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Test – Results

Order-No.: **T38868-05-00HS**

Client	DR. JOHANNES HEIDENHAIN GmbH, Dr.-Johannes-Heidenhain-Strasse 5, 83301 TRAUNREUT, GERMANY
Manufacturer	DR. JOHANNES HEIDENHAIN GmbH, Dr.-Johannes-Heidenhain-Strasse 5, 83301 TRAUNREUT, GERMANY
Product Description	Wireless hand wheel system
Type / Model Name	HR 550 FS
Testing commenced on	2018-12-11
Testing concluded on	2018-12-18
Serial - No.	0065388548

Retest
are made according to
FCC Part 15247

Type of test	Limits		Test Results		
Emission / Immunity	Margin (dB)	exceeded by (dB)	ok	not ok	meet criteria
SER2 328 MHz	-8.4 dB	-	☒	☐	-
SER3 2483.54 MHz	-1.4 dB	-	☒	☐	-

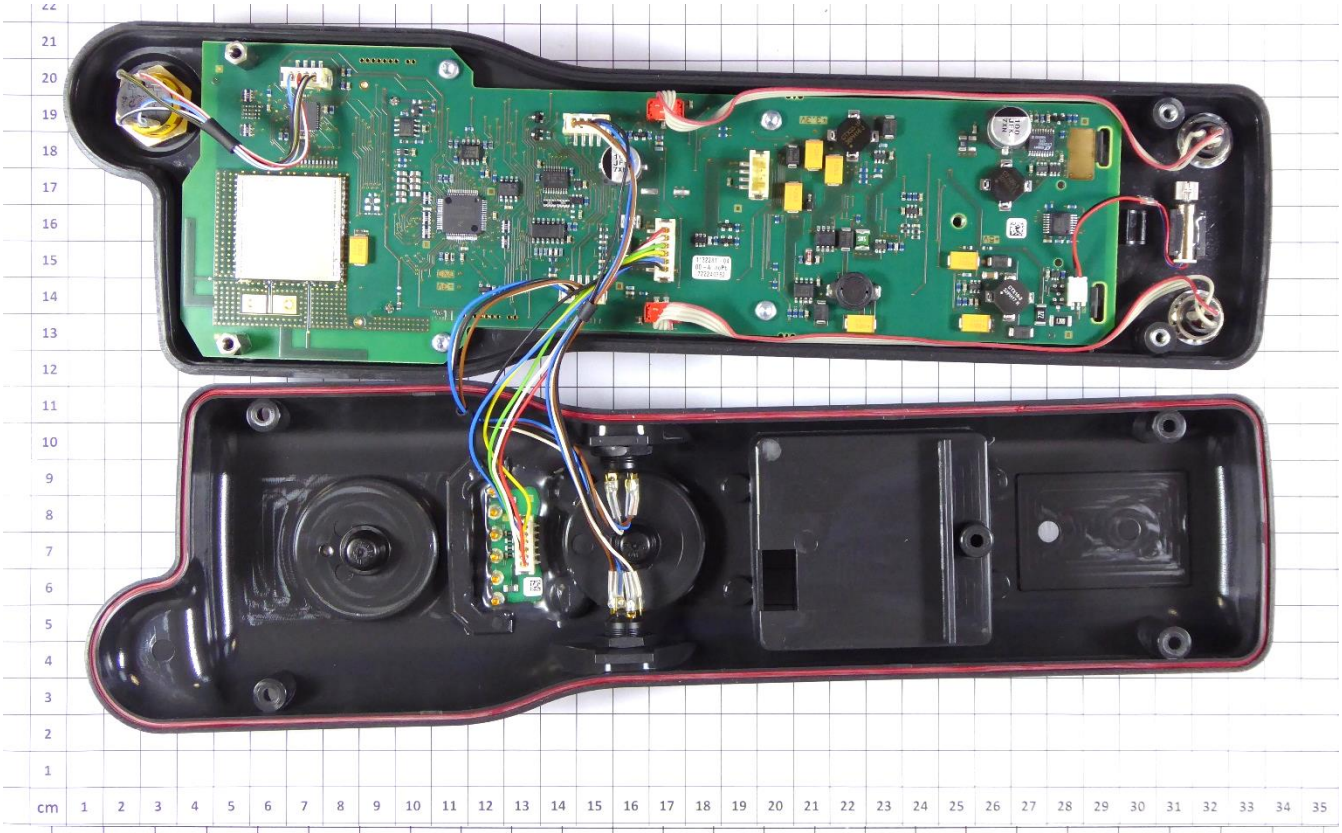
Remarks: **FCC ID: YJKHR0GACZ4 IC: 11148A-HR0GACZ4**

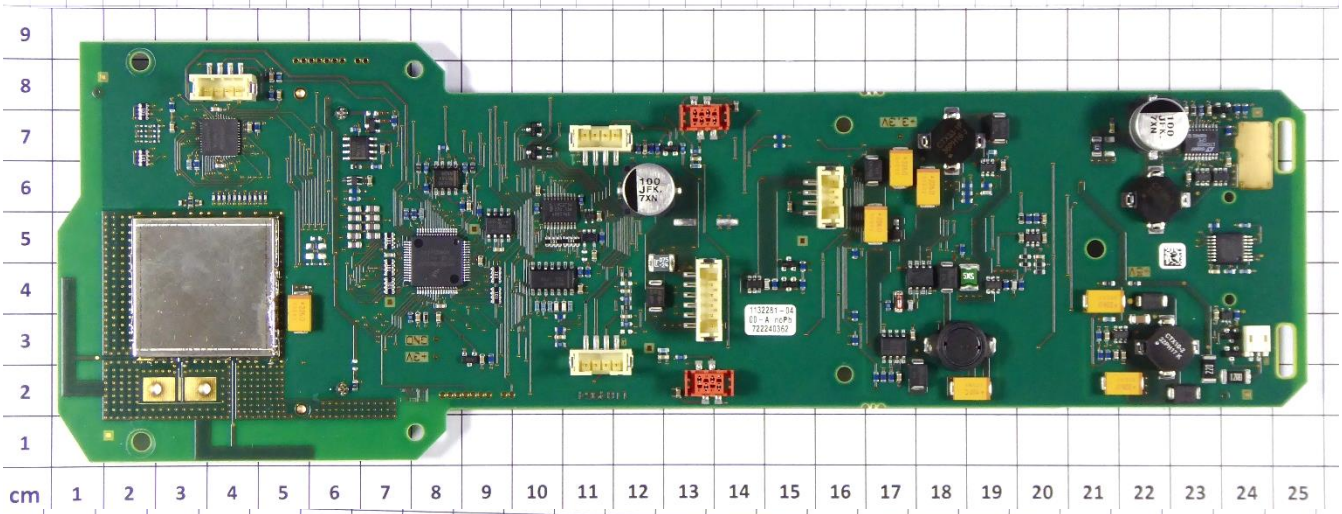
The EUT is a certified and approved device under FCC part 15.247. The main PCB of the EUT has been made a litte bit smaller. Some devices has to replaced and routed by new routes. The frequency determining devices and routes are identically as before. In order to check the new placement and routes spurious emissions are re-measured in order to show the further compliant to the FCC part 15.247.

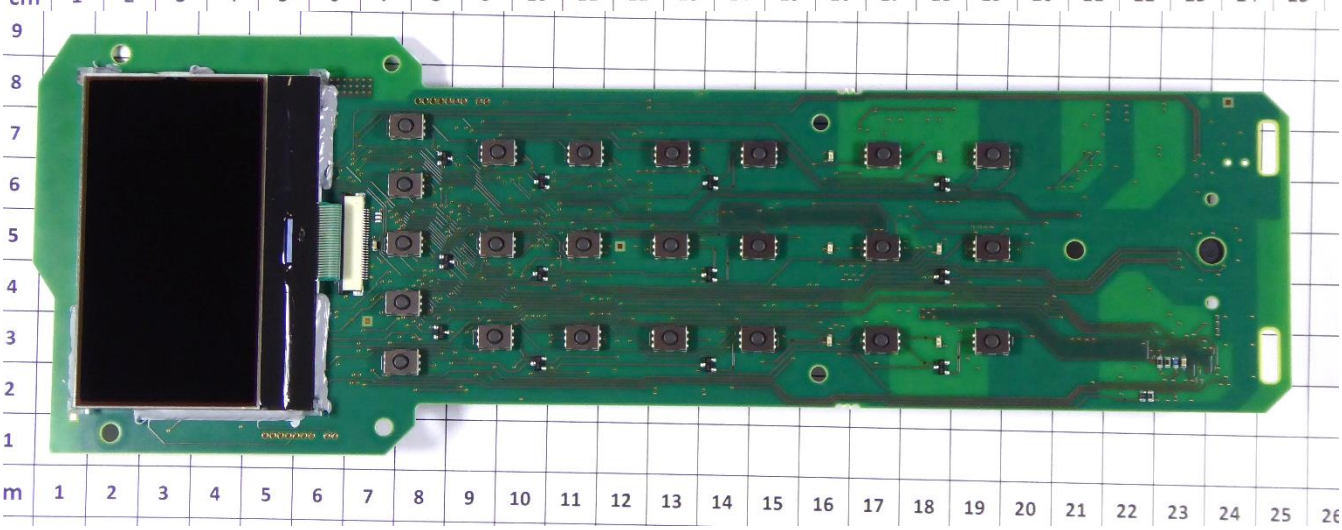
This test result consists of 15 page(s). The test result only corresponds to the tested sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

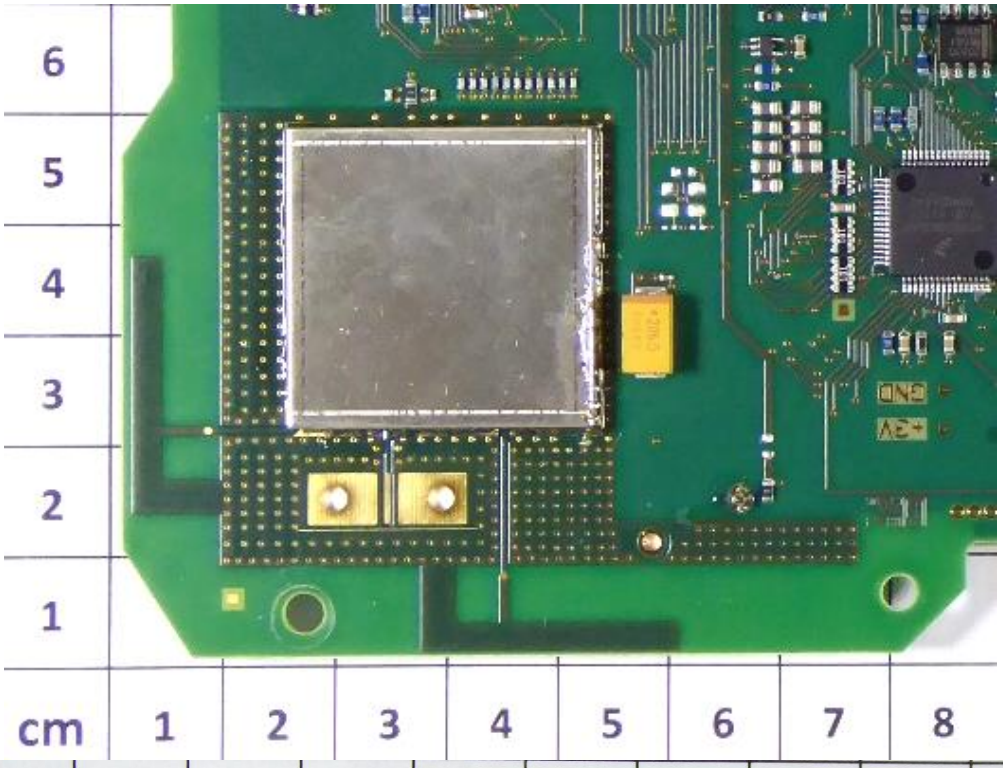
Date	Checked by	Tested by	Result
2018-12-19	Klaus Gegenfurtner I confirm the correctness and integrity of this document. 2018.12.20 09:26:41 +01'00'	Hermann Smetana I am the author of this document. 2018.12.20 09:10:08 +01'00'	☒ **passed** ☐ **not passed**

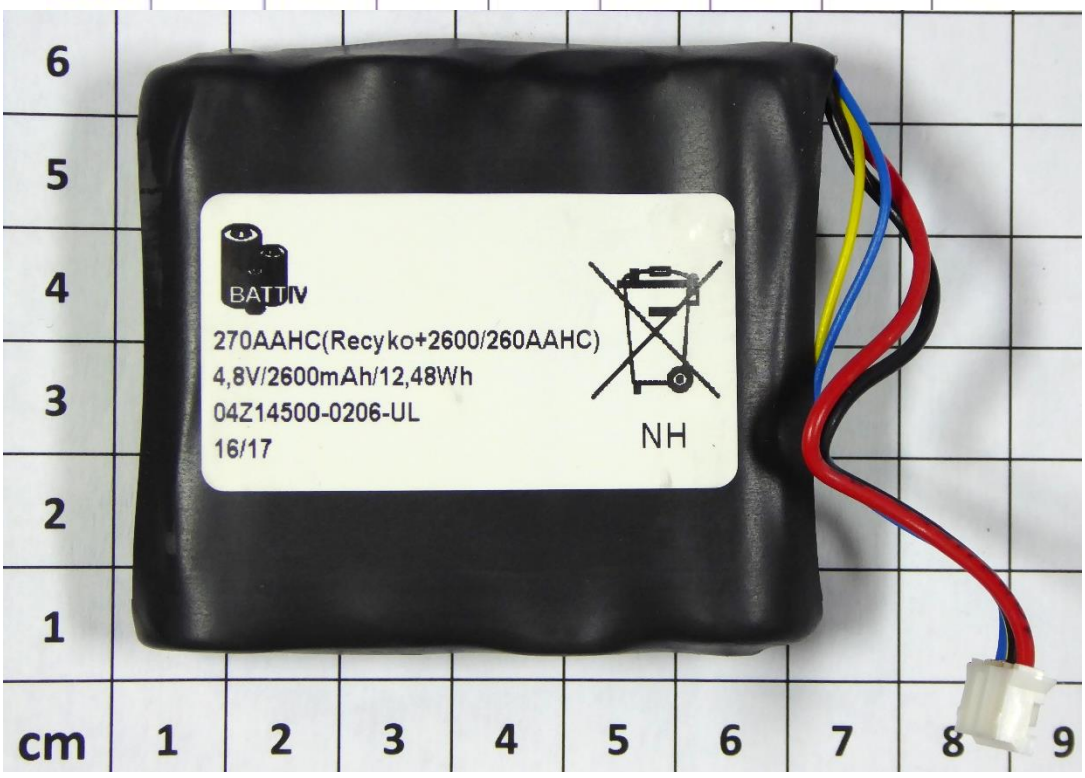
Photo documentation of the EUT








6
5
4
3
2
1
cm 1 2 3 4 5 6 7 8


6
5
4
3
2
1
cm 1 2 3 4 5 6 7 8 9
BATTIV
270AAHC(Recyko+2600/260AAHC)
4,8V/2600mAh/12,48Wh
04Z14500-0206-UL
16/17
NH

TEST RESULT SUMMARY

Operating in the 2400 MHz – 2483.5 MHz:

FCC Rule Part	RSS Rule Part	Description	Result
15.207(a)	RSS-Gen, 8.8	AC power line conducted emissions	Not tested
15.247(a)(2)	RSS-247, 5.2(1)	-6 dB EBW	Not tested
15.247(b)(3)	RSS-247, 5.4(4)	Maximum peak conducted output power	Not tested
15.247(d)	RSS-247, 5.5	Unwanted emission, radiated	passed
15.247(d)	RSS-Gen, 8.10	Emissions in restricted bands	passed
15.247(e)	RSS-247, 5.2(2)	PSD	Not tested
	RSS-Gen, 6.11	Transmitter frequency stability	Not tested
	RSS-Gen, 6.6	99 % Bandwidth	Not tested

The mentioned RSS Rule Parts in the above table are related to:
RSS-Gen, Issue 5, April 2018
RSS-247, Issue 2, February 2017

Note: The EUT is connected to the base station and transmits data.

Test conditions and results

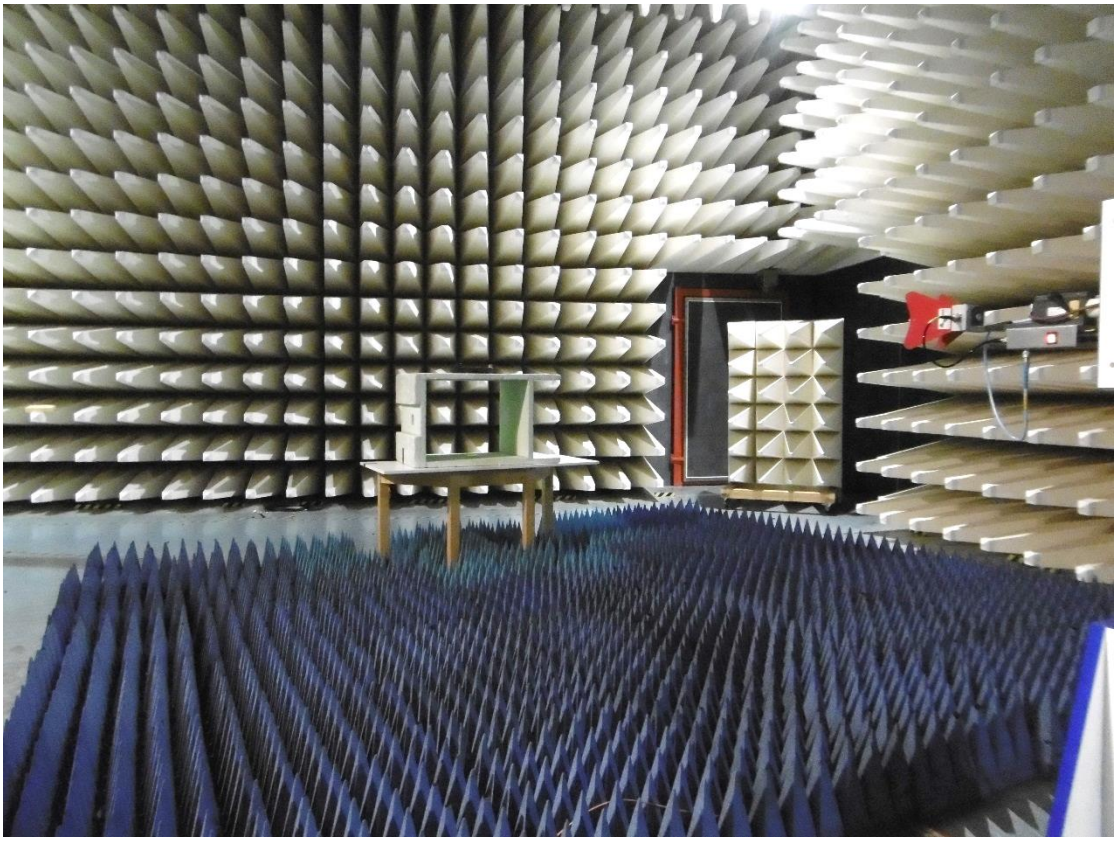
Unwanted emissions in restricted bands, radiated

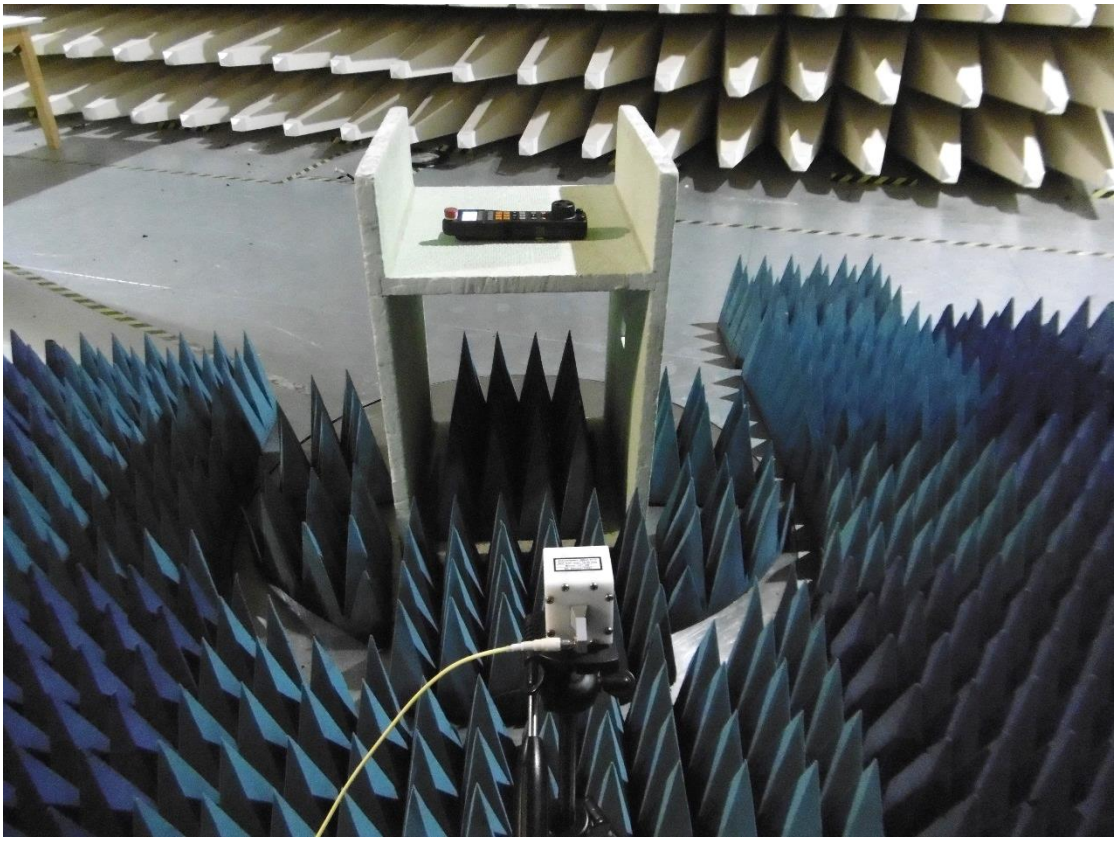
For test instruments and accessories used see section 6 Part **SER 2, SER 3**.

Description of the test location

Test location:	OATS 1
Test location:	Anechoic chamber 1
Test distance:	3 m
Test distance:	1 m (18-26 GHz)

Photo documentation of the test set-up – Detailed photos see ATTACHMENT A





Applicability

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).

Description of Measurement

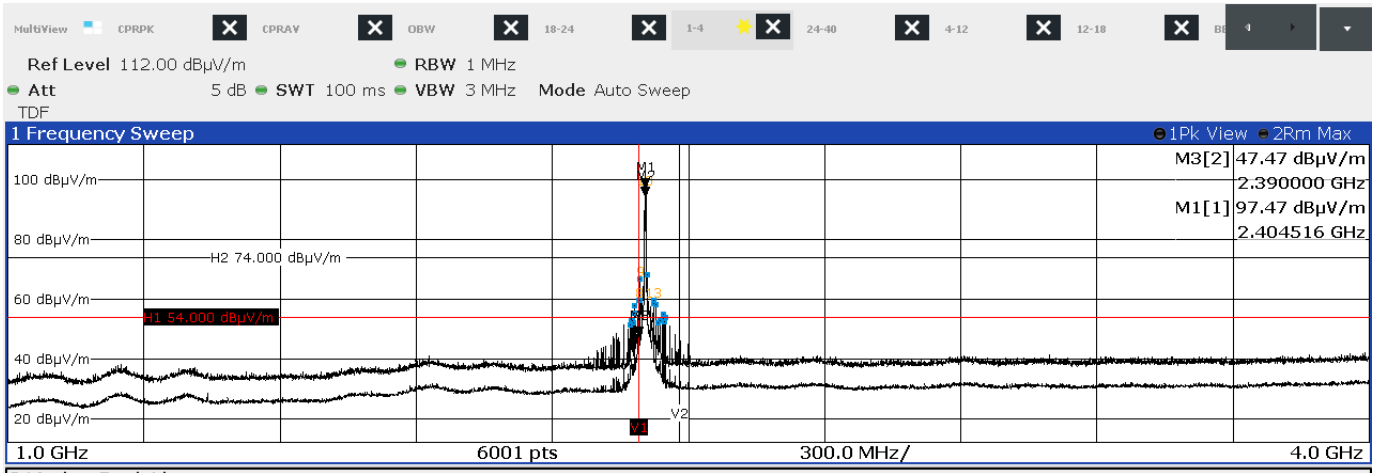
The restricted bands are measured radiated. The span of the spectrum analyser is set wide enough to capture the restricted band and measure the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of 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.
Spectrum analyser settings:
30 MHz – 1000 MHz: RBW: 120 kHz
1000 MHz – 26 GHz: RBW: 1 MHz, VBW: 3 MHz, Sweep: Auto, Detector function: Peak

Test result

f < 1 GHz:

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)
52.21	3.4	4.2	15.1	14.1	18.5	18.3	40.0	-21.5
61.82	5.3	8.8	14.6	13.7	19.9	22.5	40.0	-17.5
328.00	12.7	20.3	17.7	17.3	30.4	37.6	46.0	-8.4
829.00	3.5	4.1	30.0	29.5	33.5	33.6	46.0	-12.4
886.00	3.1	3.2	30.9	30.5	34.0	33.7	46.0	-12.0

f > 1 GHz:
CH11

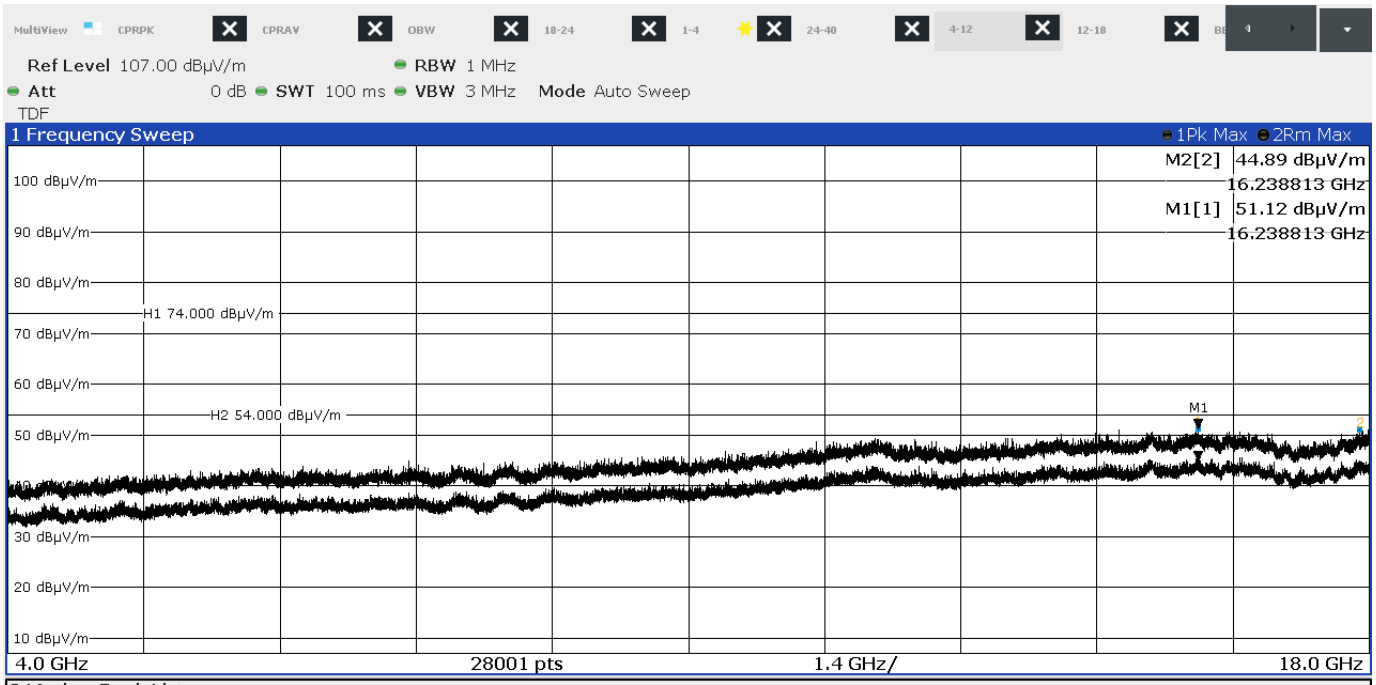


2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	2.371020 GHz	51.449 dBµV/m	11	2.410010 GHz	68.328 dBµV/m
2	2.374020 GHz	53.054 dBµV/m	12	2.422510 GHz	58.547 dBµV/m
3	2.377020 GHz	52.900 dBµV/m	13	2.424010 GHz	59.560 dBµV/m
4	2.379020 GHz	52.051 dBµV/m	14	2.428010 GHz	58.353 dBµV/m
5	2.380020 GHz	55.216 dBµV/m	15	2.433010 GHz	52.228 dBµV/m
6	2.382020 GHz	57.935 dBµV/m	16	2.437010 GHz	52.713 dBµV/m
7	2.390020 GHz	59.671 dBµV/m	17	2.443510 GHz	55.190 dBµV/m
8	2.392520 GHz	59.686 dBµV/m	18	2.445010 GHz	53.711 dBµV/m
9	2.393520 GHz	66.803 dBµV/m	19	2.446010 GHz	52.530 dBµV/m
10	2.404520 GHz	97.474 dBµV/m	20	2.448510 GHz	53.926 dBµV/m

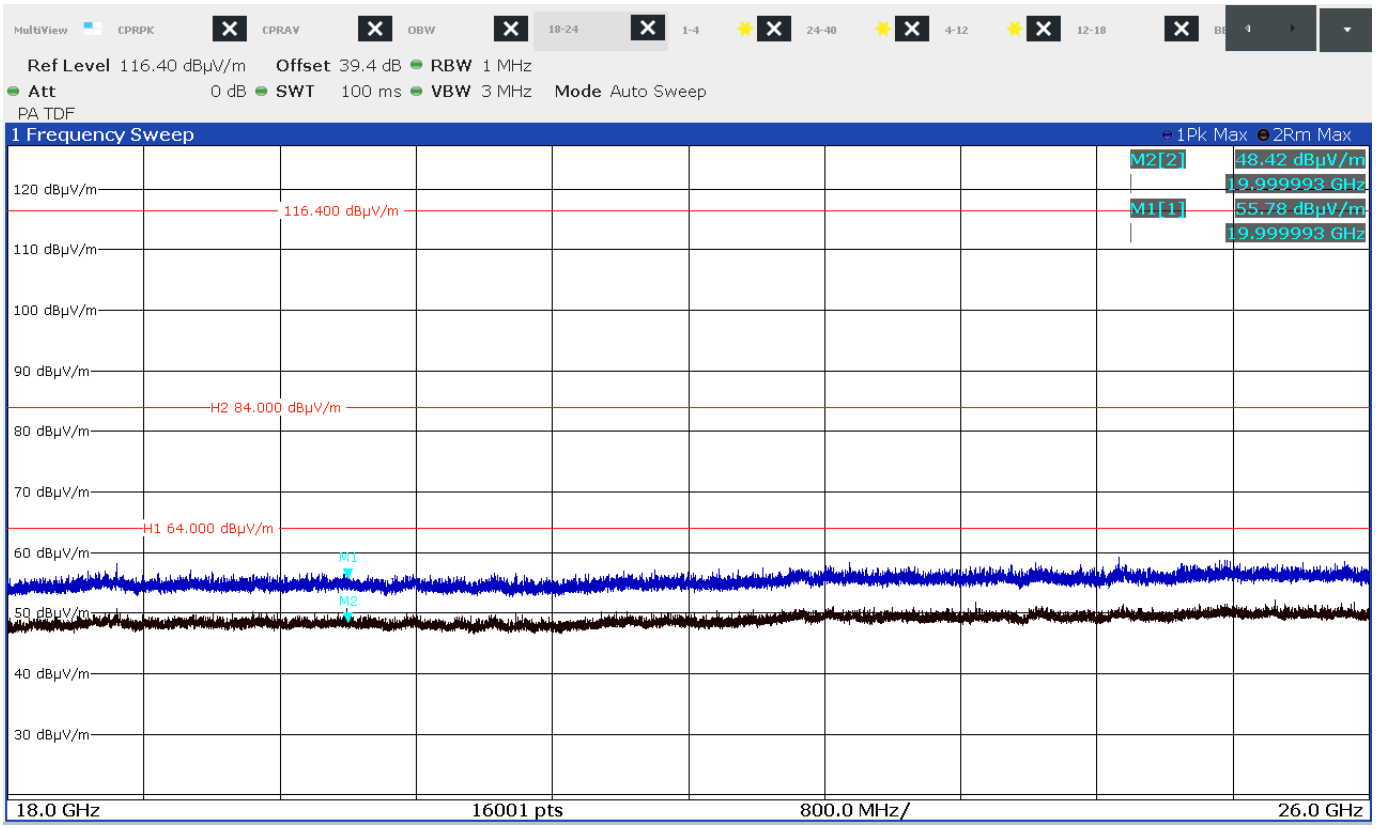
3 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**2.404516 GHz**	**97.47 dBµV/m**		
M2		2	**2.404516 GHz**	**94.33 dBµV/m**		
M3		2	**2.39 GHz**	**47.47 dBµV/m**		

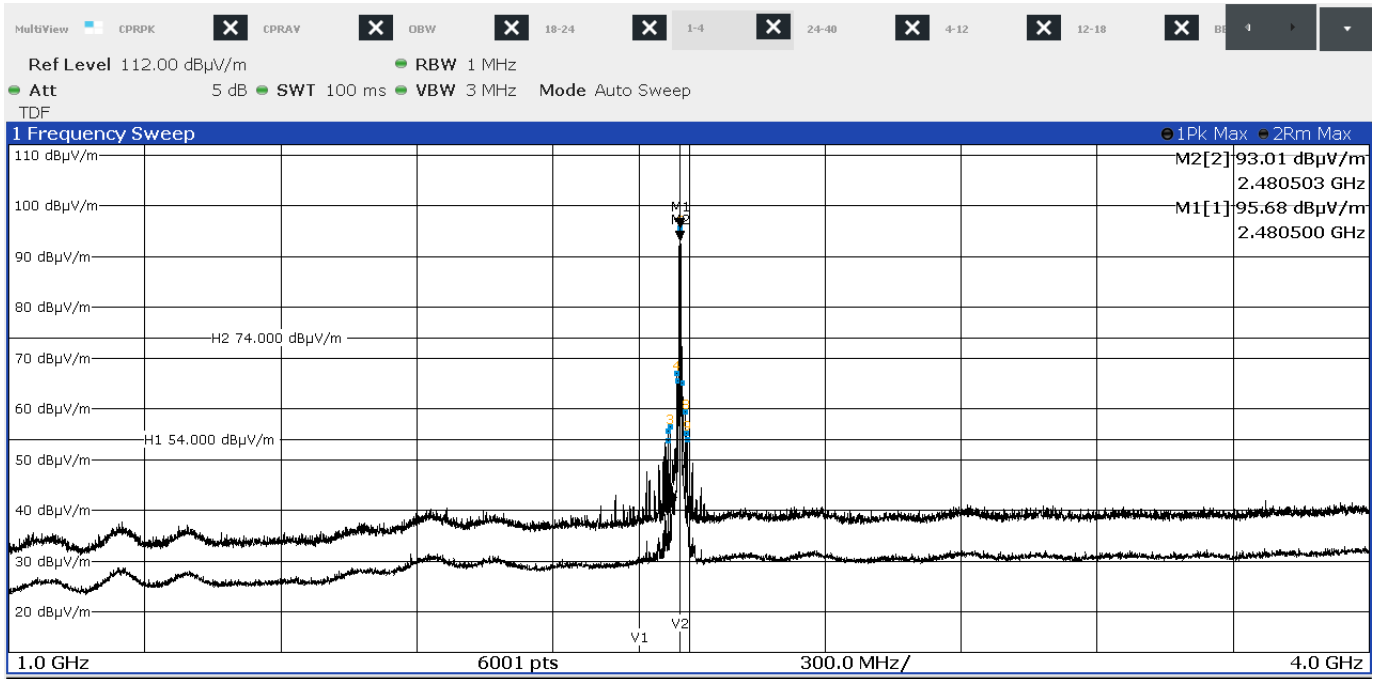


2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	16.238810 GHz	51.118 dBµV/m	2	17.904750 GHz	51.066 dBµV/m

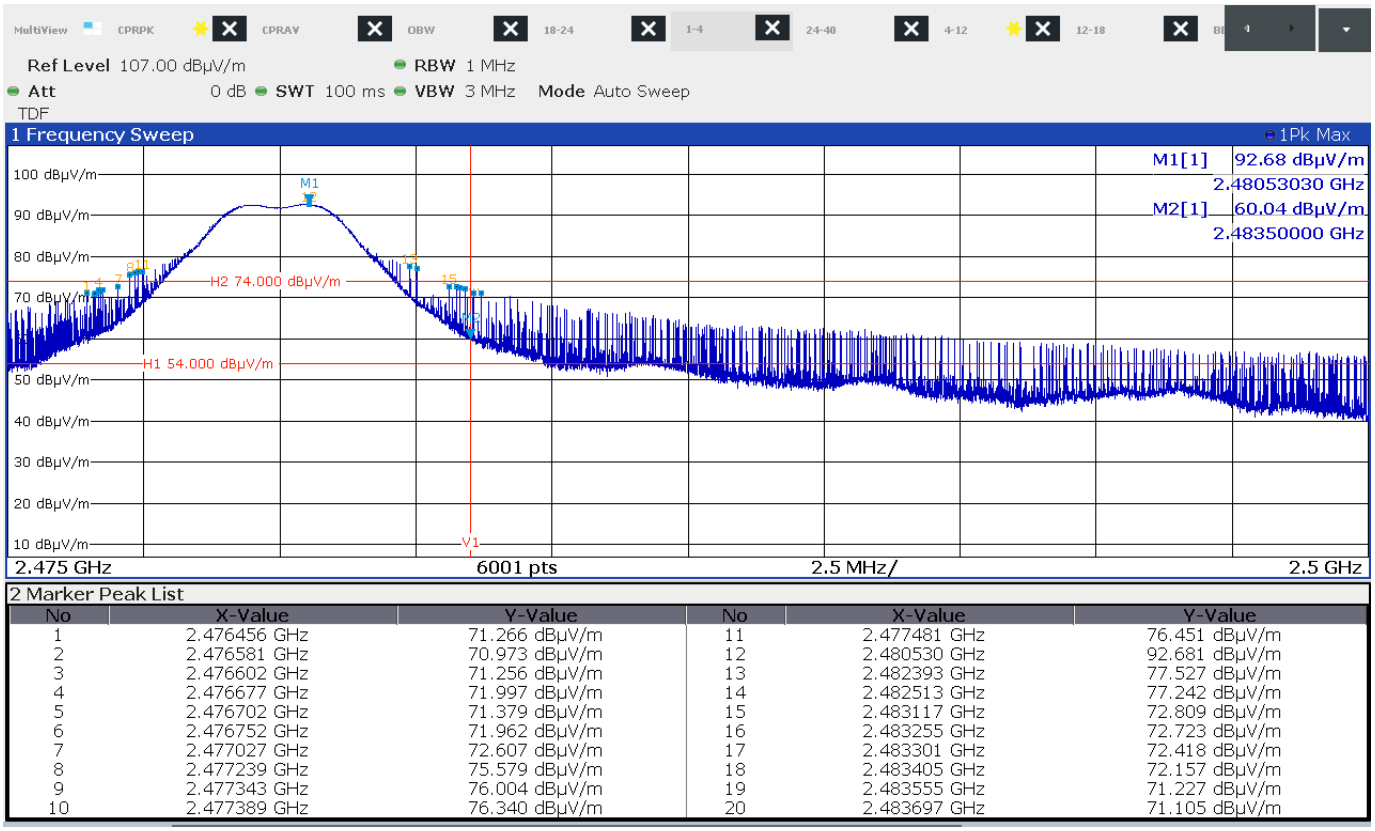


CH26



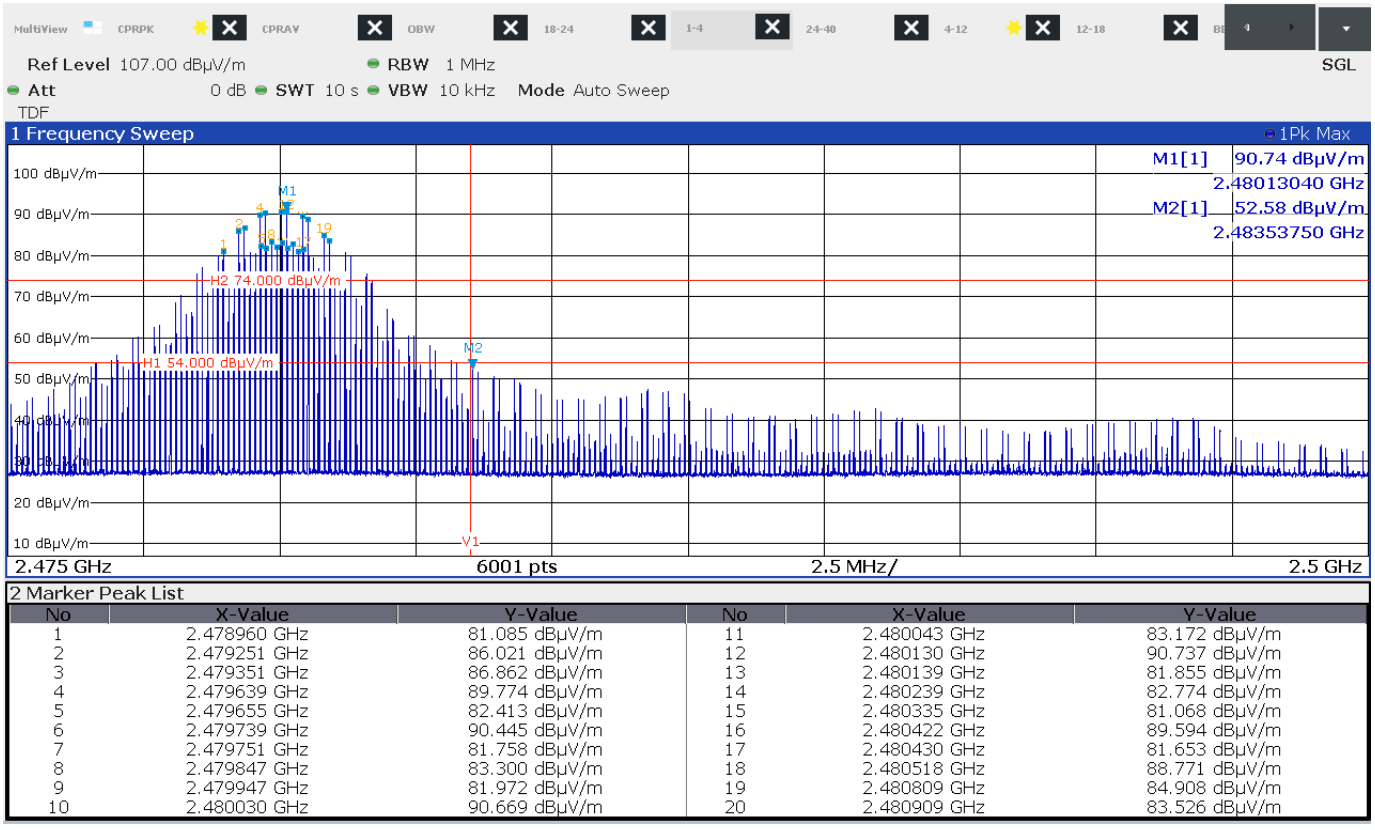
2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	2.453510 GHz	55.616 dBµV/m	6	2.480500 GHz	95.678 dBµV/m
2	2.455010 GHz	53.764 dBµV/m	7	2.485500 GHz	65.052 dBµV/m
3	2.458510 GHz	56.462 dBµV/m	8	2.492500 GHz	59.427 dBµV/m
4	2.473000 GHz	66.842 dBµV/m	9	2.494500 GHz	55.092 dBµV/m
5	2.475500 GHz	65.539 dBµV/m	10	2.495500 GHz	53.890 dBµV/m



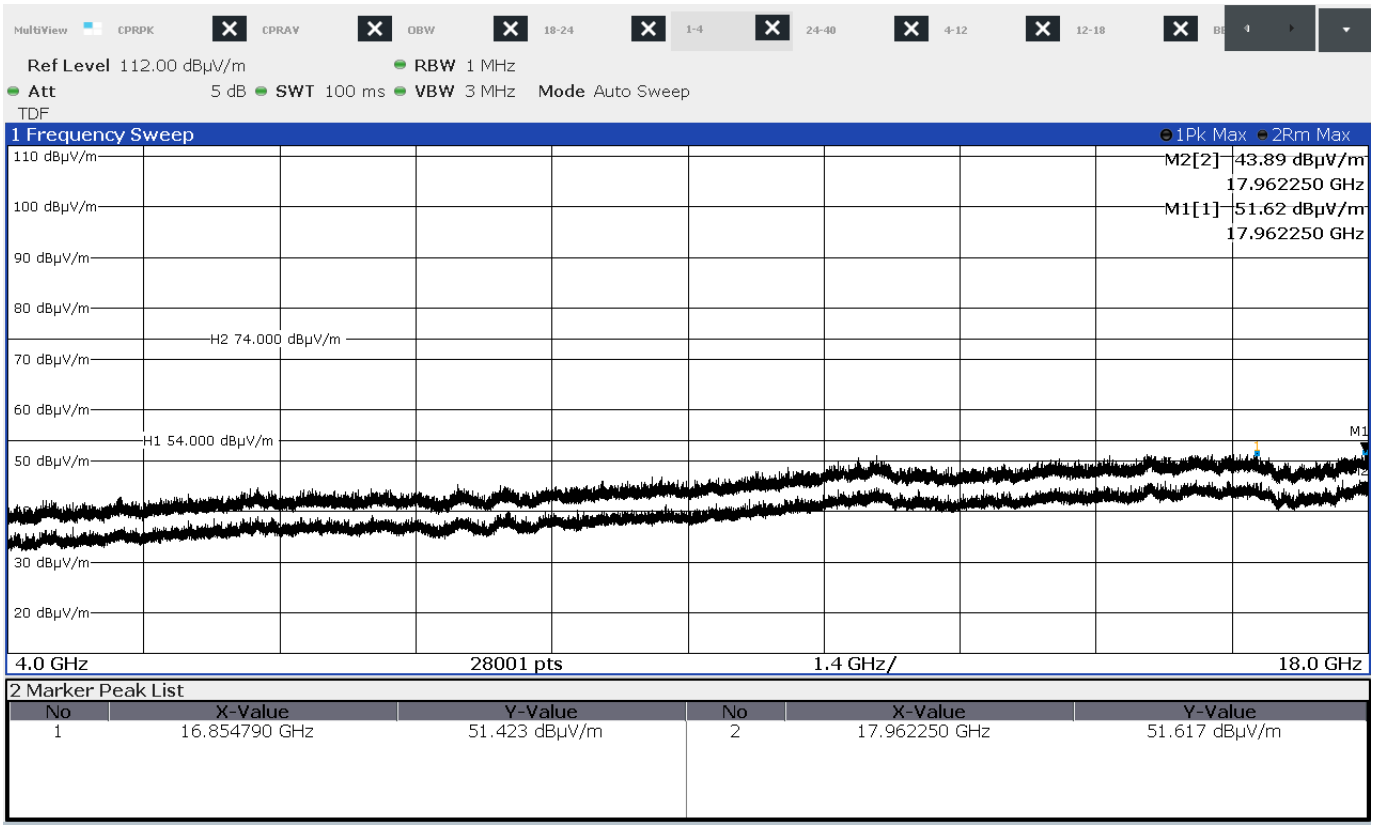
2 Marker Peak List

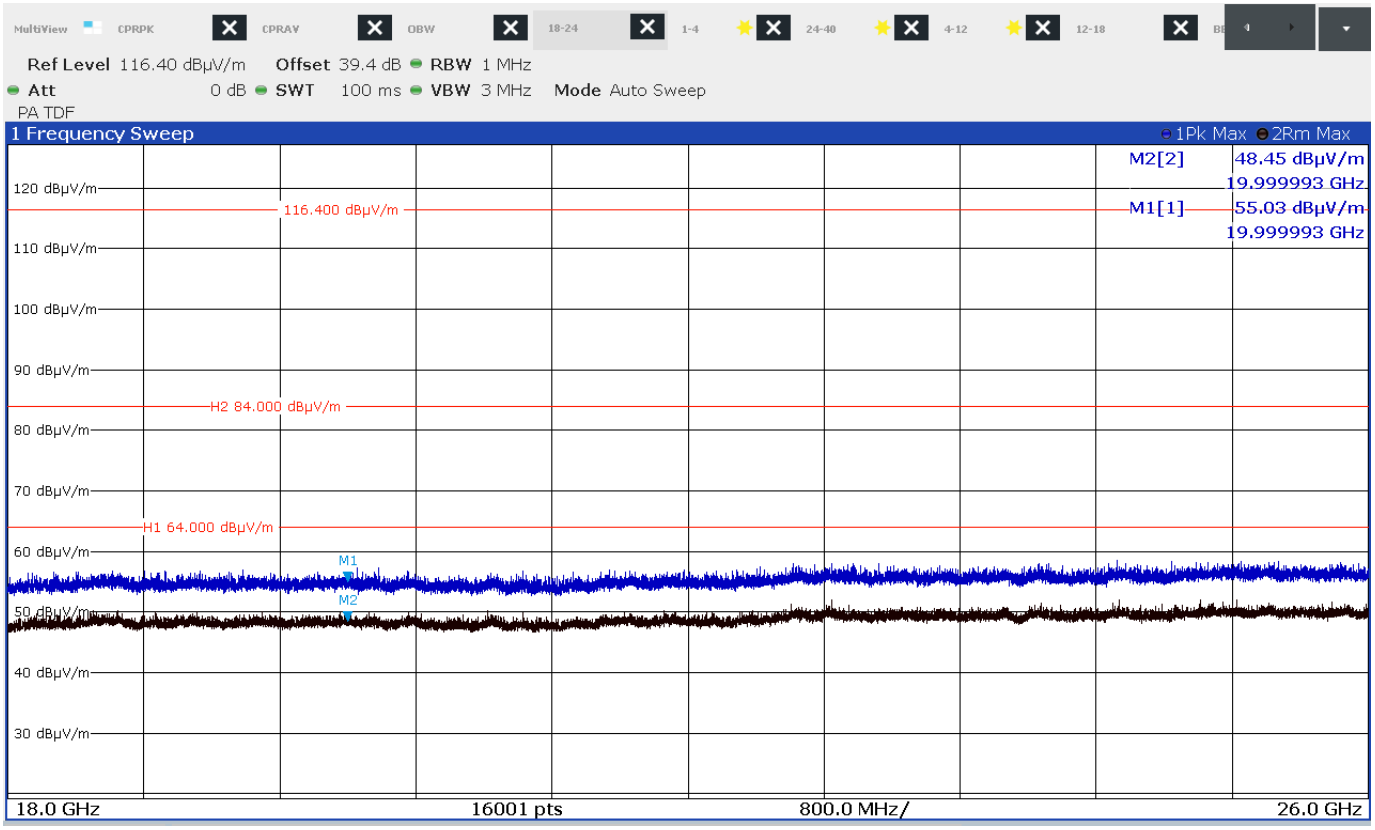
No	X-Value	Y-Value	No	X-Value	Y-Value
1	2.476456 GHz	71.266 dBµV/m	11	2.477481 GHz	76.451 dBµV/m
2	2.476581 GHz	70.973 dBµV/m	12	2.480530 GHz	92.681 dBµV/m
3	2.476602 GHz	71.256 dBµV/m	13	2.482393 GHz	77.527 dBµV/m
4	2.476677 GHz	71.997 dBµV/m	14	2.482513 GHz	77.242 dBµV/m
5	2.476702 GHz	71.379 dBµV/m	15	2.483117 GHz	72.809 dBµV/m
6	2.476752 GHz	71.962 dBµV/m	16	2.483255 GHz	72.723 dBµV/m
7	2.477027 GHz	72.607 dBµV/m	17	2.483301 GHz	72.418 dBµV/m
8	2.477239 GHz	75.579 dBµV/m	18	2.483405 GHz	72.157 dBµV/m
9	2.477343 GHz	76.004 dBµV/m	19	2.483555 GHz	71.227 dBµV/m
10	2.477389 GHz	76.340 dBµV/m	20	2.483697 GHz	71.105 dBµV/m



2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	2.478960 GHz	81.085 dBµV/m	11	2.480043 GHz	83.172 dBµV/m
2	2.479251 GHz	86.021 dBµV/m	12	2.480130 GHz	90.737 dBµV/m
3	2.479351 GHz	86.862 dBµV/m	13	2.480139 GHz	81.855 dBµV/m
4	2.479639 GHz	89.774 dBµV/m	14	2.480239 GHz	82.774 dBµV/m
5	2.479655 GHz	82.413 dBµV/m	15	2.480335 GHz	81.068 dBµV/m
6	2.479739 GHz	90.445 dBµV/m	16	2.480422 GHz	89.594 dBµV/m
7	2.479751 GHz	81.758 dBµV/m	17	2.480430 GHz	81.653 dBµV/m
8	2.479847 GHz	83.300 dBµV/m	18	2.480518 GHz	88.771 dBµV/m
9	2.479947 GHz	81.972 dBµV/m	19	2.480809 GHz	84.908 dBµV/m
10	2.480030 GHz	90.669 dBµV/m	20	2.480909 GHz	83.526 dBµV/m


MultiView
CPRPK
CPRAV
OBW
18-24
1-4
24-40
4-12
12-18
Ref Level 112.00 dBµV/m
RBW 1 MHz
Att 5 dB SWT 100 ms VBW 3 MHz Mode Auto Sweep
TDF
1 Frequency Sweep
1Pk Max 2Rm Max
M2[2] 43.89 dBµV/m
17.962250 GHz
M1[1] 51.62 dBµV/m
17.962250 GHz
110 dBµV/m
100 dBµV/m
90 dBµV/m
80 dBµV/m
H2 74.000 dBµV/m
70 dBµV/m
60 dBµV/m
H1 54.000 dBµV/m
50 dBµV/m
30 dBµV/m
20 dBµV/m
M1
4.0 GHz
28001 pts
1.4 GHz/
18.0 GHz
2 Marker Peak List
No X-Value Y-Value No X-Value Y-Value
1 16.854790 GHz 51.423 dBµV/m 2 17.962250 GHz 51.617 dBµV/m


MultiView
CPRPK
CPRAV
OBW
18-24
1-4
24-40
4-12
12-18
Ref Level 116.40 dBµV/m Offset 39.4 dB RBW 1 MHz
Att 0 dB SWT 100 ms VBW 3 MHz Mode Auto Sweep
PA TDF
1 Frequency Sweep
1Pk Max 2Rm Max
M2[2] 48.45 dBµV/m
19.999993 GHz
M1[1] 55.03 dBµV/m
19.999993 GHz
120 dBµV/m
116.400 dBµV/m
110 dBµV/m
100 dBµV/m
90 dBµV/m
H2 84.000 dBµV/m
80 dBµV/m
70 dBµV/m
H1 64.000 dBµV/m
60 dBµV/m
M1
M2
50 dBµV/m
40 dBµV/m
30 dBµV/m
18.0 GHz
16001 pts
800.0 MHz/
26.0 GHz

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

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 is performed up to the 10th harmonic.

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.
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	FSW43	02-02/11-15-001	19/03/2019	19/03/2018		
	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	08/05/2019	08/05/2018		
	BBHA 9170	02-02/24-05-014	12/06/2021	12/06/2018	12/06/2019	12/06/2018
	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				