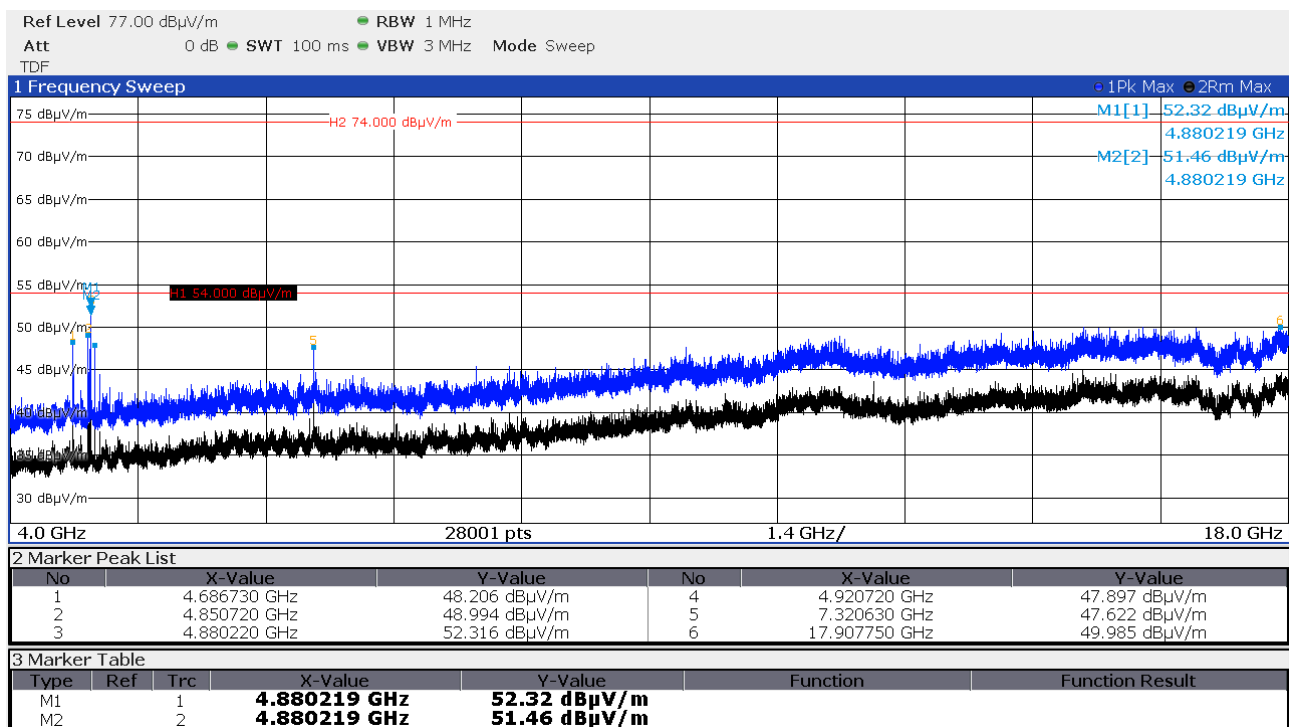
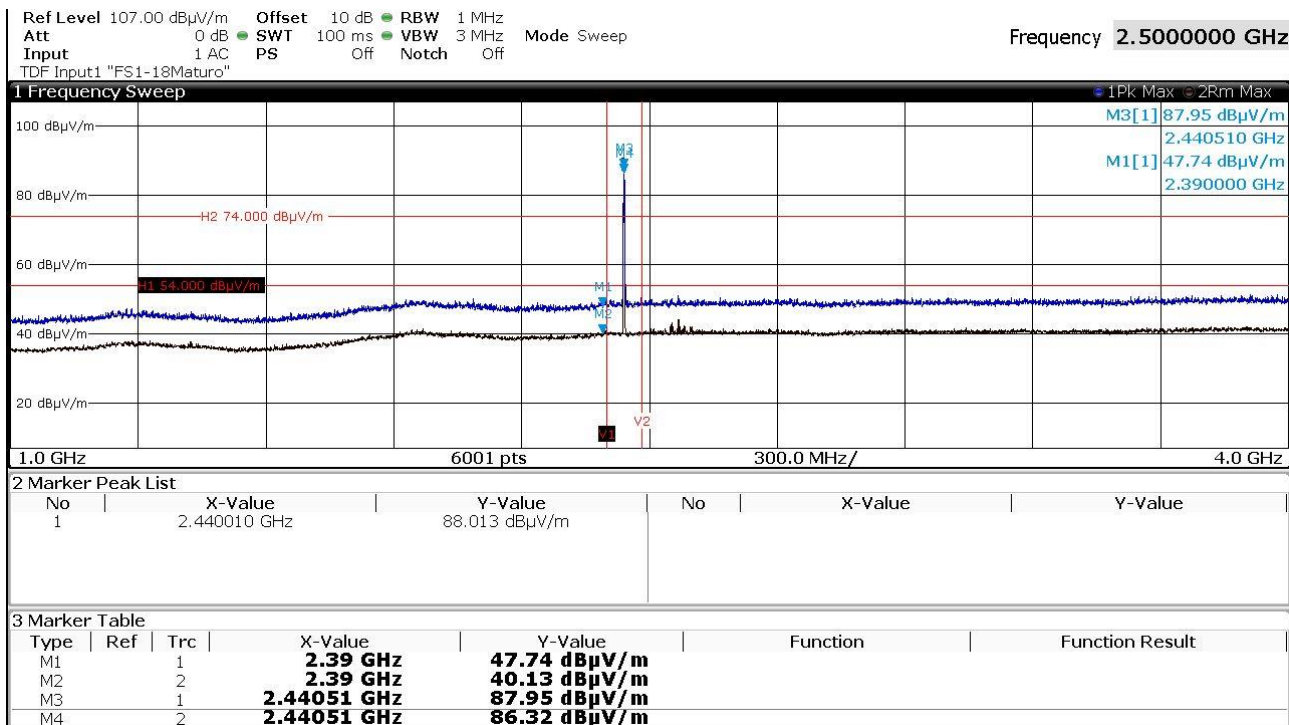
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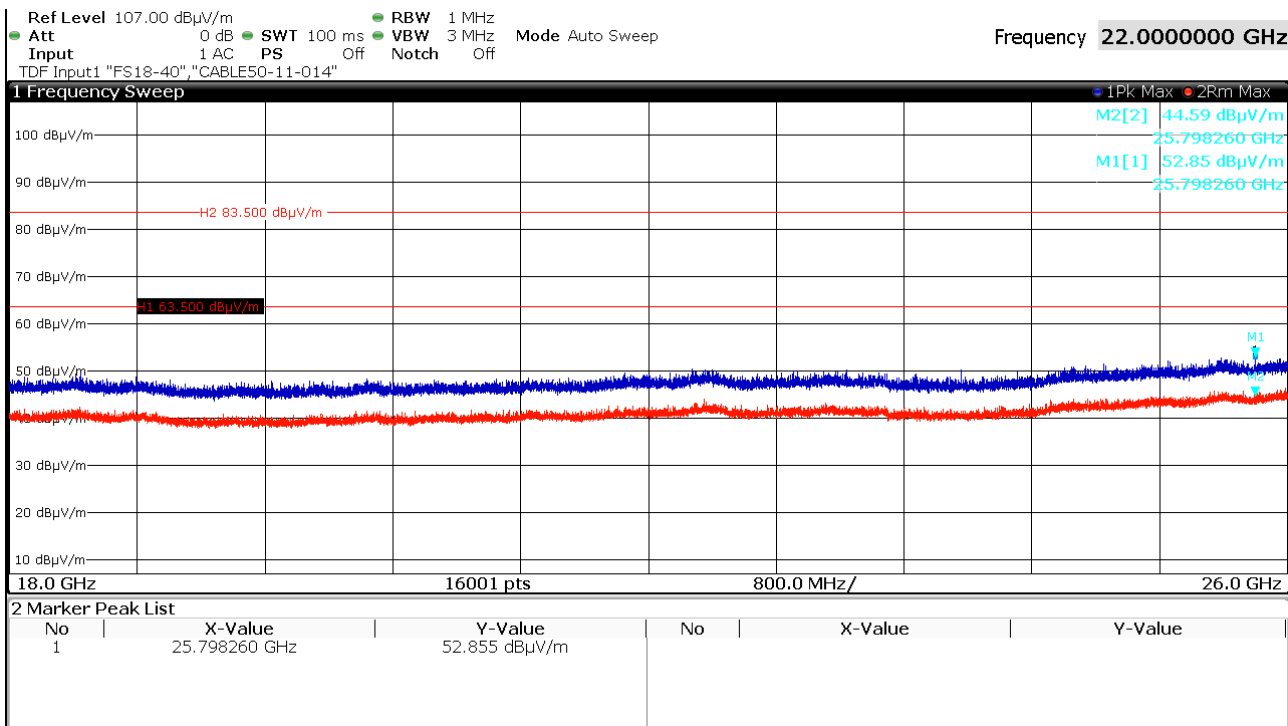
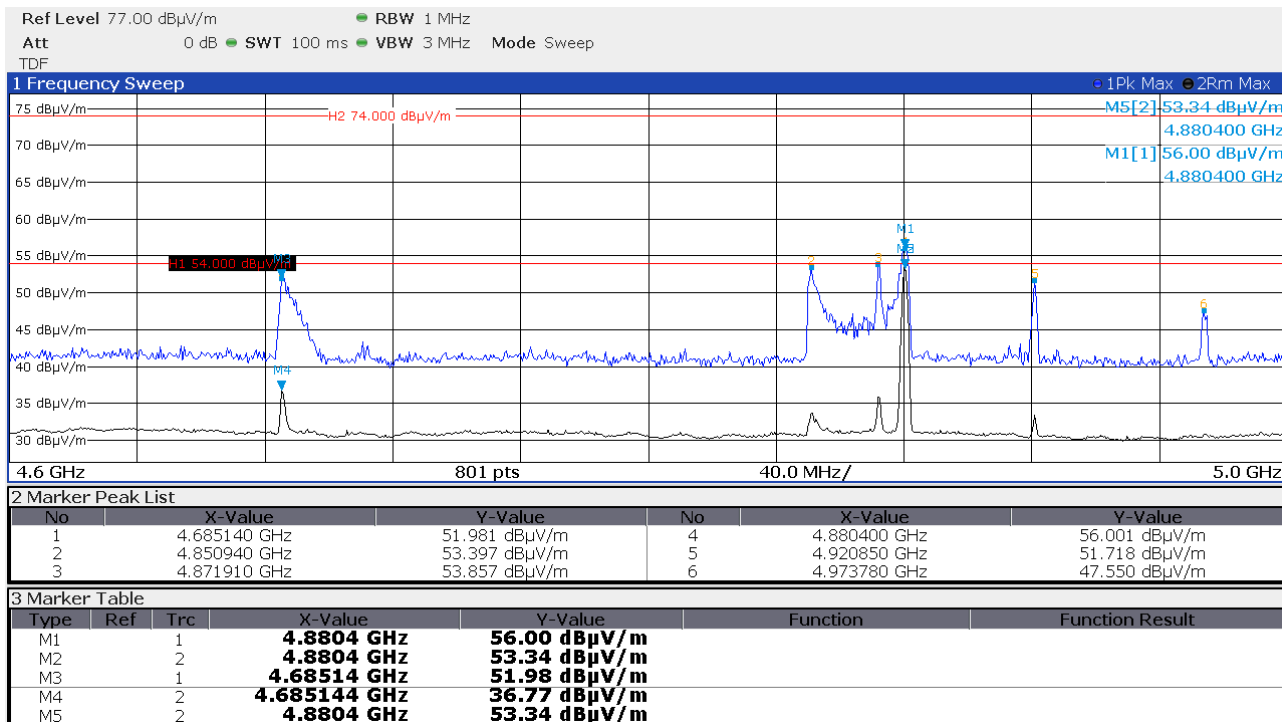
IC: 25048-DS02DC02

2440 MHz, vertical polarisation, EUT-Z:



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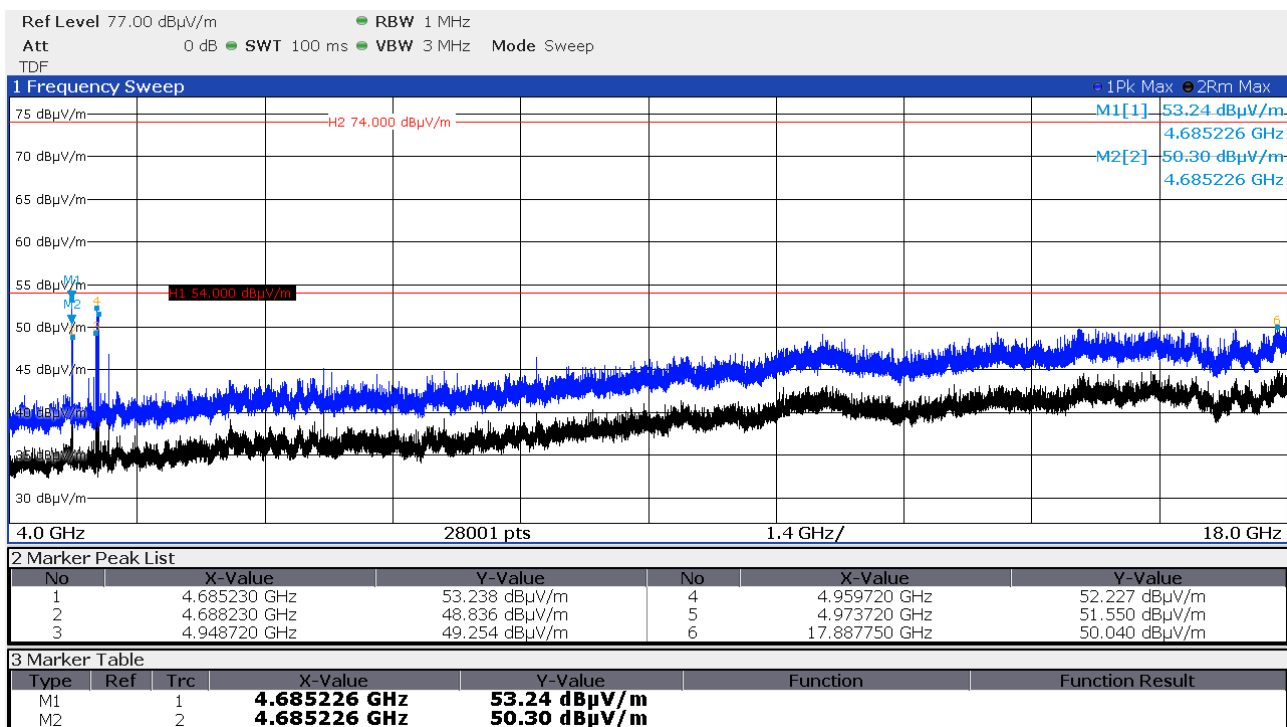
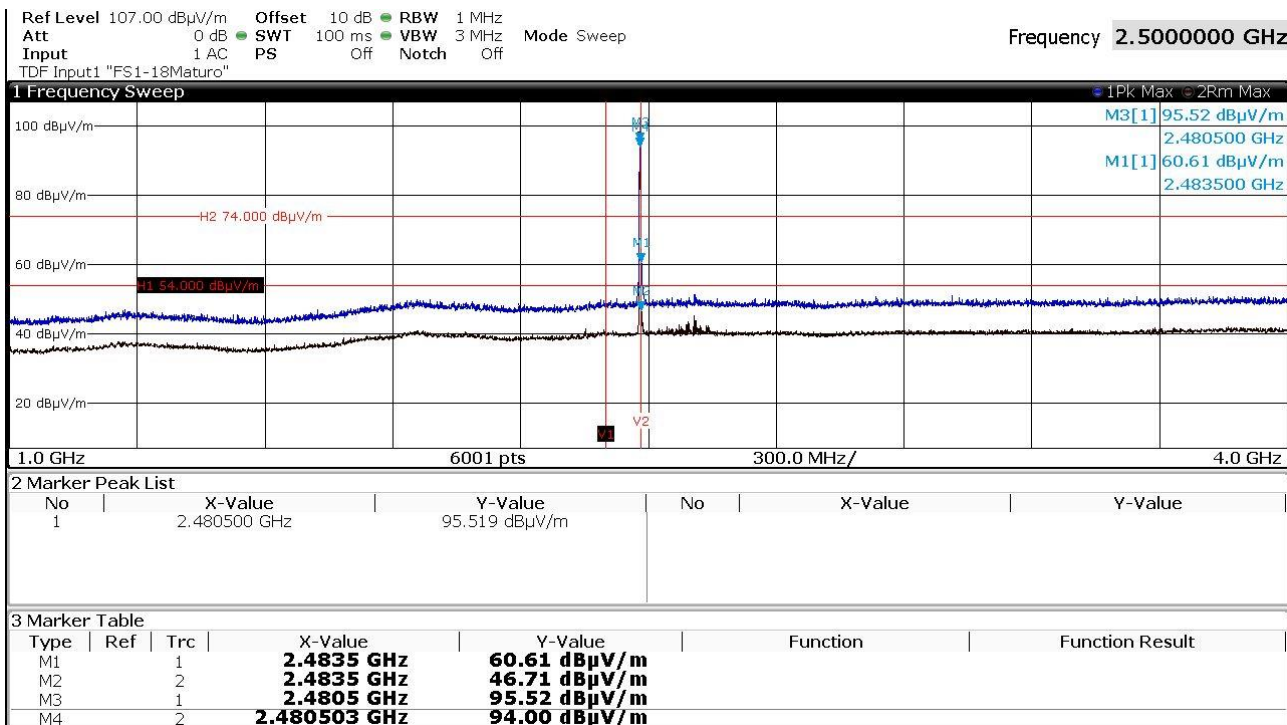
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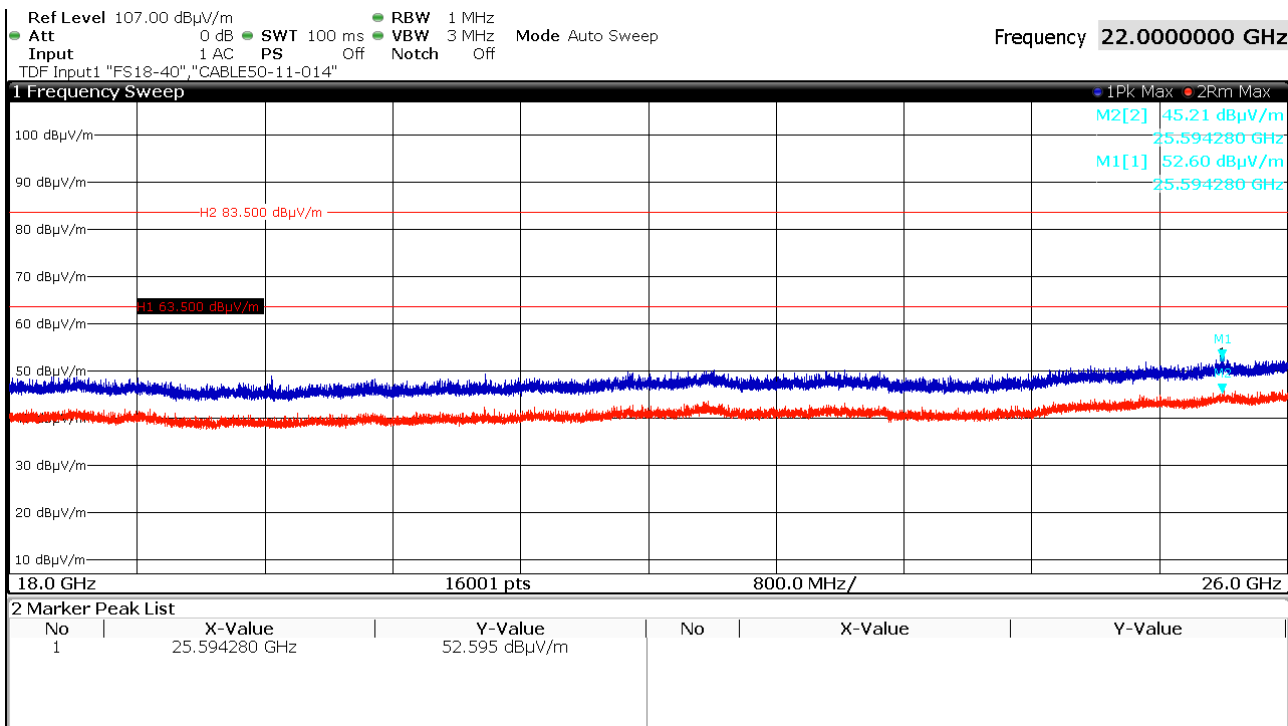
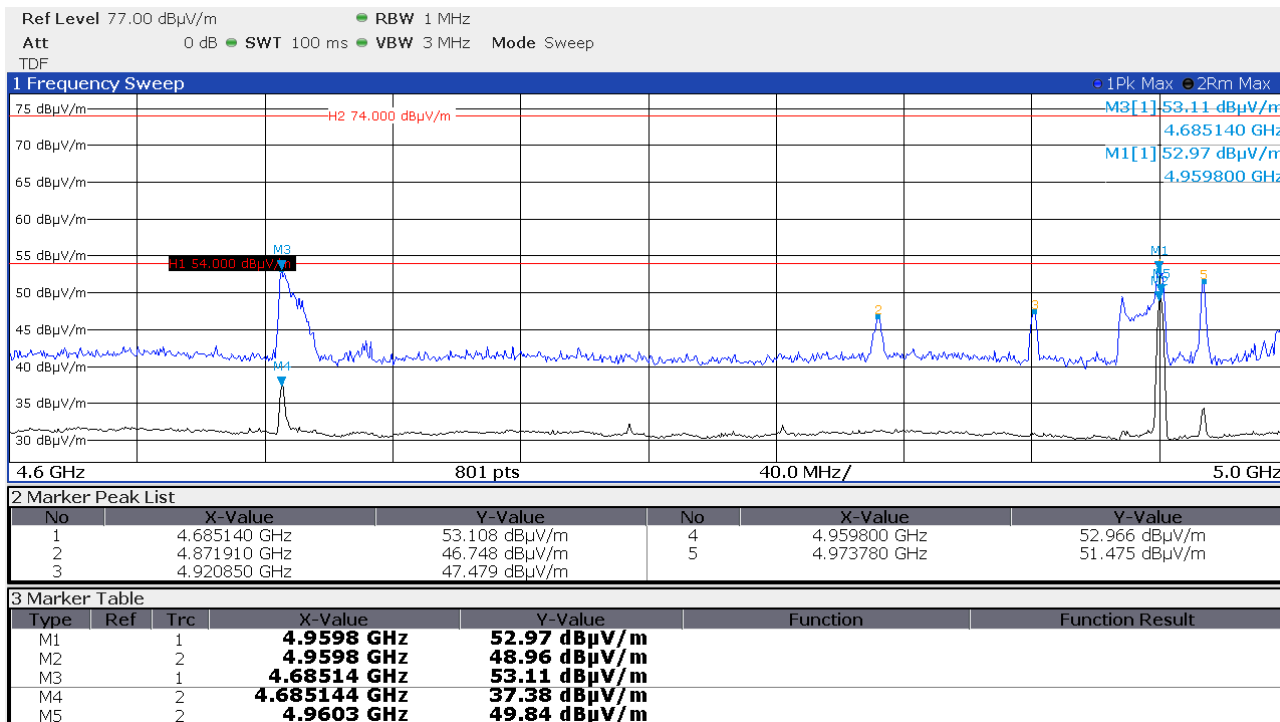
IC: 25048-DS02DC02

2480 MHz, horizontal polarisation, EUT-X:



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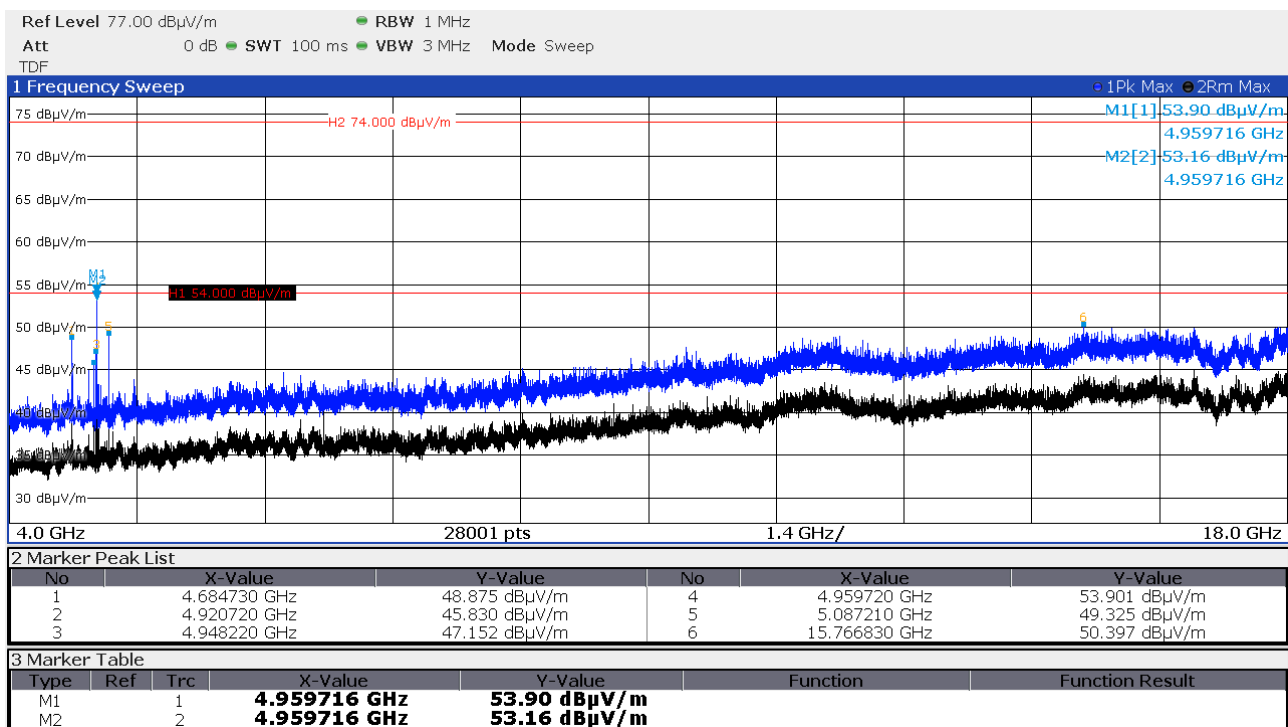
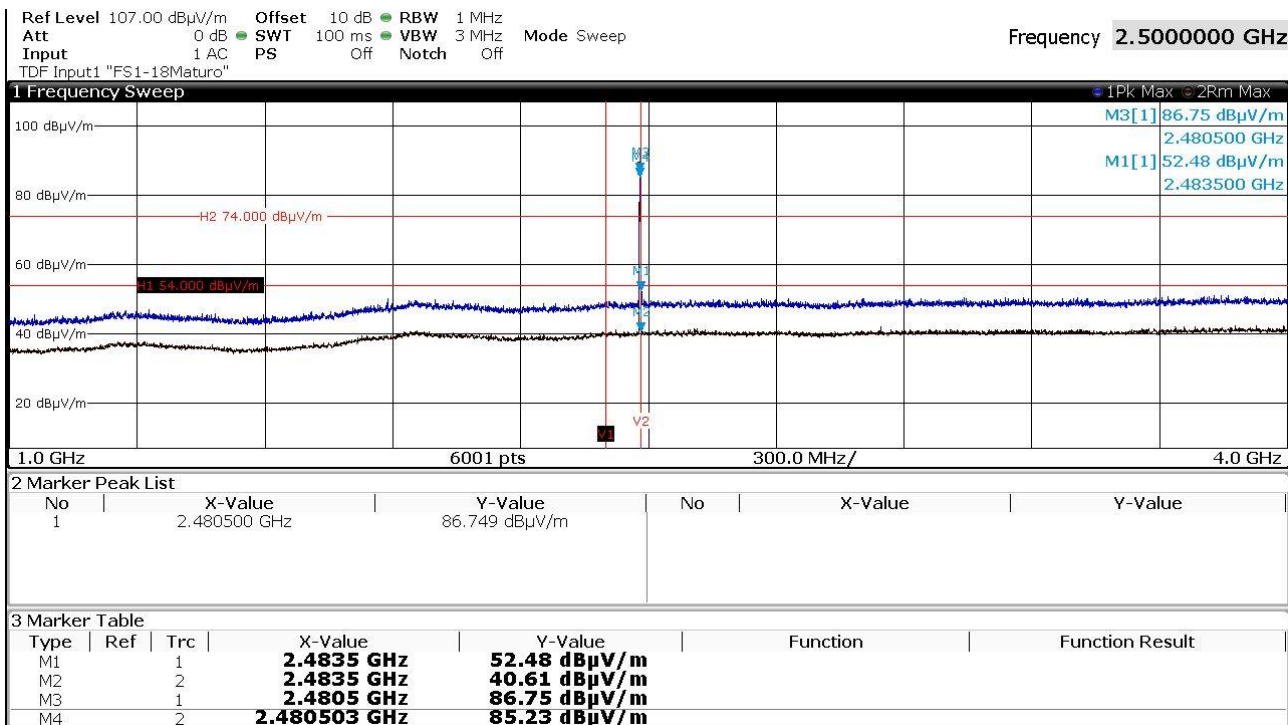
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FCC ID: 2ATBZDS02DC02

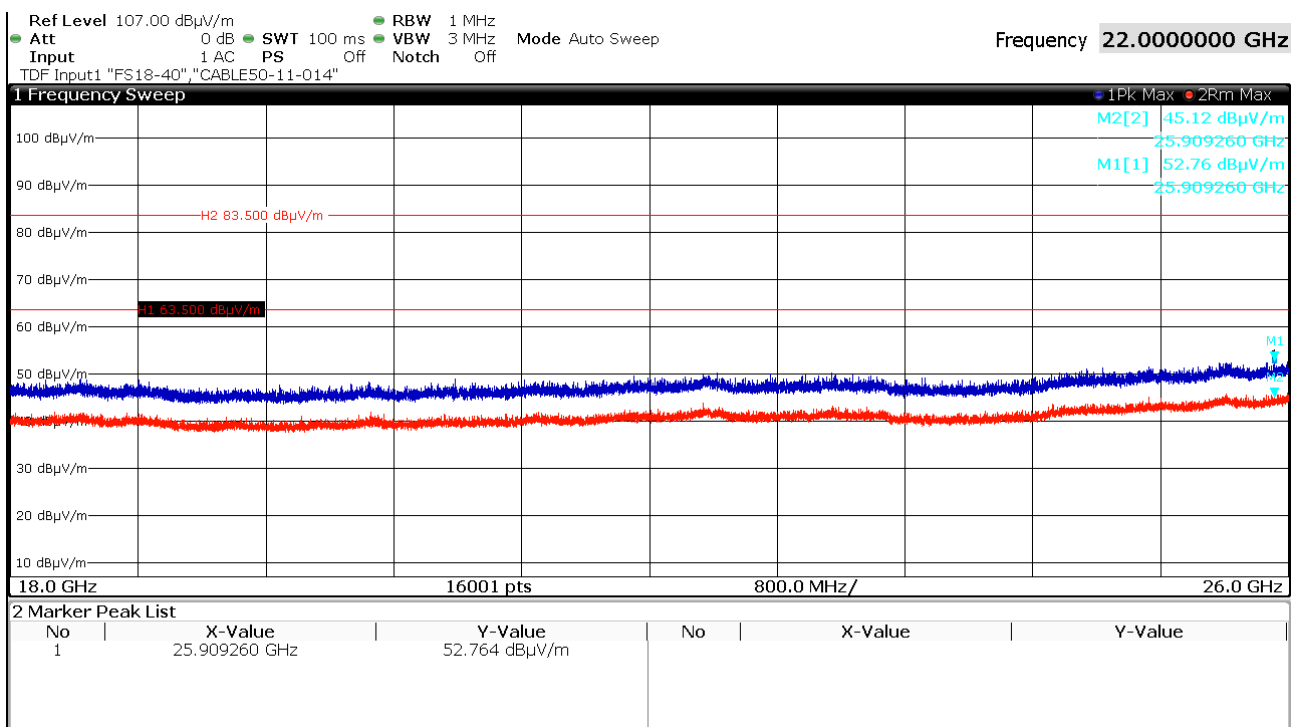
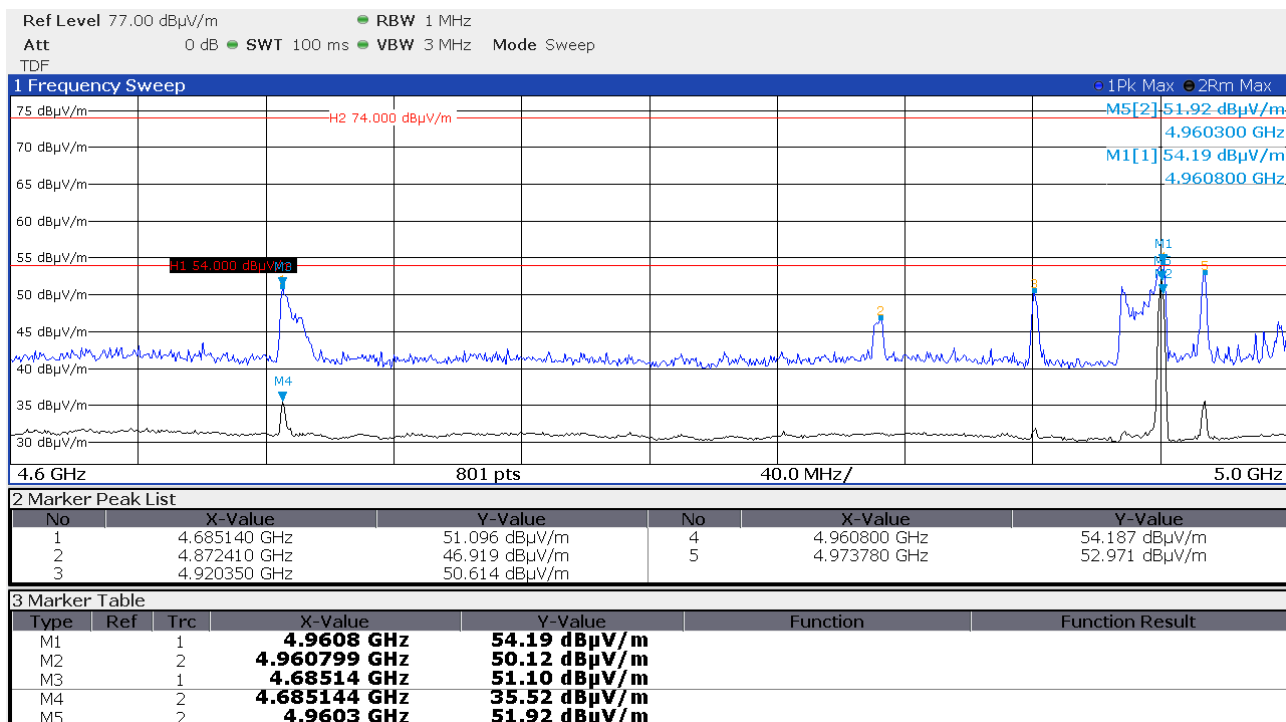
IC: 25048-DS02DC02

2480 MHz, vertical polarisation, EUT-X:



FCC ID: 2ATBZDS02DC02

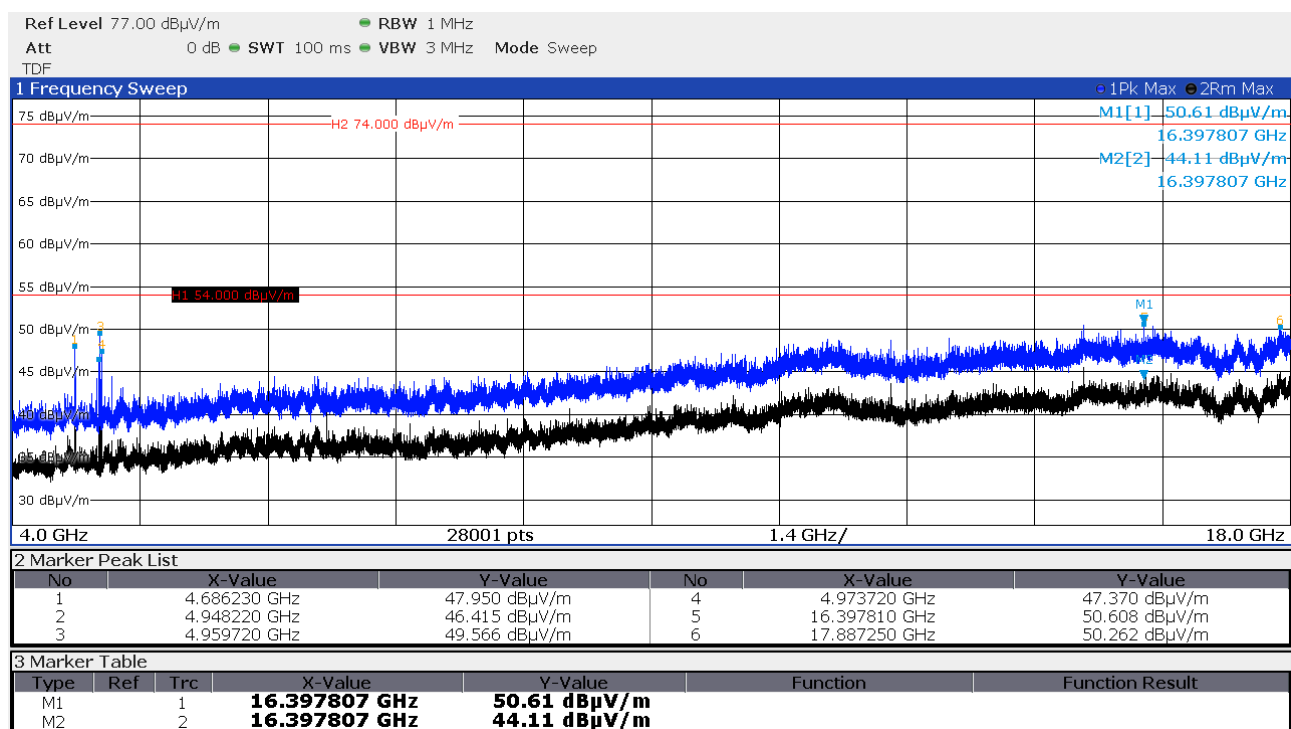
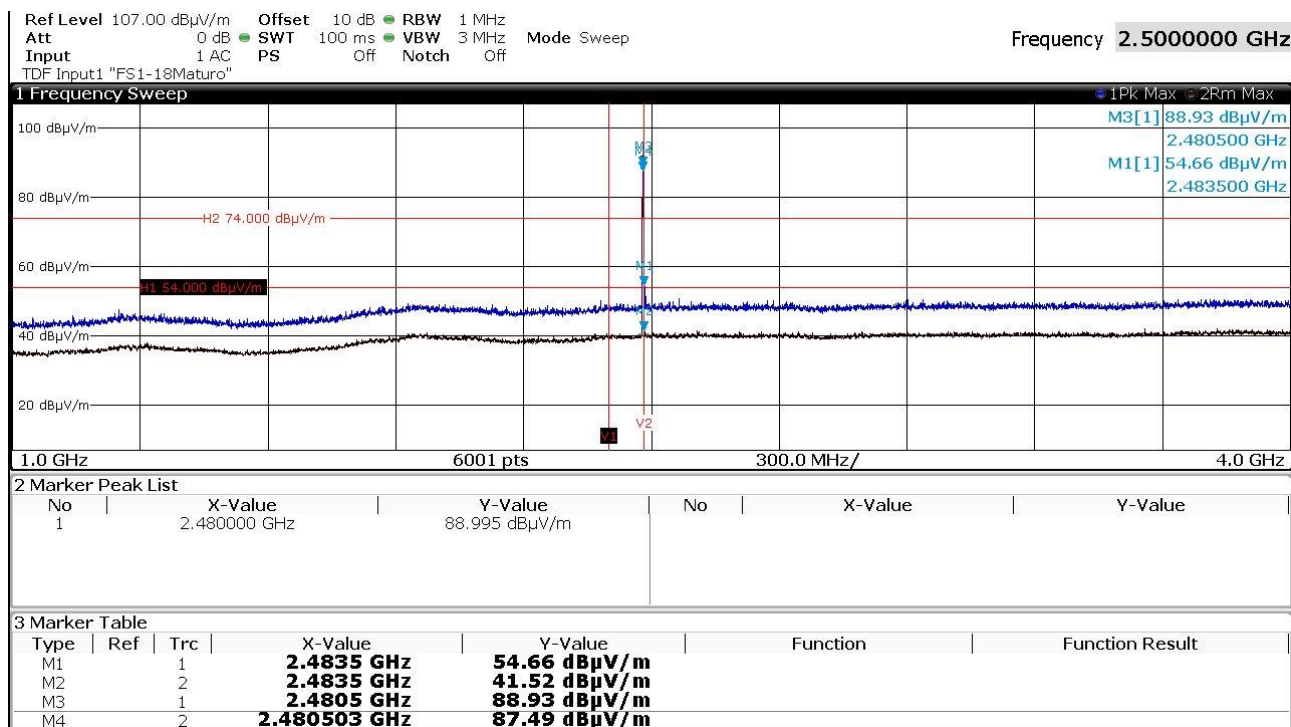
IC: 25048-DS02DC02



FCC ID: 2ATBZDS02DC02

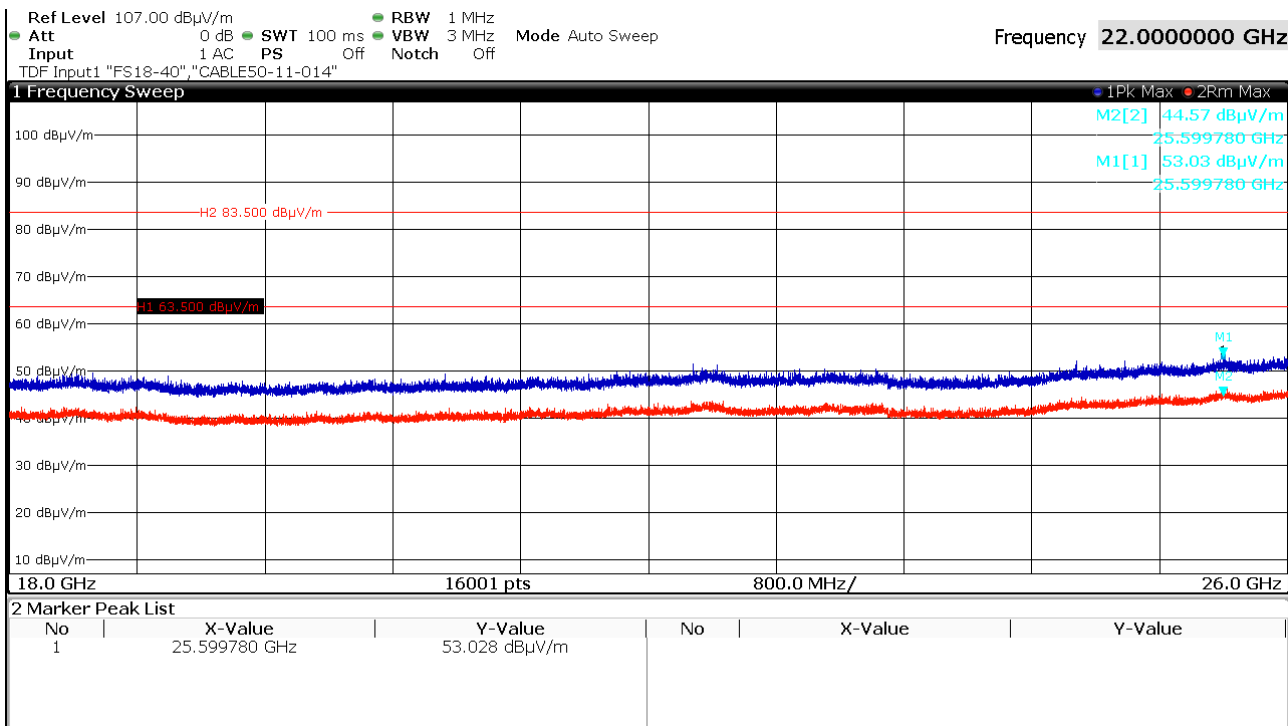
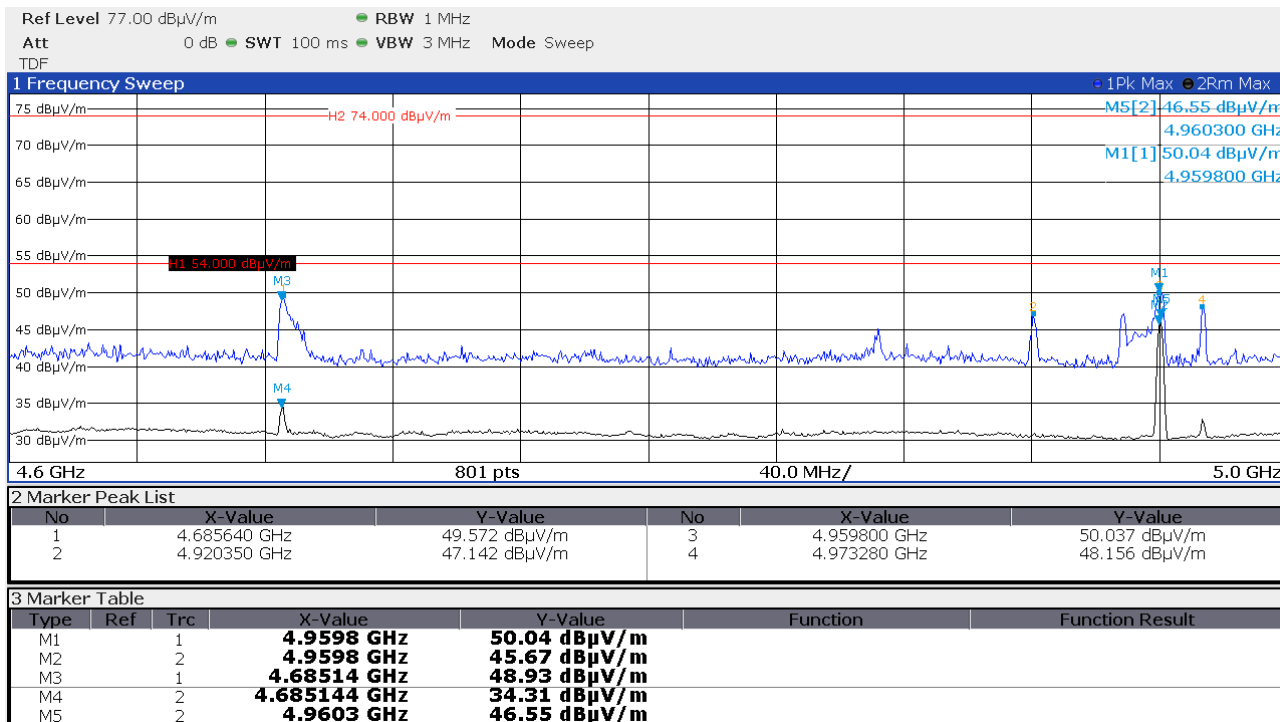
IC: 25048-DS02DC02

2480 MHz, horizontal polarisation, EUT-Y:



FCC ID: 2ATBZDS02DC02

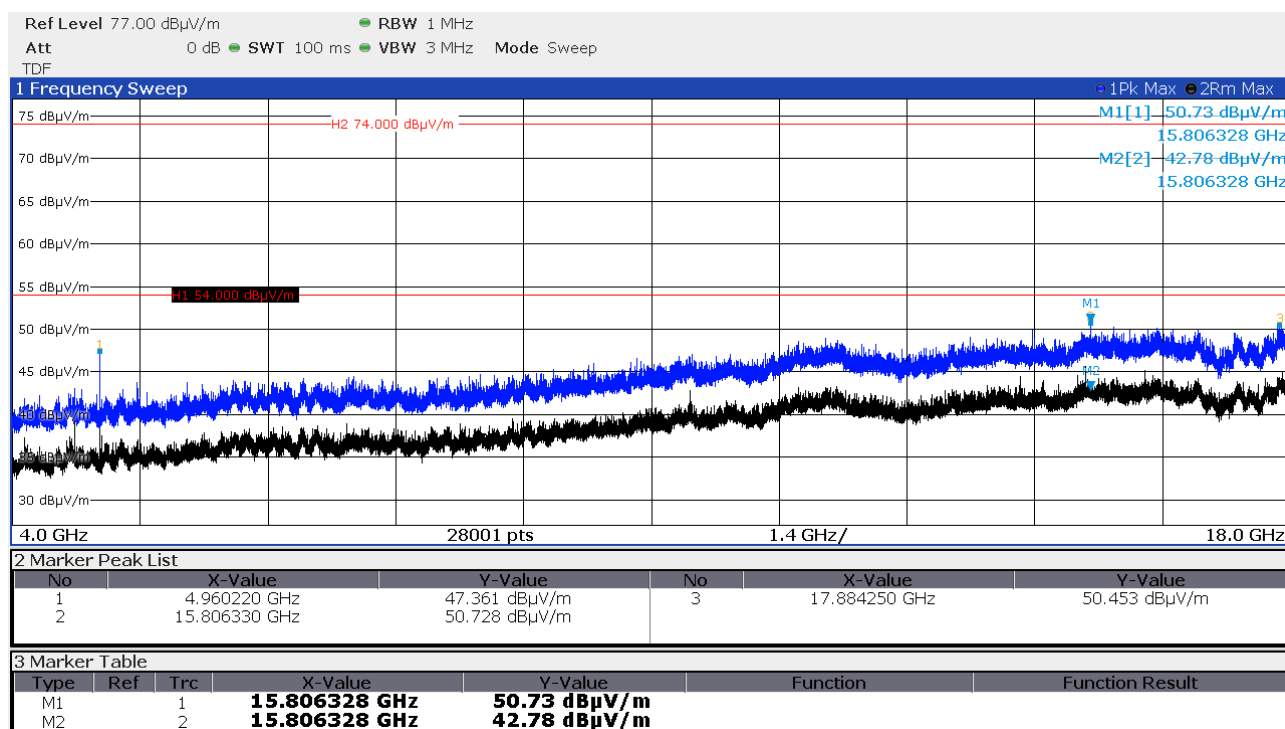
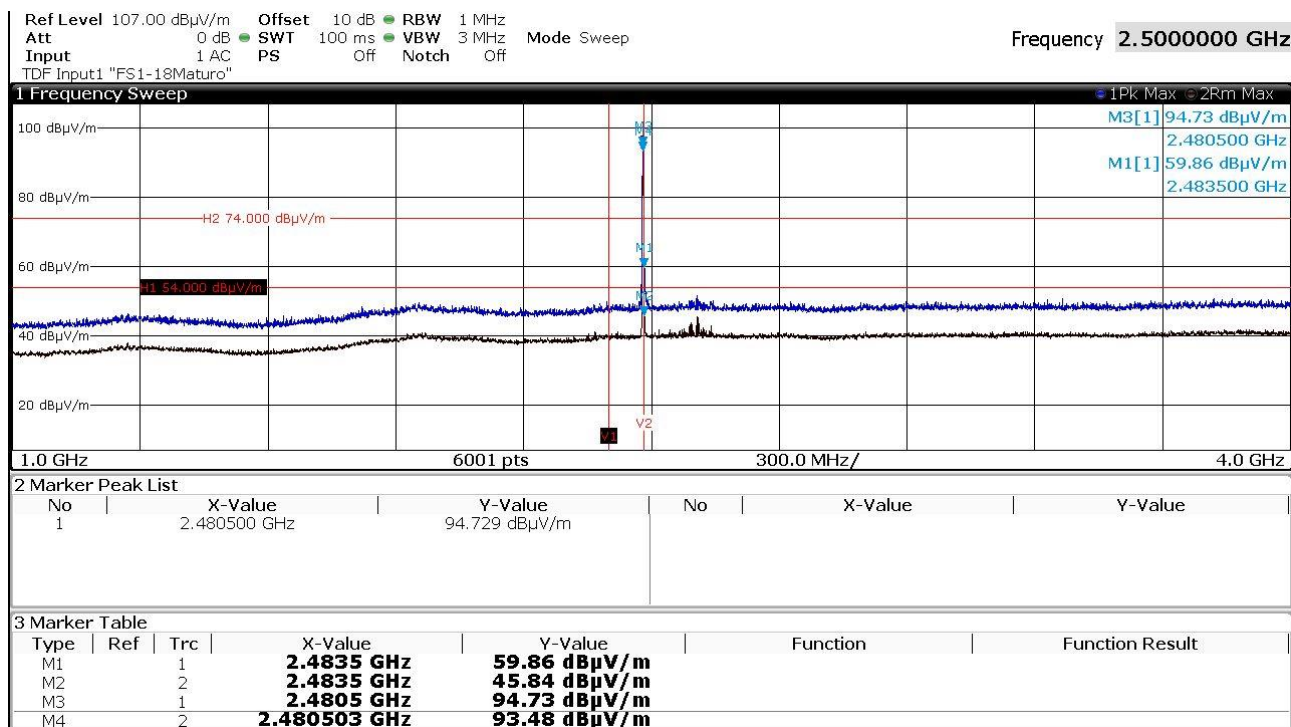
IC: 25048-DS02DC02

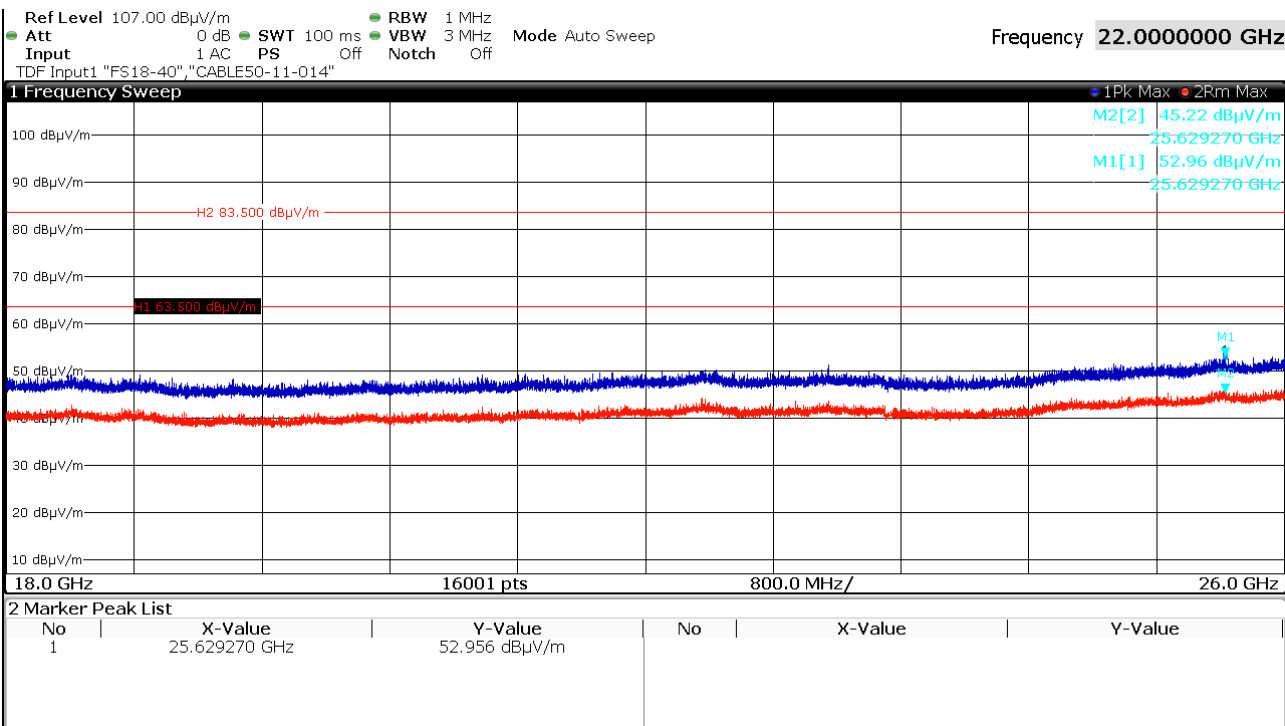
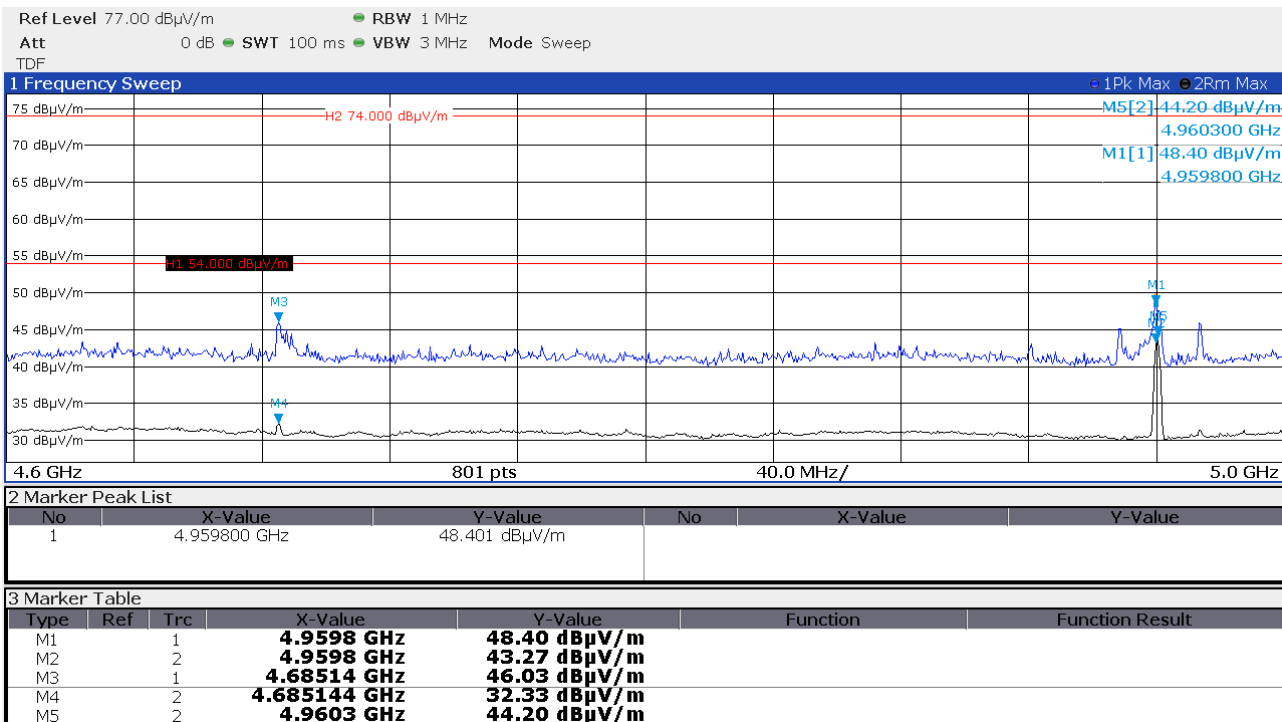


FCC ID: 2ATBZDS02DC02

IC: 25048-DS02DC02

2480 MHz, vertical polarisation, EUT-Y:

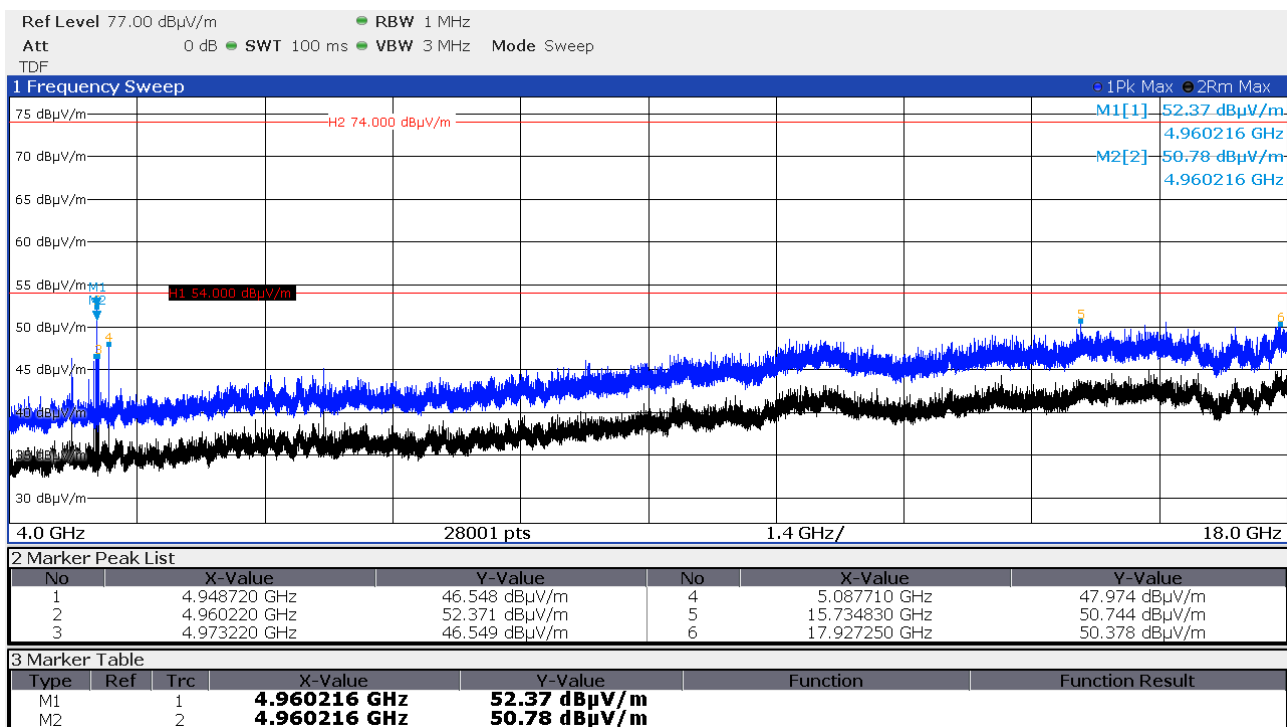
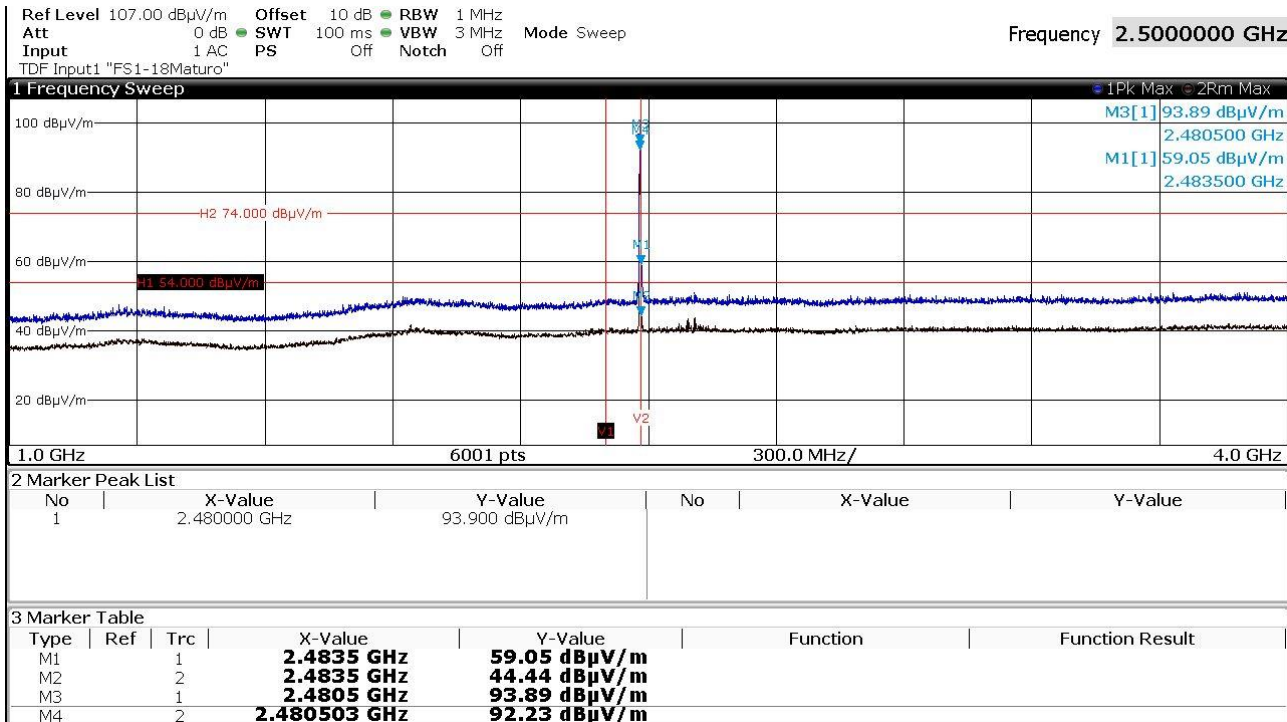


FCC ID: 2ATBZDS02DC02
IC: 25048-DS02DC02


FCC ID: 2ATBZDS02DC02

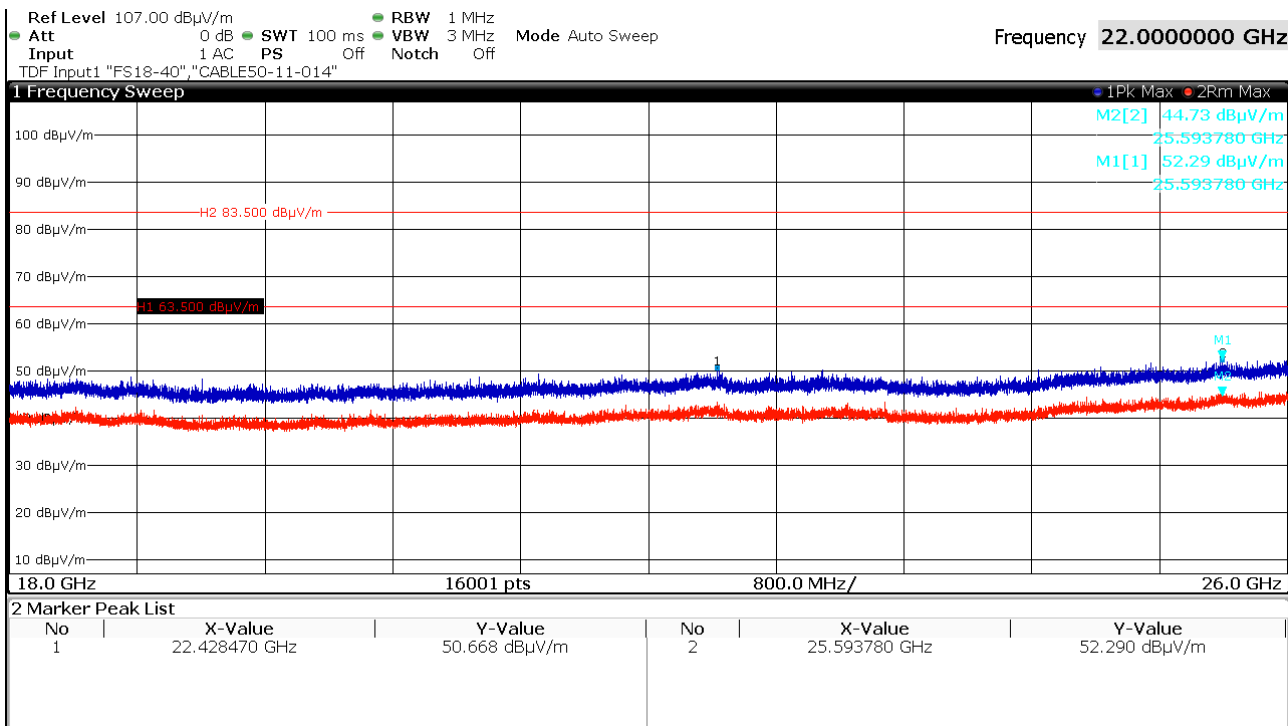
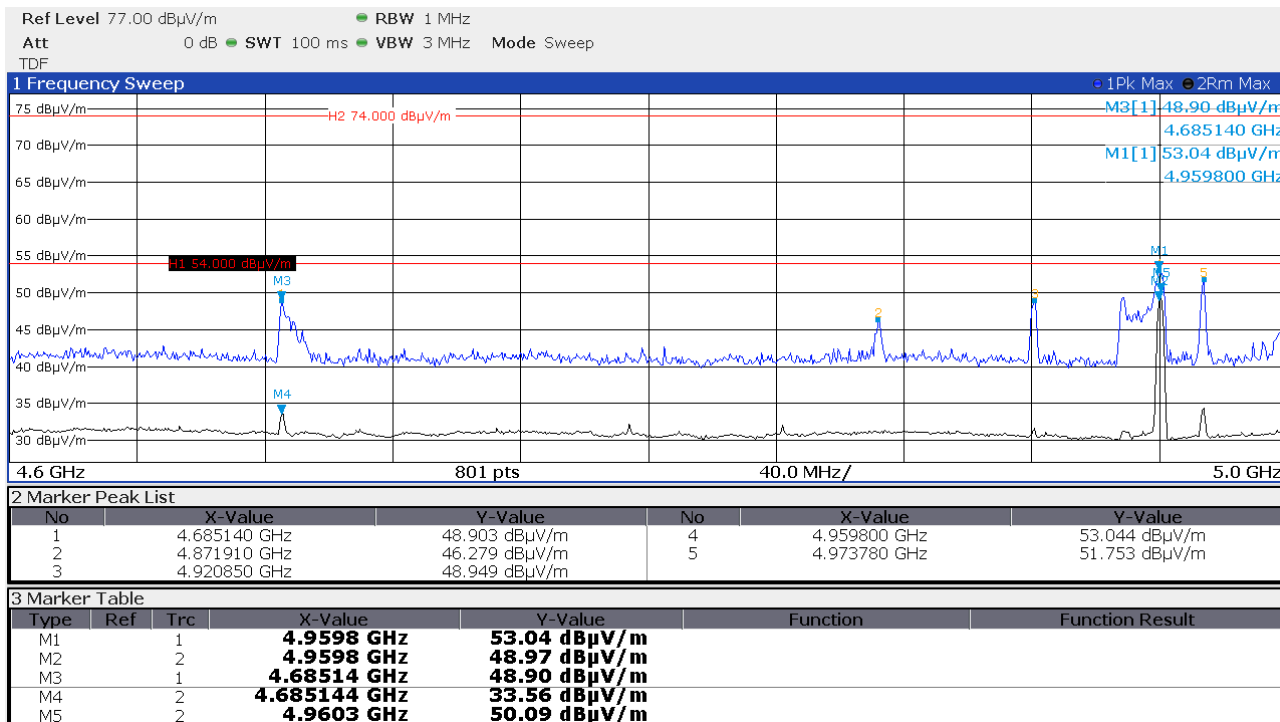
IC: 25048-DS02DC02

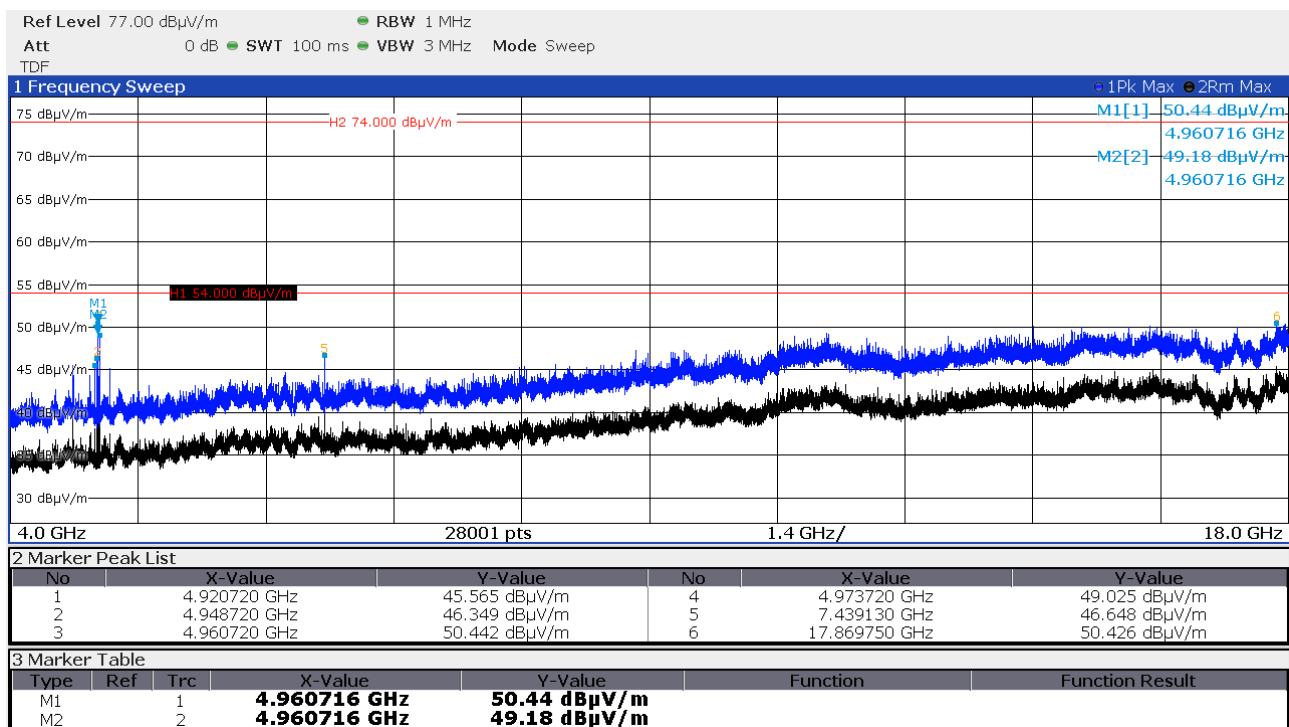
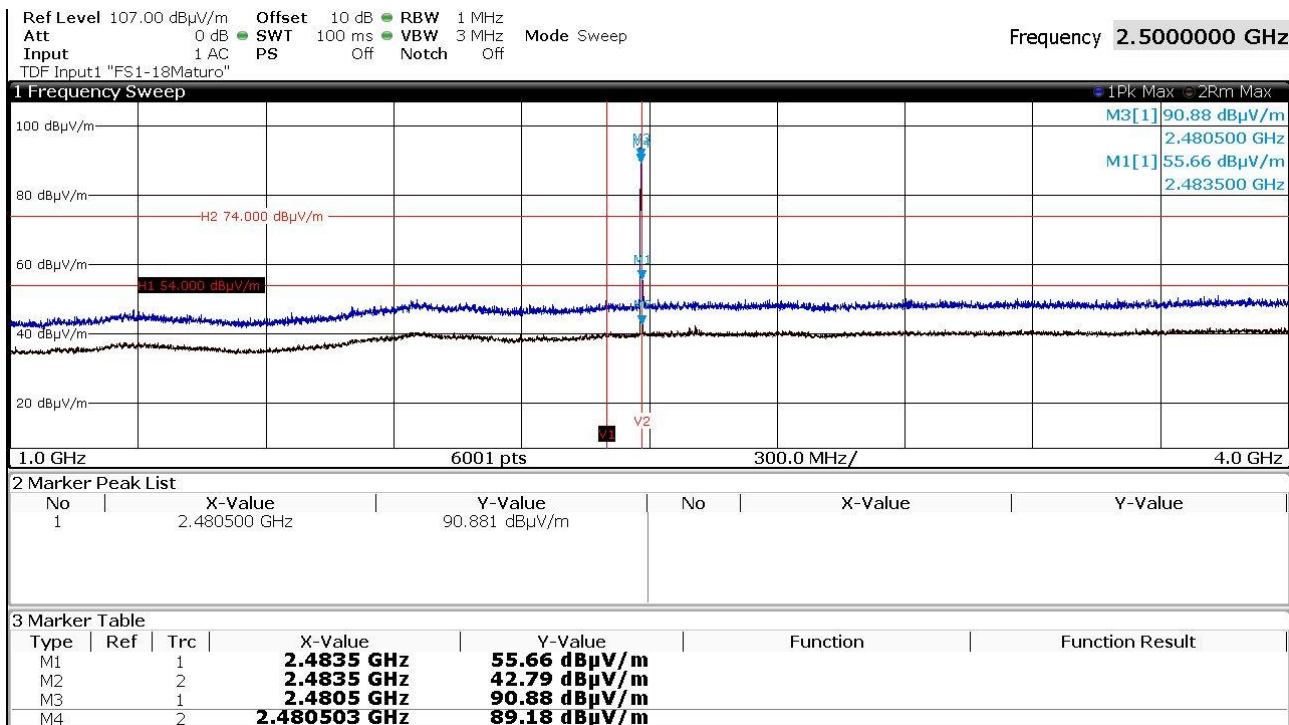
2480 MHz, horizontal polarisation, EUT-Z:

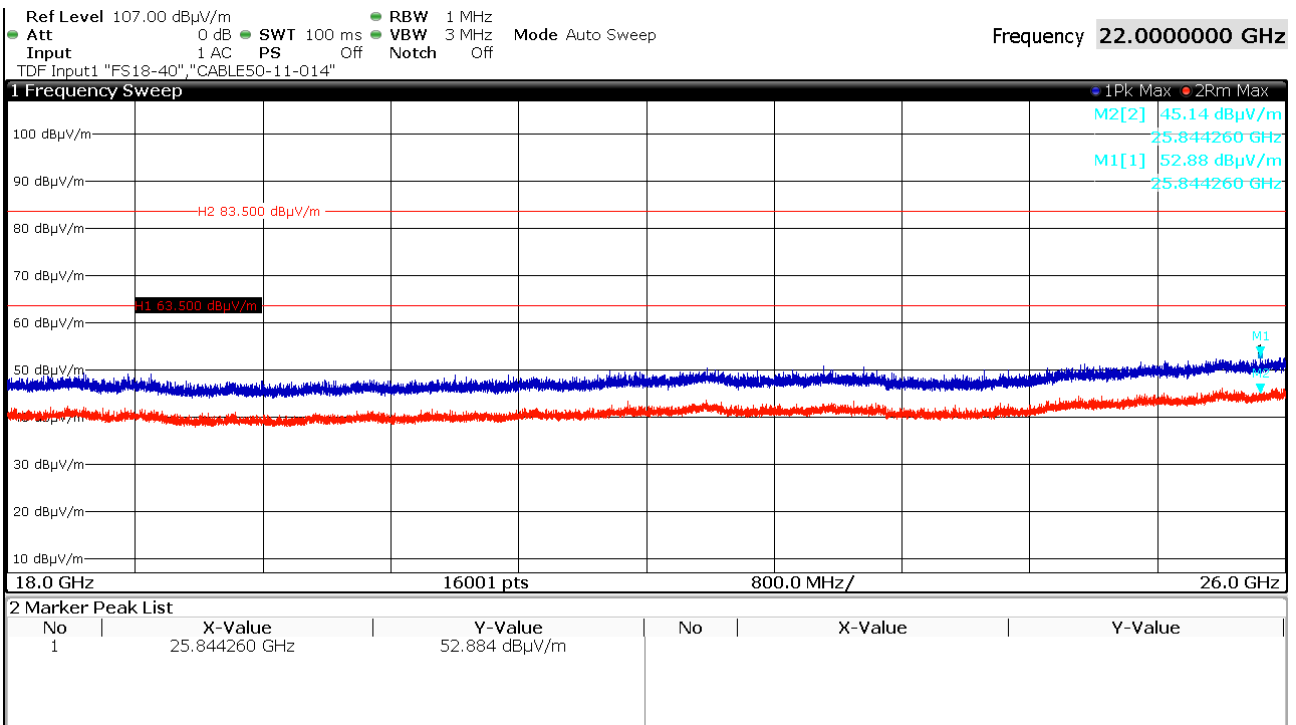
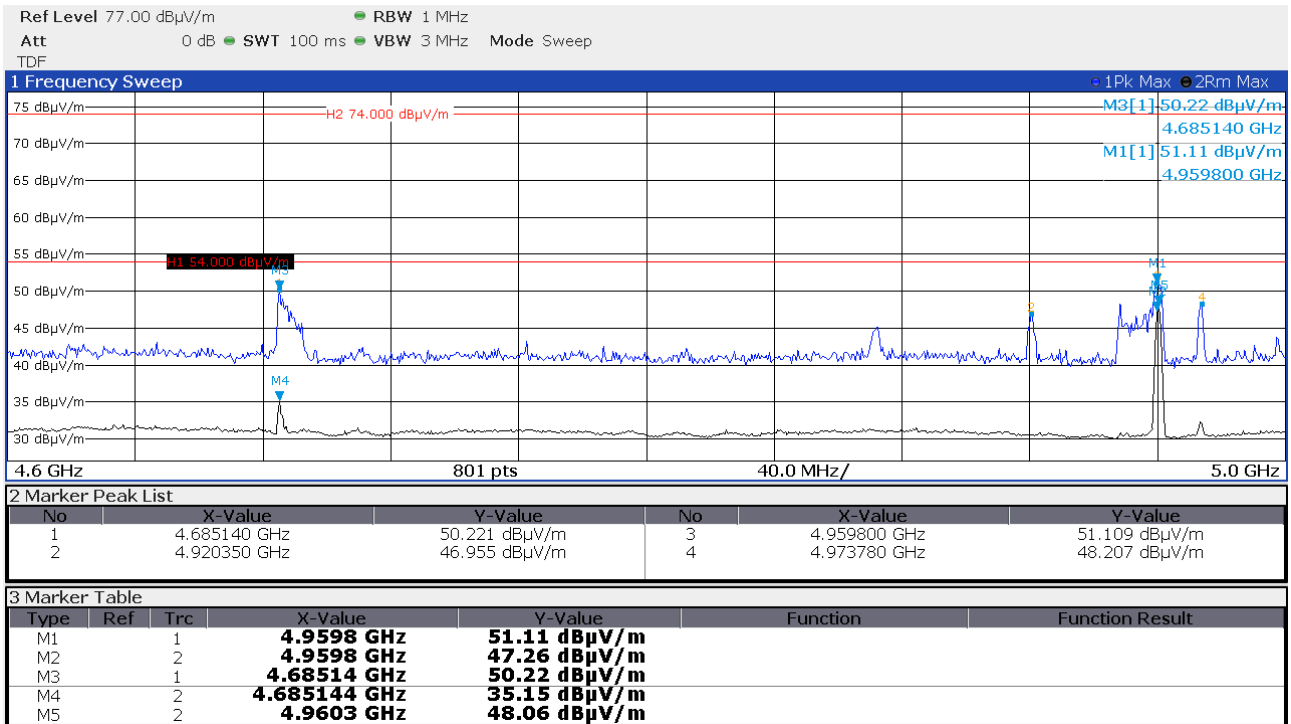


FCC ID: 2ATBZDS02DC02

IC: 25048-DS02DC02



FCC ID: 2ATBZDS02DC02
IC: 25048-DS02DC02
2480 MHz, vertical polarisation, EUT-Z:


FCC ID: 2ATBZDS02DC02
IC: 25048-DS02DC02


FCC ID: 2ATBZDS02DC02**IC: 25048-DS02DC02**

5.7 Spurious emissions radiated

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

5.7.1 Description of the test location

Test location: Anechoic chamber 1
Test distance: 3 m

5.7.2 Photo documentation of the test set-up

For test setup photos see T44704-00 ATTACHMENT C

5.7.3 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)).

5.7.4 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 SER3:

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

5.7.5 Test result

Frequency range: 2.39 GHz – 2.4 GHz

Highest value (Peak detection): 39.0 dB μ V/m at 2.3996 GHz

Note:

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

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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).

Compliance to the radiated emission limit specified in Section 15.209(a) is shown in section 5.4 of this test report. Only emissions exceeding the general limits of section 15.209(a) and which do not fall into the restricted bands are re-measured applying the limit of section 15.247(d).

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

In any 100 kHz bandwidth outside the frequency bands 2400 – 2483.50 MHz and 5725 – 5850 MHz, the digitally modulated radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required.

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

The requirements are **FULFILLED**.

Remarks: Only the frequency range not complying with the general emission limit has been re-measured.

Compliance to the general limit of the other frequency ranges are shown in section 5.6

For detailed test results please see the following test plots.

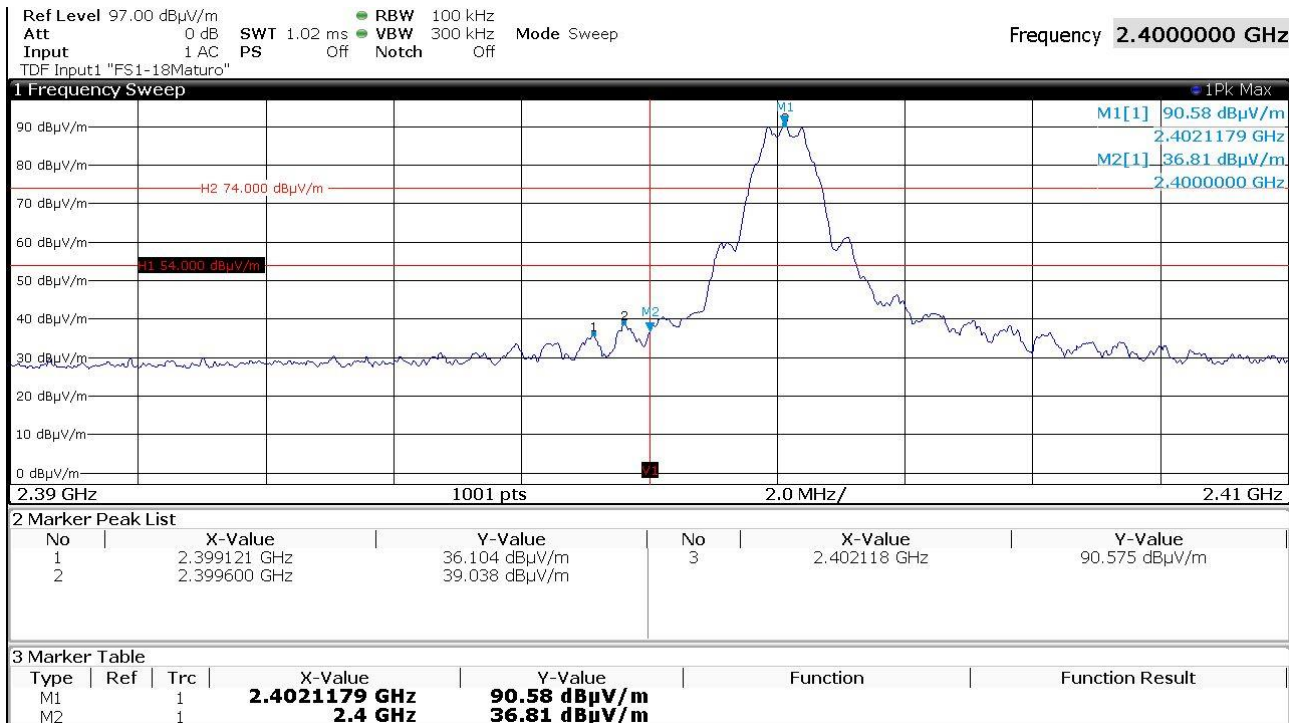
FCC ID: 2ATBZDS02DC02

IC: 25048-DS02DC02

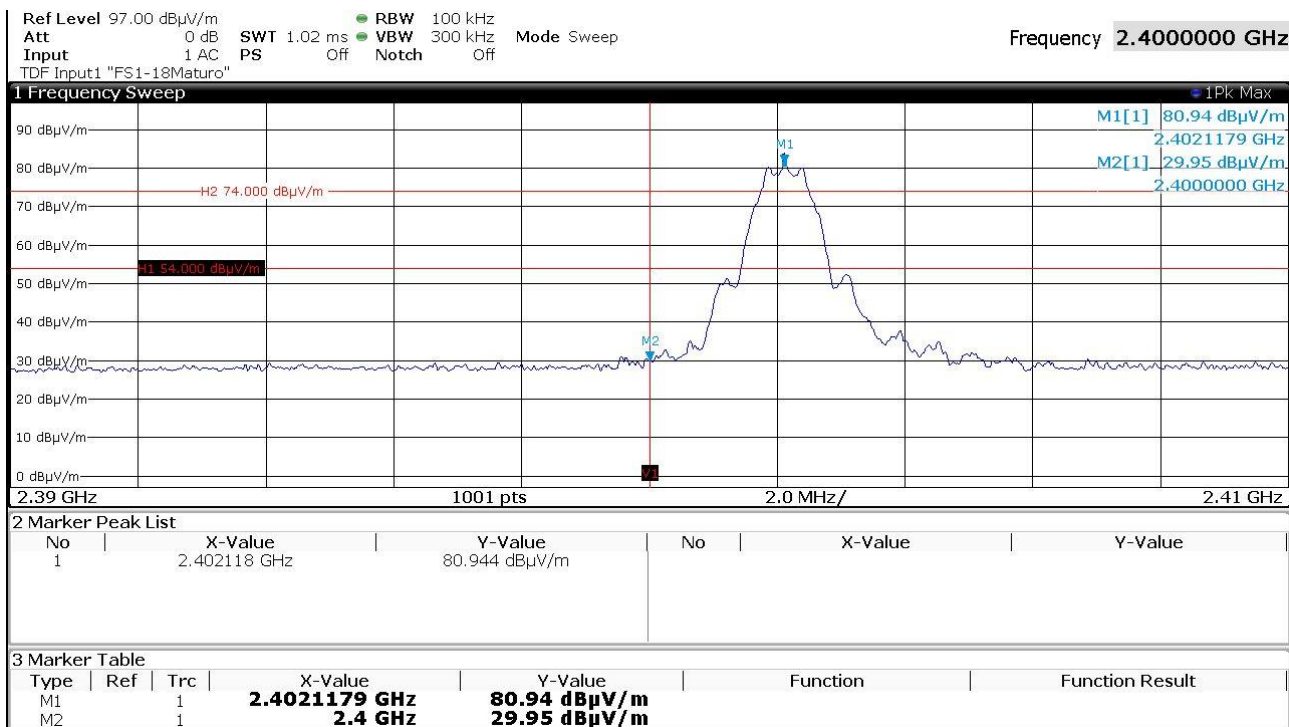
5.7.6 Test protocols radiated emissions

2.39 GHz ≤ f ≤ 2.4 GHz

2402 MHz, horizontal polarisation, EUT-X:



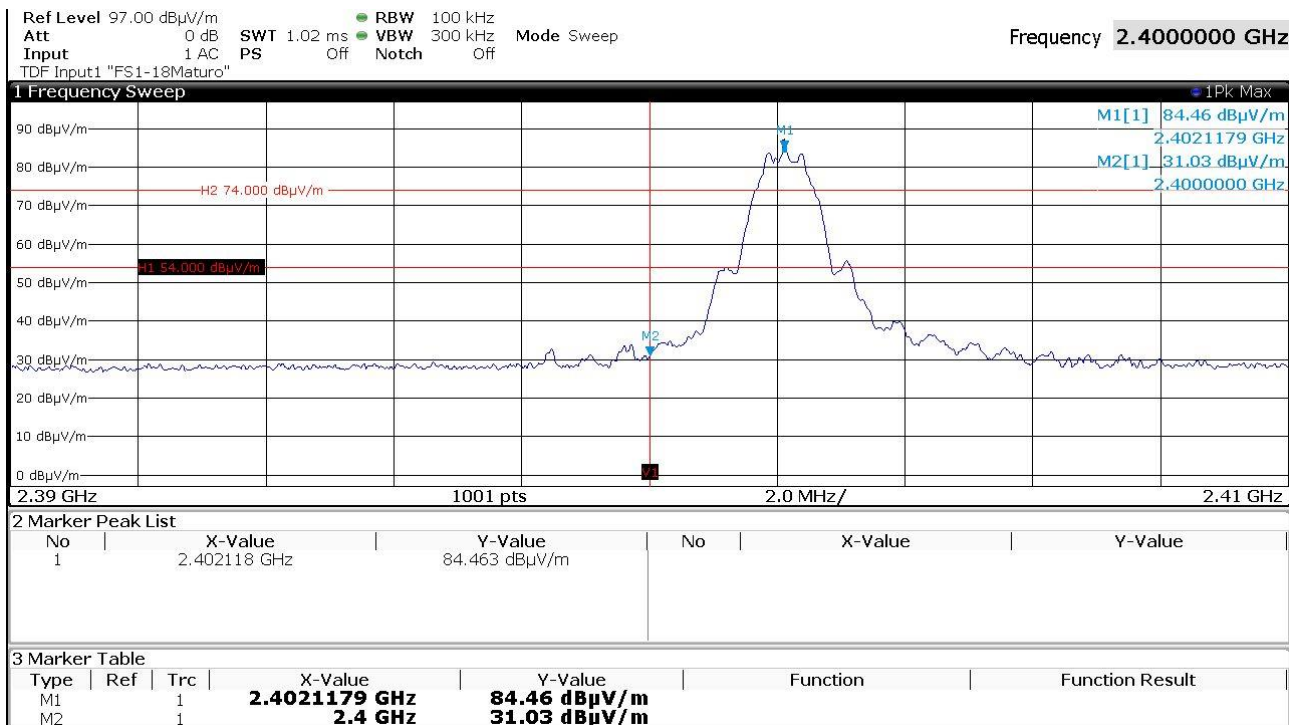
2402 MHz, vertical polarisation, EUT-X:



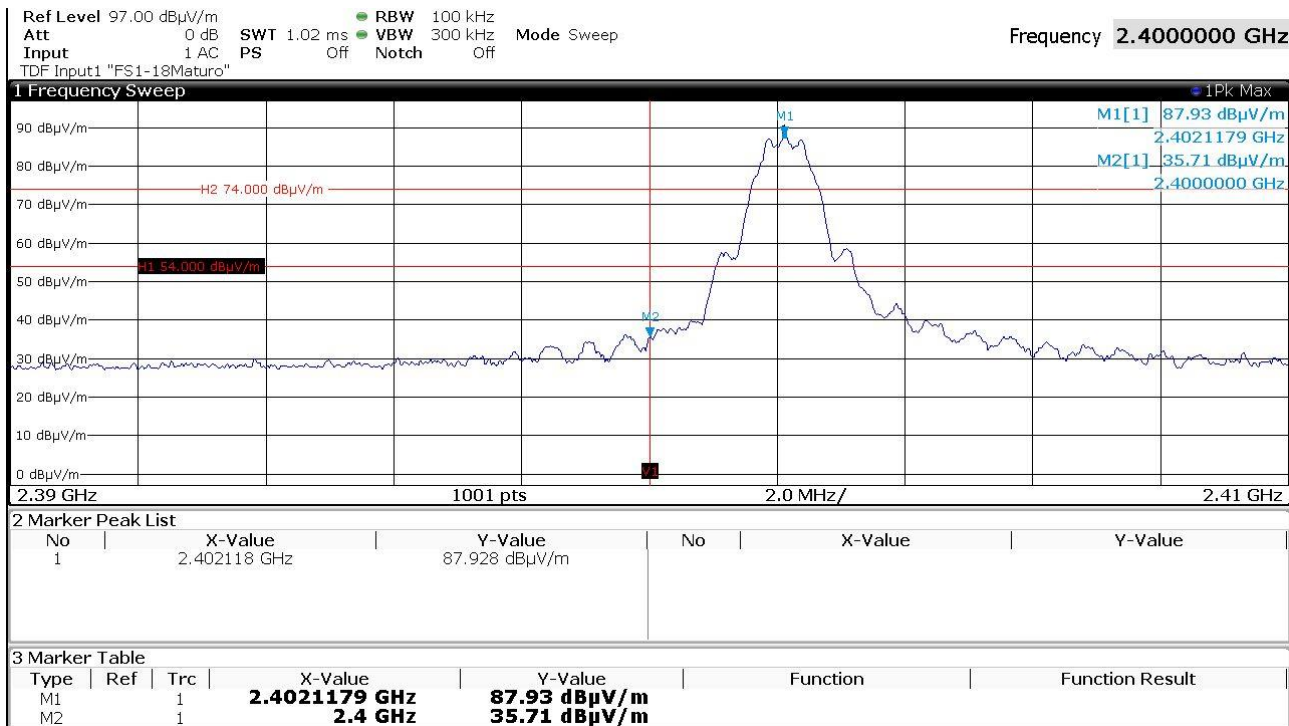
FCC ID: 2ATBZDS02DC02

IC: 25048-DS02DC02

2402 MHz, horizontal polarisation, EUT-Y:



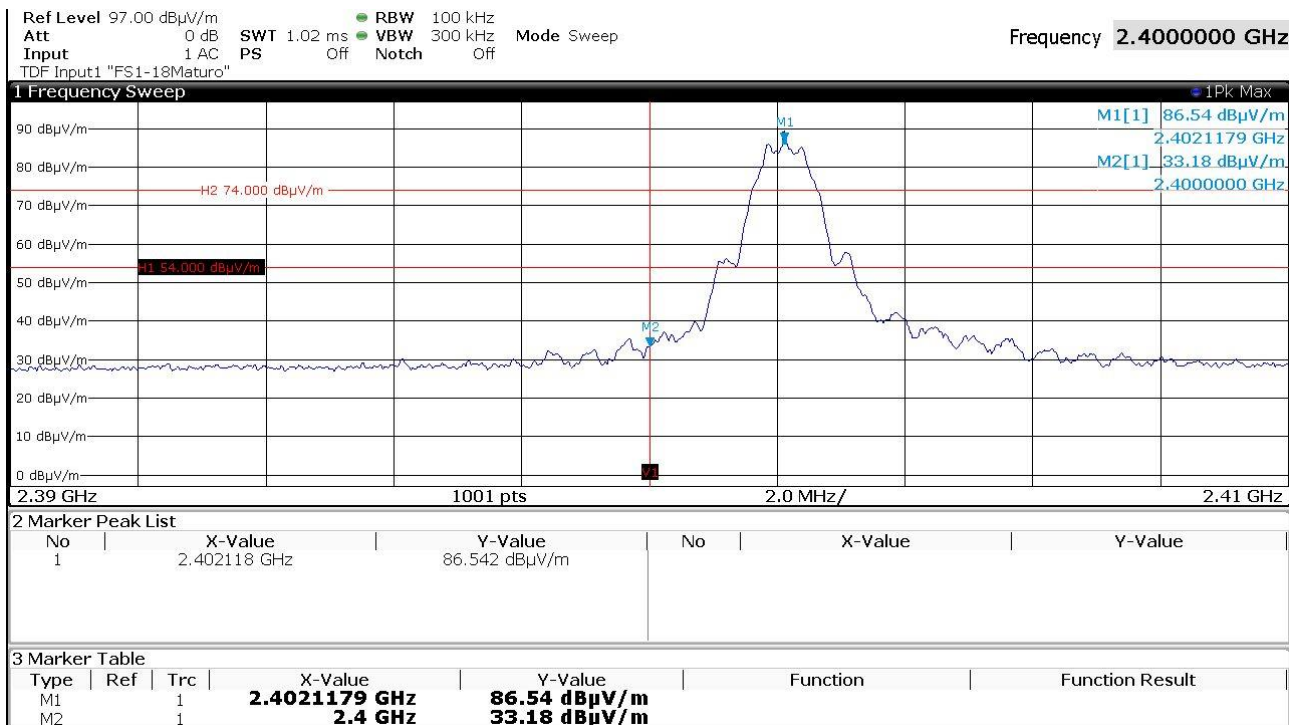
2402 MHz, vertical polarisation, EUT-Y:



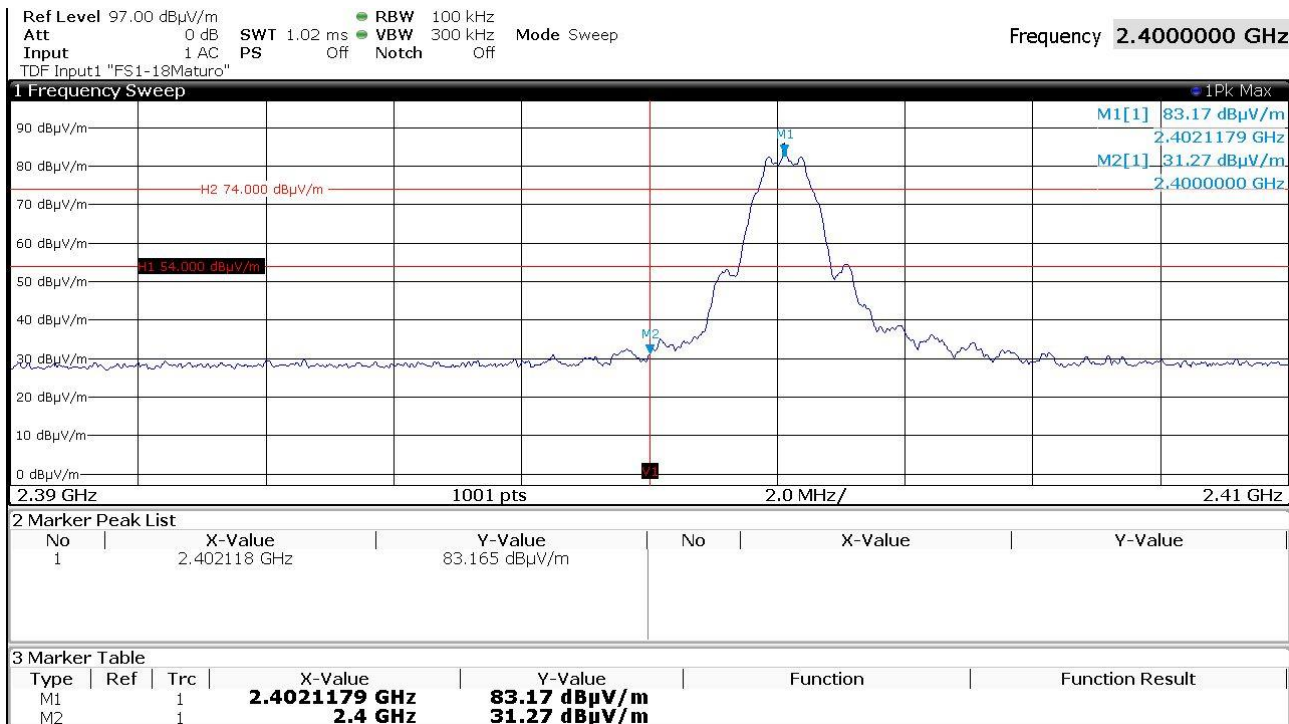
FCC ID: 2ATBZDS02DC02

IC: 25048-DS02DC02

2402 MHz, horizontal polarisation, EUT-Z:



2402 MHz, vertical polarisation, EUT-Z:



FCC ID: 2ATBZDS02DC02

IC: 25048-DS02DC02

5.8 Antenna application

5.8.1 Applicable standard

According to FCC Part 15C, Section 15.203:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

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

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

5.8.2 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.

Remarks: No power reduction results from the defacto limit, peak Gain of the used antenna is 2.5 dBi.

-

FCC ID: 2ATBZDS02DC02
IC: 25048-DS02DC02

6 USED TEST EQUIPMENT AND ACCESSORIES

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

Test ID	Model Type	Equipment No.	Next Calib.	Last Calib.	Next Verif.	Last Verif.
CPR 3	ESW26	02-02/03-17-002	13/12/2019	13/12/2018		
	AMF-6D-01002000-22-10P	02-02/17-15-004				
	3117	02-02/24-05-009	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				
DC	KK-SF106-2X11N-6,5M	02-02/50-18-016				
ESR 7						
KMS102-1 m						
MB						
ESR 7						
PSD						
FSW43						
AMF-6D-01002000-22-10P						
3117						
18N-20						
NMS111-GL200SC01-NMS11						
BAM 4.5-P						
NCD						
KK-SF106-2X11N-6,5M						
SER 1	ESCI	02-02/03-05-004	17/09/2019	17/09/2018		
	HFH 2 - Z 2	02-02/24-05-020	09/08/2020	09/08/2017	15/01/2020	15/01/2019
	NW-2000-NB	02-02/50-05-113				
	KK-EF393/U-16N-21N20 m	02-02/50-12-018				
	KK-SD_7/8-2X21N-33,0M	02-02/50-15-028				
SER 2	ESVS 30	02-02/03-05-006	06/06/2019	06/06/2018		
	VULB 9168	02-02/24-05-005	18/04/2019	18/04/2018		
	NW-2000-NB	02-02/50-05-113				
	KK-EF393/U-16N-21N20 m	02-02/50-12-018				
	KK-SD_7/8-2X21N-33,0M	02-02/50-15-028				
SER 3	ESW26	02-02/03-17-002	13/12/2019	13/12/2018		
	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				
	3117	02-02/24-05-009	06/06/2020	06/06/2019		
	BBHA 9170	02-02/24-05-014	12/06/2021	12/06/2018	12/12/2019	12/12/2018
	WHK 3.0/18G-10EF	02-02/50-05-180				
	KMS102-1 m	02-02/50-11-014				
	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				