

RADIO TEST REPORT – 477931-1TRFWL

Type of assessment:

Final product testing

Applicant:

Leonardo Spa

Piazza Monte Grappa, 4

00195 - Roma, Italy

Product:

Radio Base Station for fixed installation

Model:

RBS4000KU4110DA0C14W0E100S1V2G2-000

Part number:

145-0550/01

Specifications:

◆ **FCC 47 CFR Part 90, Subpart I**

Date of issue: February 11, 2025

D. Guarnone

Tested by



Signature

P. Barbieri

Reviewed by



Signature

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Doc. n. TRF001; Rev. 0; Date: 2020-11-30

Lab locations

Company name	Nemko Spa	
Facilities	Via del Carroccio, 4 – 20853 Biassono (MB) – Italy +39 039 220 12 01 +39 039 220 12 21	
Test site registration	Organization	Recognition numbers
	FCC	682159
Website	www.nemko.com	

Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contained in this report are within Nemko Spa ISO/IEC 17025 accreditation.

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Section 1 Report summary

1.1 Test specifications

FCC 47 CFR Part 90, Subpart I

Private land mobile radio services. General technical standards

1.2 Test methods

ANSI C63.26-2015	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
FCC 47 CFR Part 2, Subpart J	Equipment authorization procedures

1.3 Exclusions

None

1.4 Statement of compliance

In the configuration tested, the EUT was found compliant.

Testing was performed against all relevant requirements of the test standard except as noted in section 1.3 above. Results obtained indicate that the product under test complies in full with the requirements tested. The test results relate only to the items tested.

See "Summary of test results" for full details.

1.5 Test report revision history

Table 1.5-1: Test report revision history

Revision #	Date of issue	Details of changes made to test report
477931TRFWL	September 01, 2022	Original report issued
477931-1TRFWL	February 11, 2025	Second release; typos correction on the conducted and radiated emissions; no re-test needed.

Section 2 Engineering considerations

2.1 Modifications incorporated in the EUT for compliance

There were no modifications performed to the EUT during this assessment.

2.2 Technical judgment

None

2.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 3 Test conditions

3.1 Atmospheric conditions

In the laboratory, the following ambient conditions are respected for each test reported below:

Ambient temperature: $18 \div 33 \text{ }^{\circ}\text{C}^{(1)}$

Relative Humidity: $25 \div 70 \text{ \%}^{(2)}$

Atmospheric pressure: $860 \div 1060 \text{ hPa}$

The following instruments are used to monitor the environmental conditions:

Equipment	Manufacturer	Model	Serial N°
Thermo-hygrometer data loggers	Testo	175-H2	20012380/305
Thermo-hygrometer data loggers	Testo	175-H2	38203337/703
Barometer	Castle	GPB 3300	072015

3.2 Power supply range

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages $\pm 5 \text{ \%}$, for which the equipment was designed.

Section 4 Measurement uncertainty

4.1 Uncertainty of measurement

The measurement uncertainty was calculated for each test and quantity listed in this test report, according to CISPR 16-4-2 and other specific test standard and is documented in Nemko Spa working manual WML1002. The assessment of conformity for each test performed on the equipment is performed not taking into account the measurement uncertainty. The two following possible verdicts are stated in the report:

P (Pass) - The measured values of the equipment respect the specification limit at the points tested. The specific risk of false accept is up to 50% when the measured result is close to the limit.

F (Fail) - One or more measured values of the equipment do not respect the specification limit at the points tested. The specific risk of false reject is up to 50% when the measured result is close to the limit.

Hereafter Nemko's measurement uncertainties are reported:

EUT	Type	Test	Range	Measurement Uncertainty	Notes
Transmitter	Conducted	Frequency error	0.001 MHz ÷ 40 GHz	0.08 ppm	(1)
		Carrier power RF Output Power	0.009 MHz ÷ 30 MHz	1.1 dB	(1)
			30 MHz ÷ 18 GHz	1.5 dB	(1)
			18 MHz ÷ 40 GHz	3.0 dB	(1)
			40 MHz ÷ 140 GHz	5.0 dB	(1)
		Adjacent channel power	1 MHz ÷ 18 GHz	1.4 dB	(1)
		Conducted spurious emissions	0.009 MHz ÷ 18 GHz	3.0 dB	(1)
			18 GHz ÷ 40 GHz	4.2 dB	(1)
			40 GHz ÷ 220 GHz	6.0 dB	(1)
		Intermodulation attenuation	1 MHz ÷ 18 GHz	2.2 dB	(1)
		Attack time – frequency behaviour	1 MHz ÷ 18 GHz	2.0 ms	(1)
		Attack time – power behaviour	1 MHz ÷ 18 GHz	2.5 ms	(1)
		Release time – frequency behaviour	1 MHz ÷ 18 GHz	2.0 ms	(1)
		Release time – power behaviour	1 MHz ÷ 18 GHz	2.5 ms	(1)
		Transient behaviour of the transmitter– Transient frequency behaviour	1 MHz ÷ 18 GHz	0.2 kHz	(1)
		Transient behaviour of the transmitter – Power level slope	1 MHz ÷ 18 GHz	9%	(1)
		Frequency deviation - Maximum permissible frequency deviation	0.001 MHz ÷ 18 GHz	1.3%	(1)
		Frequency deviation - Response of the transmitter to modulation frequencies above 3 kHz	0.001 MHz ÷ 18 GHz	0.5 dB	(1)
		Dwell time	-	3%	(1)
		Hopping Frequency Separation	0.01 MHz ÷ 18 GHz	1%	(1)
		Occupied Channel Bandwidth	0.01 MHz ÷ 18 GHz	2%	(1)
		Modulation Bandwidth	0.01 MHz ÷ 18 GHz	2%	(1)
	Radiated	Radiated spurious emissions	0.009 MHz ÷ 26.5 GHz	6.0 dB	(1)
			26.5 GHz ÷ 66 GHz	8.0 dB	(1)
			66 GHz ÷ 220 GHz	10 dB	(1)
		Effective radiated power transmitter	10 kHz ÷ 26.5 GHz	6.0 dB	(1)
			26.5 GHz ÷ 66 GHz	8.0 dB	(1)
			66 GHz ÷ 220 GHz	10 dB	(1)

NOTES:

(1) The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2$, which for a normal distribution corresponds to a coverage probability of approximately 95 %

Section 5 Information provided by the applicant

5.1 Disclaimer

This section contains information provided by the applicant and has been utilized to support the test plan. Inaccurate information provided by the applicant can affect the validity of the results contained within this test report. Nemko accepts no responsibility for the information contained within this section and the impact it may have on the test plan and resulting measurements.

5.2 Applicant/Manufacture

Applicant name	Leonardo Spa
Applicant address	Piazza Monte Grappa 4 00195 Roma RM Italy
Manufacture name	Leonardo Spa
Manufacture address	Piazza Monte Grappa 4 00195 Roma RM Italy

5.3 EUT information

Product name	Radio Base Station for fixed installation
Model	ECOS-D RBS4000K U4110DA0C14W0E100S1V2G2-000
Part number	145-0550/01
Model variant(s)	General Code: ECOS-D RBS4000K aabbbwAcde4WgE1hmSnVpGr Frequency Band aa aa = U4 (806 - 894 MHz) RF Power bbbW bbb = 110 - Pout 110W bbb = 000 - indicates no Power Amplifier module w = W - Configuration without RX Diversity w = D - Configuration with RX Diversity Power Supply Acde c = 0 - does not provide 12Vdc power supply d = 0 - indicates the absence of alternatives at 12Vdc power supply d = C - indicates 48Vdc power supply e = 1 - indicates one power supply module e = 0 - indicates no power supply modules 4 Wires interfaces 4Wg g = 1 - indicates one LIF (Line Interface module) with back-card g = 0 indicates no Line Interface modules and no back-card E1 Interfaces E1hm h = C - indicates back-DIF (Digital Interface back-card) with coax connectors @75 Ohm unbalanced h = R - indicates back-DIF (Digital Interface back-card) with RJ45 connectors @120 Ohm balanced h = 0 - indicates no back-DIF m = 1 - indicates one Digital Interface module m = 0 - indicates no Digital Interface modules Option Board – SOIP Sn n = 1 - indicates one SOIP piggy-back on one CORE module n = 0 - indicates no SOIP piggy-back Option Board VOCODER Vp p = 1 - indicates one VOCODER piggy-back on one CORE module p = 0 - indicates no VOCODER piggy-back

	Synchronization GPS receiver Gr r = 1 - indicates one GPS receiver piggy-back on one CORE module (Master) r = 2 - indicates two GPS receiver piggy-back on one CORE module (Master) r = 0 - indicates no GPS receivers piggy-back
Serial number	00322929
Power supply requirements	48 V DC (35 ÷ 60 Vdc)
Product description and theory of operation	The EUT is a radio base station for fixed installation
Software version	6.0.19.2

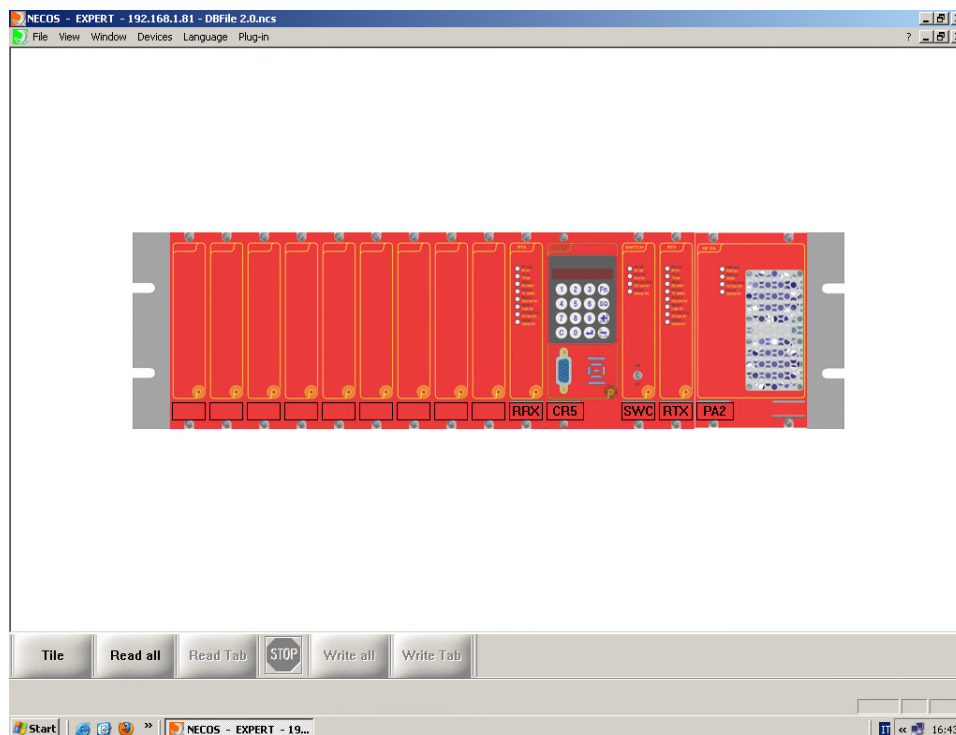
5.4 Technical information

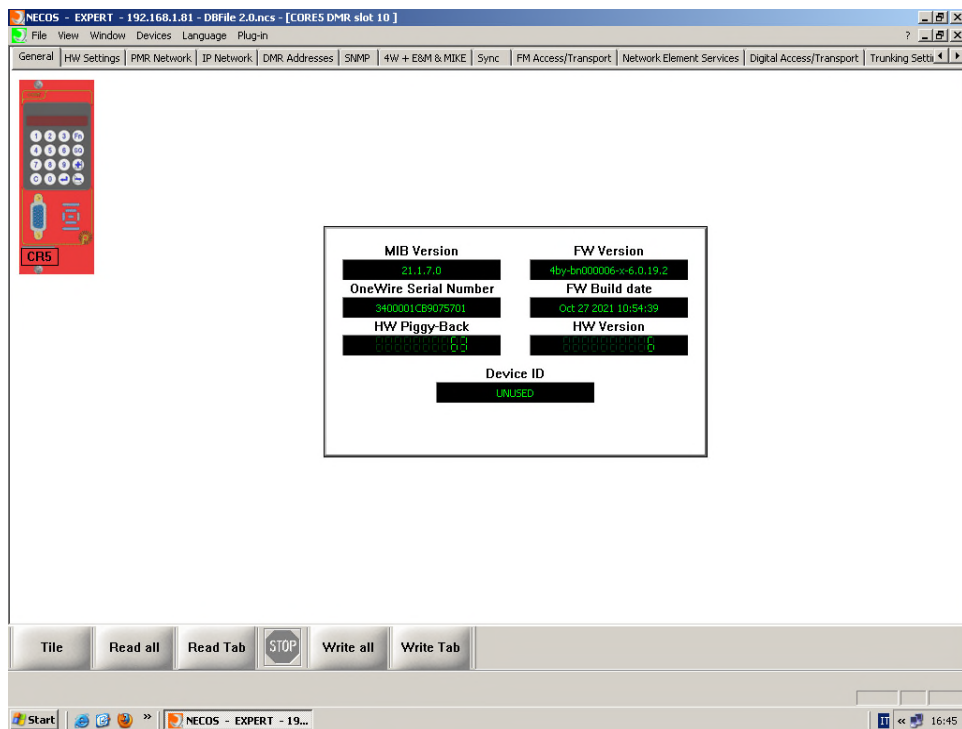
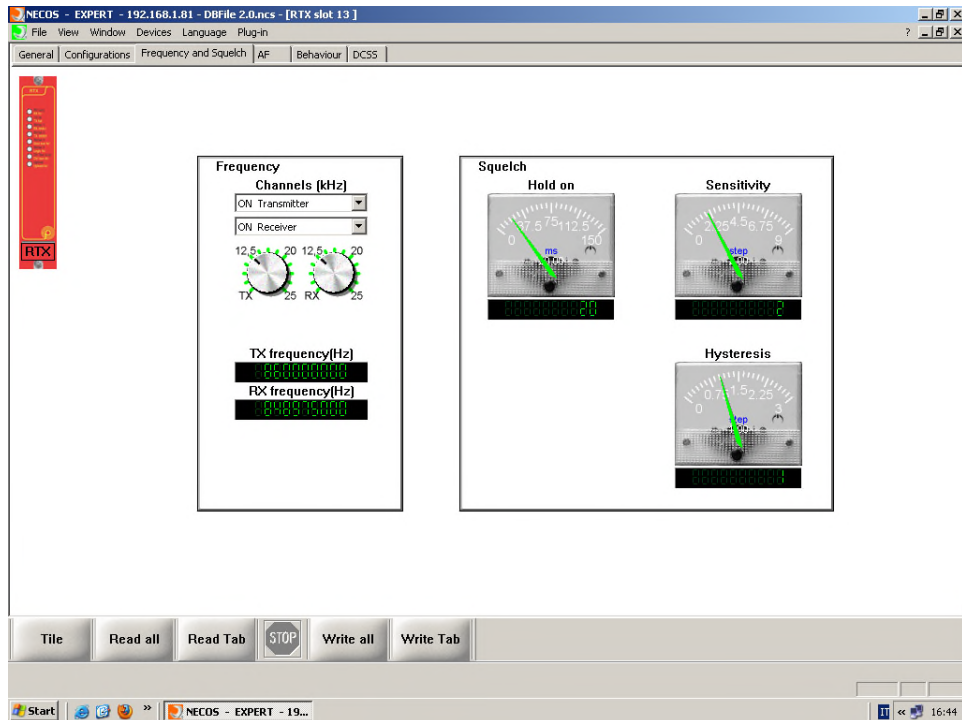
System type	☐ Mobile system
	☒ Base/Fixed point-to-point system
Frequency band	806 MHz – 894 MHz
Frequency Min (MHz)	851 MHz
Frequency Max (MHz)	869 MHz
RF power Max (W), Conducted	110 W (50.414 dBm)
Field strength, dBμV/m @ 3 m	N/A
Measured BW (kHz), 99% OBW	14.9 kHz
Emission designators	Analog FM 11K0F3E / 16K0F3E (12.5 / 25 kHz) PM 11K0G3E / 16K0G3E (12.5 / 25 kHz) DMR 4FSK Voice 7K60FXE (12.5 kHz) DMR 4FSK Data 7K60FXD (12.5 kHz) P25 C4FM Voice and data 8K10F1E (12.5 kHz) P25 C4FM Data 8K10F1D (12.5 kHz)
Transmitter spurious, dBm @ 3 m	-14.5 dBm (@8600 MHz)
Antenna information	Antenna not provided

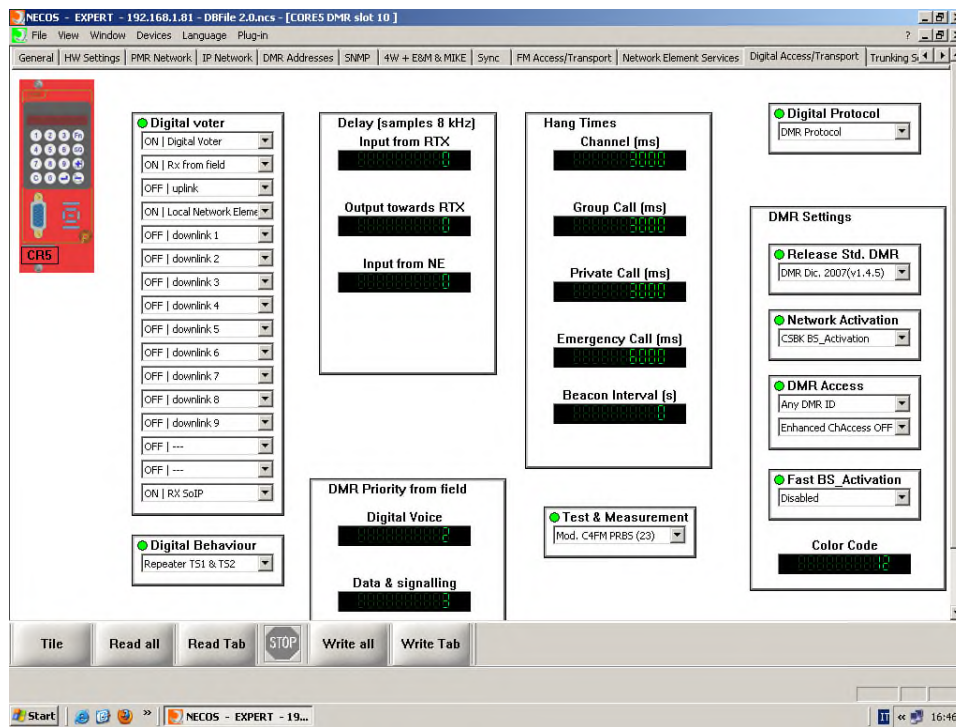
5.5 EUT setup details

5.5.1 Radio exercise details

The following software has been used to set the EUT.







5.5.2 EUT sub assemblies

none

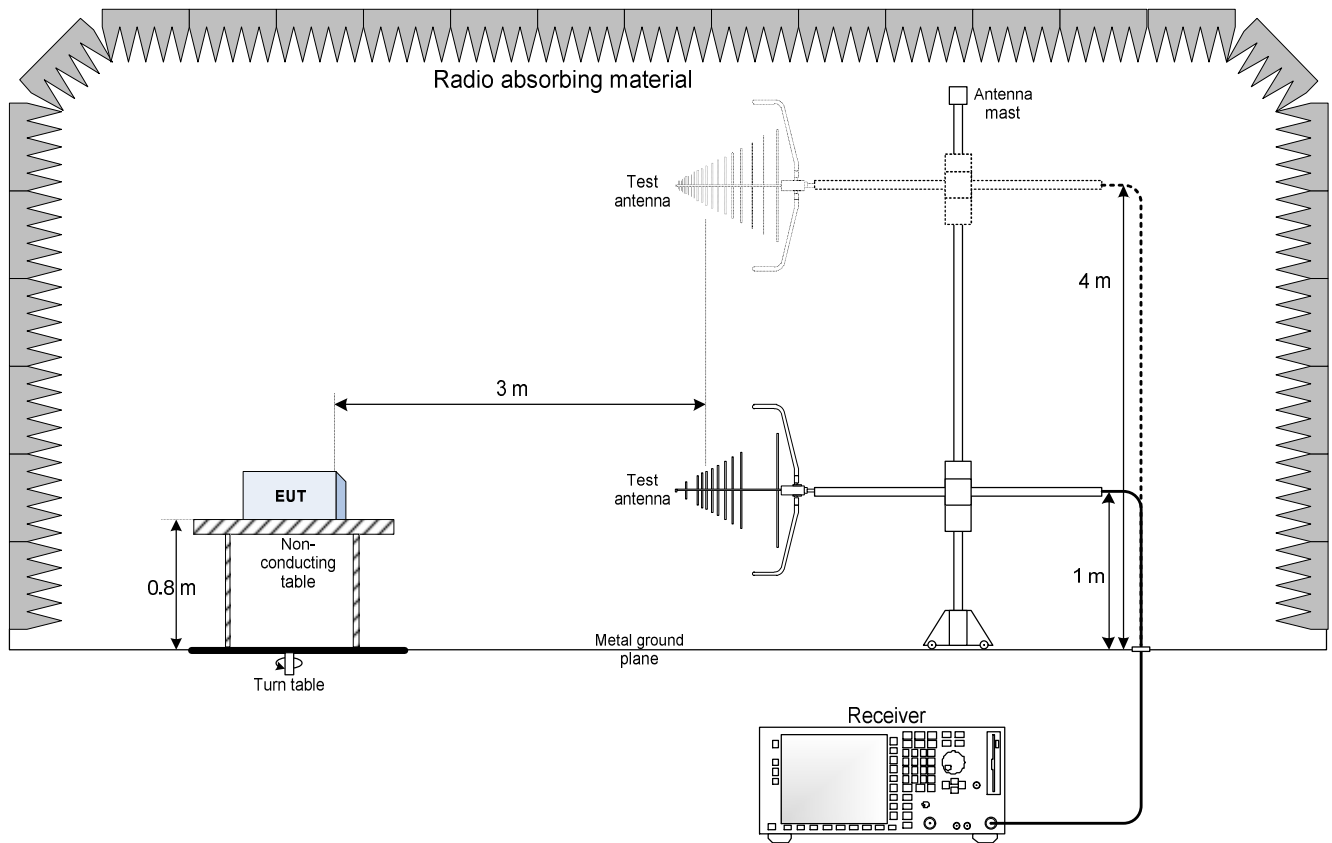
5.5.3 EUT interface ports

Port	Name	Type ¹	Cable Max. >3m	Cable Shielded	Description
0	Enclosure	N/E	—	—	—
1	Power in	DC	☐	☐	Two wires cable
2	LAN	TP	☒	☒	Standard cable with RJ45 connector
3	TX Out	ANT	☐	☒	Coaxial cable with sma connector
4	Antenna	ANT	☐	☒	Coaxial cable with sma connector
5	Main GPS antenna	ANT	☐	☒	Coaxial cable with sma connector
6	Spare GPS antenna	ANT	☐	☒	Coaxial cable with sma connector
7	I/O	I/O	☐	☐	Multi wires cable
8	I/O	I/O	☐	☐	Multi wires cable
Notes: ¹ Port type: AC = AC Power Port DC = DC Power Port N/E = Non-Electrical ANT = Antenna Port I/O = Signal/Control Input or Output Port TP = Wired network or telecommunication Port					

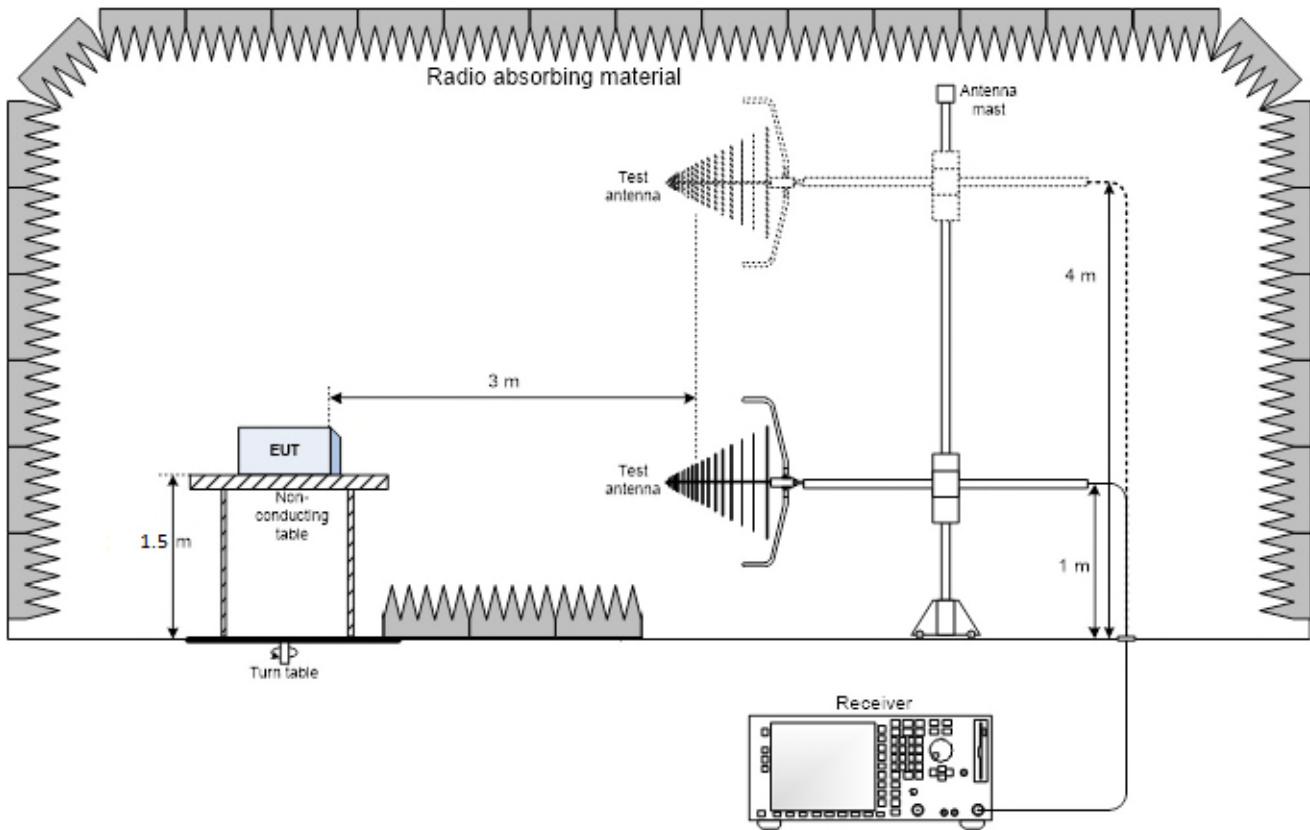
5.5.4 Support equipment

Use ¹	Product Type	Manufacturer	Model	Comments
AE	Notebook	Packard Bell	EasyNote TS	—
Notes: ¹ Use EUT - Equipment Under Test SIM - Simulator (Not Subjected to Test) AE - Auxiliary/Associated Equipment (Not Subjected to Test)				

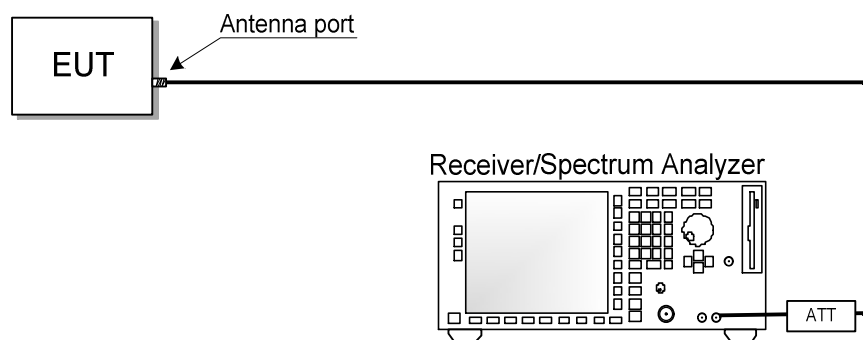
5.5.5 Radiated testing block diagram (below 1 GHz)



5.5.6 Radiated testing block diagram (above 1 GHz)



5.5.7 Antenna port testing block diagram



Section 6 Summary of test results

6.1 Testing location

Test location (s) Nemko Spa

6.2 Testing period

Test start date August 23, 2022 Test end date August 31, 2022

6.3 Sample information

Receipt date July 28, 2022 Nemko sample ID number(s) 47793110002

6.4 FCC Part 2 Subpart J and Part 90 Subpart I test results

Table 6.4-1: FCC requirements results

Section	Test description	Verdict
§2.1047	Modulation characteristics	Pass
§90.205(k)	Transmitter output power	Pass
§90.209(b)	Bandwidth limitations	Pass
§90.210	Spectrum mask and spurious emissions	Pass
§90.214	Transient frequency behavior	Not Applicable
§90.213(a)	Transmitter frequency stability	Pass

Notes: --

Section 7 Testing data

7.1 Number of frequencies

7.1.1 References, definitions and limits

Table 7.1-1: Frequency Range of Operation

Frequency range over which the device operates (in each band)	Number of test frequencies required	Location of measurement frequency inside the operating frequency range
1 MHz or less	1	Center (middle of the band)
1–10 MHz	2	1 near high end, 1 near low end
Greater than 10 MHz	3	1 near high end, 1 near center and 1 near low end

Notes: "near" means as close as possible to or at the centre / low end / high end of the frequency range over which the device operates.

7.1.2 Test summary

Verdict	Pass		
Tested by	D. Guarnone	Test date	August 23, 2022

7.1.3 Observations, settings and special notes

None

7.1.4 Test data

Table 7.1-2: Test channels selection

Start of Frequency range, MHz	End of Frequency range, MHz	Frequency range bandwidth, MHz	Low channel, MHz	Mid channel, MHz	High channel, MHz
851	869	18	851.1	860	868.9

7.2 FCC 2.1047 Modulation characteristic

7.2.1 References, definitions and limits

- (a) Voice modulated communication equipment. A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted. For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter, or of all circuitry installed between the modulation limiter and the modulated stage shall be submitted.
- (b) Equipment which employs modulation limiting. A curve or family of curves showing the percentage of modulation versus the modulation input voltage shall be supplied. The information submitted shall be sufficient to show modulation limiting capability throughout the range of modulating frequencies and input modulating signal levels employed

7.2.2 Test summary

Verdict	Pass				
Tested by	D. Guarnone	Test date	August 25, 2022		

7.2.3 Observations, settings and special notes

Per ANSI C63.26 Subclause 5.3.1: The audio frequency response is the degree of closeness to which the frequency deviation of the transmitter follows a prescribed characteristic. Spectrum analyser settings:

Receiver mode RMS deviation

Audio frequency generator tone 100 Hz to 5000 Hz

Reference voltage measurement: Apply a 1000 Hz tone and adjust the audio frequency generator to produce 20% of the rated system deviation. Record the DMM reading as VREF.

Calculation of the audio frequency response at the present frequency: $20 \times \log_{10} (VFREQ / VREF)$

Per ANSI C63.26 Subclause 5.3.2: Modulation limiting is the ability of a transmitter circuit to limit the transmitter from producing deviations in excess of a rated system deviation.

Spectrum analyser settings:

Receiver mode Peak positive and negative deviation

Audio frequency generator tone 300 Hz, 1000 Hz and 2500 Hz

Reference voltage measurement: Apply a 1000 Hz tone and adjust the audio frequency generator to produce 60% of the rated system deviation. This is the 0 dB reference level. Plot the data set as a percentage of deviation relative to the 0 dB reference point versus input voltage

7.2.4 Test equipment list

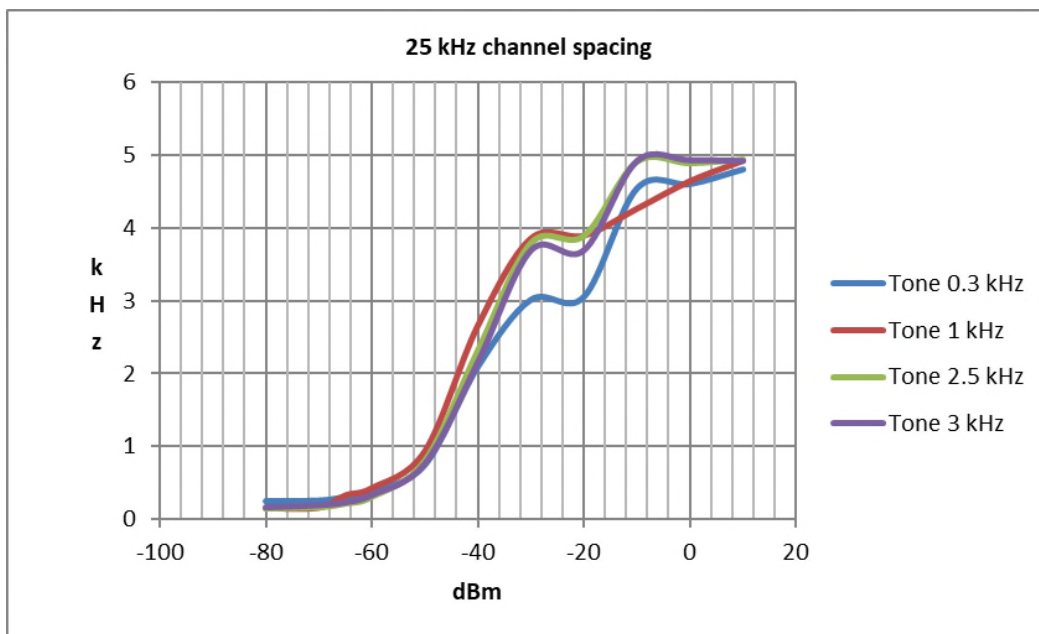
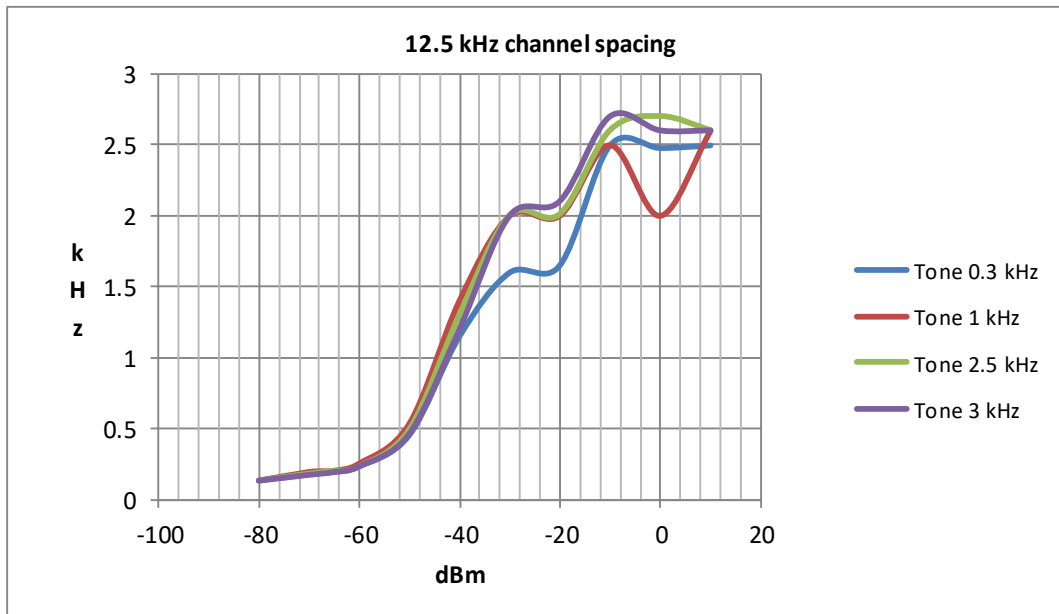
Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
EMI receiver	Rohde & Schwarz	ESU8	100202	2021-09	2022-09
Shielded room	Siemens	10m control room	1947	NCR	NCR
Radiocommunication Tester	R&S	CMT	883152/001	2021/01	2024-01
Audio Generator	Rohde & Schwarz	APN04	860 093/017	2021-12	2023-12

Note: NCR - no calibration required, VOU - verify on use

7.2.5 Test data

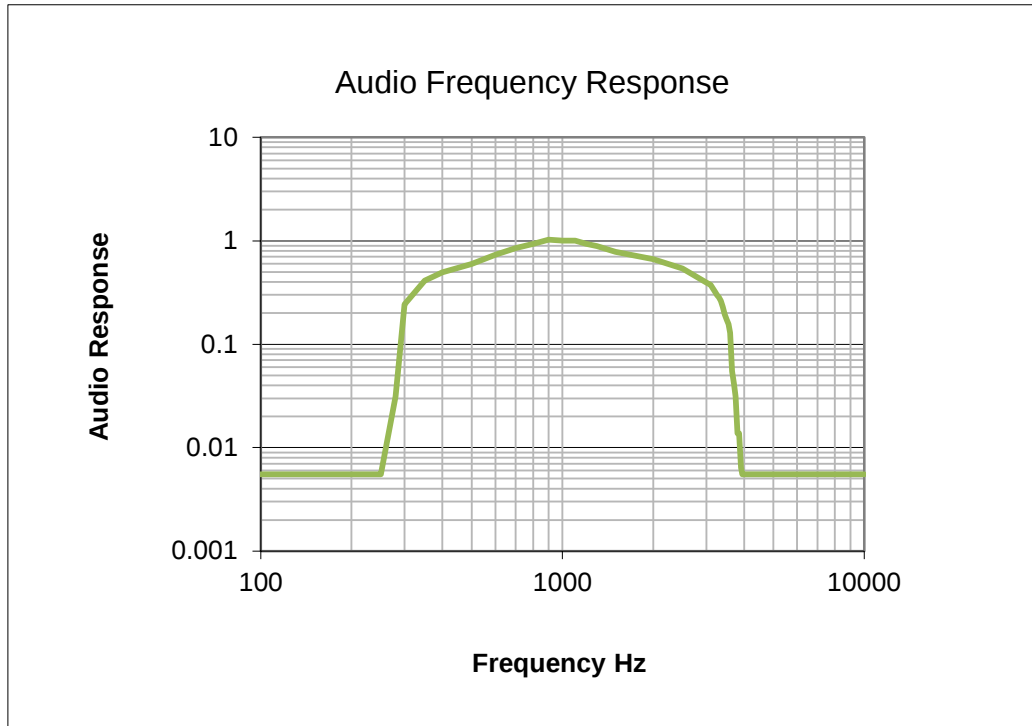
Modulation Limiting:

860 MHz



Test data, continued

Audio response 860 MHz, 25 kHz





7.3 FCC 90.205(k) Transmitter Output Power

7.3.1 References, definitions and limits

The effective radiated power and antenna height for base stations may not exceed 1 kilowatt (30 dBw) and 304 m. (1,000 ft.) above average terrain (AAT), respectively, or the equivalent thereof as determined from the Table. These are maximum values, and applicants will be required to justify power levels and antenna heights requested.

(b) The maximum output power of the transmitter for mobile stations is 100 watts (20 dBw).

Table - Equivalent Power and Antenna Heights for Base Stations in the 851-869 MHz and 935-940 MHz Bands Which Have a Requirement for a 32 km (20 mi) Service Area Radius

Table - Equivalent Power and Antenna Heights for Base Stations in the 851-869 MHz and 935-940 MHz Bands Which Have a Requirement for a 32 km (20 mi) Service Area Radius	
Antenna height (ATT) meters (feet)	Effective radiated power (watts) ^{1 2 4}
Above 1,372 (4,500)	65
Above 1,220 (4,000) to 1,372 (4,500)	70
Above 1,067 (3,500) to 1,220 (4,000)	75
Above 915 (3,000) to 1,067 (3,500)	100
Above 763 (2,500) to 915 (3,000)	140
Above 610 (2,000) to 763 (2,500)	200
Above 458 (1,500) to 610 (2,000)	350
Above 305 (1,000) to 458 (1,500)	600
Up to 305 (1,000)	³ 1,000

¹ Power is given in terms of effective radiated power (ERP).

² Applicants in the Los Angeles, CA, area who demonstrate a need to serve both the downtown and fringe areas will be permitted to utilize an ERP of 1 kw at the following mountaintop sites: Santiago Park, Sierra Peak, Mount Lukens, and Mount Wilson.

³ Stations with antennas below 305 m (1,000 ft) (AAT) will be restricted to a maximum power of 1 kw (ERP).

⁴ Licensees in San Diego, CA, will be permitted to utilize an ERP of 500 watts at the following mountaintop sites: Palomar, Otay, Woodson and Miguel.

7.3.2 Test summary

Verdict	Pass			
Tested by	D. Guarnone	Test date	August 23, 2022	

7.3.3 Observations, settings and special notes

Manufacturer's rated output power is 110 W or 50.414 dBm. 20% or $10 \times \log_{10}(0.2) = -6.99$ dB.

Measurement of peak power was performed per ANSI C63.26 subclause 5.2.3.3. Spectrum analyser settings

Measurement of peak power was performed per ANSI C63.26 subclause 5.2.3.3. Spectrum analyser settings:

Resolution bandwidth	$\geq$ OBW
Video bandwidth	$\geq 3 \times$ RBW
Frequency span	$\geq 2 \times$ OBW
Detector mode	Peak
Trace mode	Max Hold
Sweep time	$\geq 10 \times$ (number of points in sweep) $\times$ (transmission symbol period)

7.3.4 Test equipment list

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
EMI receiver	Rohde & Schwarz	ESU8	100202	2021-09	2022-09
Shielded room	Siemens	10m control room	1947	NCR	NCR

Note: NCR - no calibration required, VOU - verify on use

7.3.5 Test data

Limit: as required by §90.205(k) and §90.635(b), stations with antennas below 305 m (1,000 ft) (AAT) will be restricted to a maximum power of 1 kw (ERP).
1 kW = 60 dBm

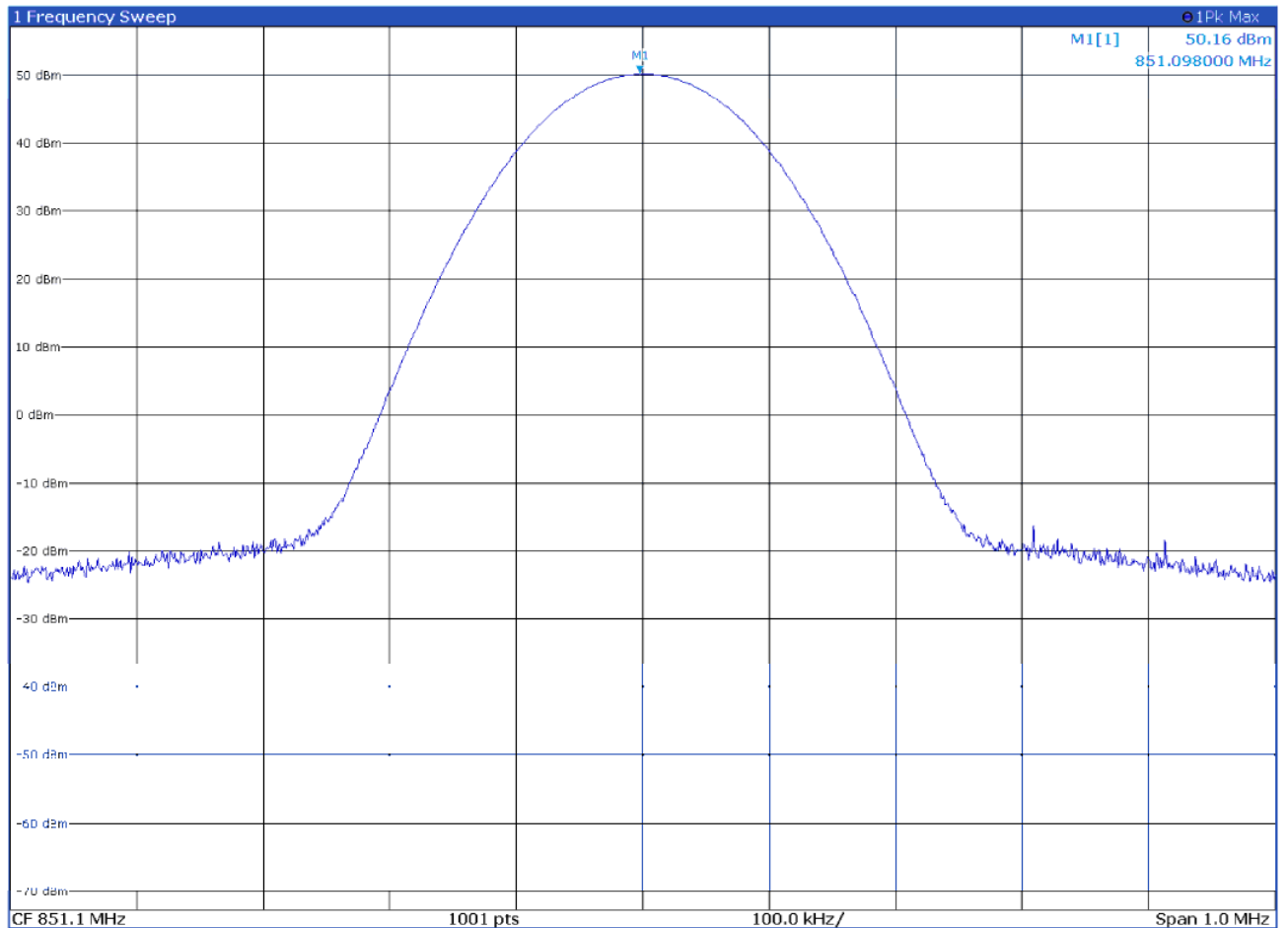
Table 7.3-1: Transmitter power results

Modulation	Frequency, MHz	Output power, dBm	Antenna gain	ERP dBm	ERP Limit dBm	Margin dB
FM 12.5 kHz	851.1	50.18	0	50.18	60	-9.82
FM 25.0 kHz	851.1	50.18	0	50.18	60	-9.82
DMR 4FSK	851.1	50.16	0	50.16	60	-9.84
P25 C4FM	851.1	50.16	0	50.16	60	-9.84
FM 12.5 kHz	860	50.05	0	50.05	60	-9.95
FM 25.0 kHz	860	50.06	0	50.06	60	-9.94
DMR 4FSK	860	50.03	0	50.03	60	-9.97
P25 C4FM	860	50.05	0	50.05	60	-9.95
FM 12.5 kHz	868.9	50.08	0	50.08	60	-9.92
FM 25.0 kHz	868.9	50.07	0	50.07	60	-9.93
DMR 4FSK	868.9	50.03	0	50.03	60	-9.97
P25 C4FM	868.9	50.05	0	50.05	60	-9.95

Table 7.3-2: Rated vs measured power

Modulation	Frequency, MHz	Rated output power, dBm	Measured output power, dBm	Difference, dB	Difference limit, ±dB	Margin, dB
P25 C4FM	851.1	50.41	50.16	-0.25	6.98	6.73
FM 12.5 kHz	851.1	50.41	50.18	-0.23	6.98	6.75
FM 25.0 kHz	851.1	50.41	50.18	-0.23	6.98	6.75
DMR 4FSK	851.1	50.41	50.16	-0.25	6.98	6.73
P25 C4FM	860	50.41	50.05	-0.36	6.98	6.62
DMR 4FSK	860	50.41	50.03	-0.38	6.98	6.60
FM 12.5 kHz	860	50.41	50.05	-0.36	6.98	6.62
FM 25 kHz	860	50.41	50.06	-0.35	6.98	6.63
P25 C4FM	868.9	50.41	50.05	-0.36	6.98	6.62
DMR 4FSK	868.9	50.41	50.03	-0.38	6.98	6.60
FM 12.5 kHz	868.9	50.41	50.08	-0.33	6.98	6.65
FM 25 kHz	868.9	50.41	50.07	-0.34	6.98	6.64

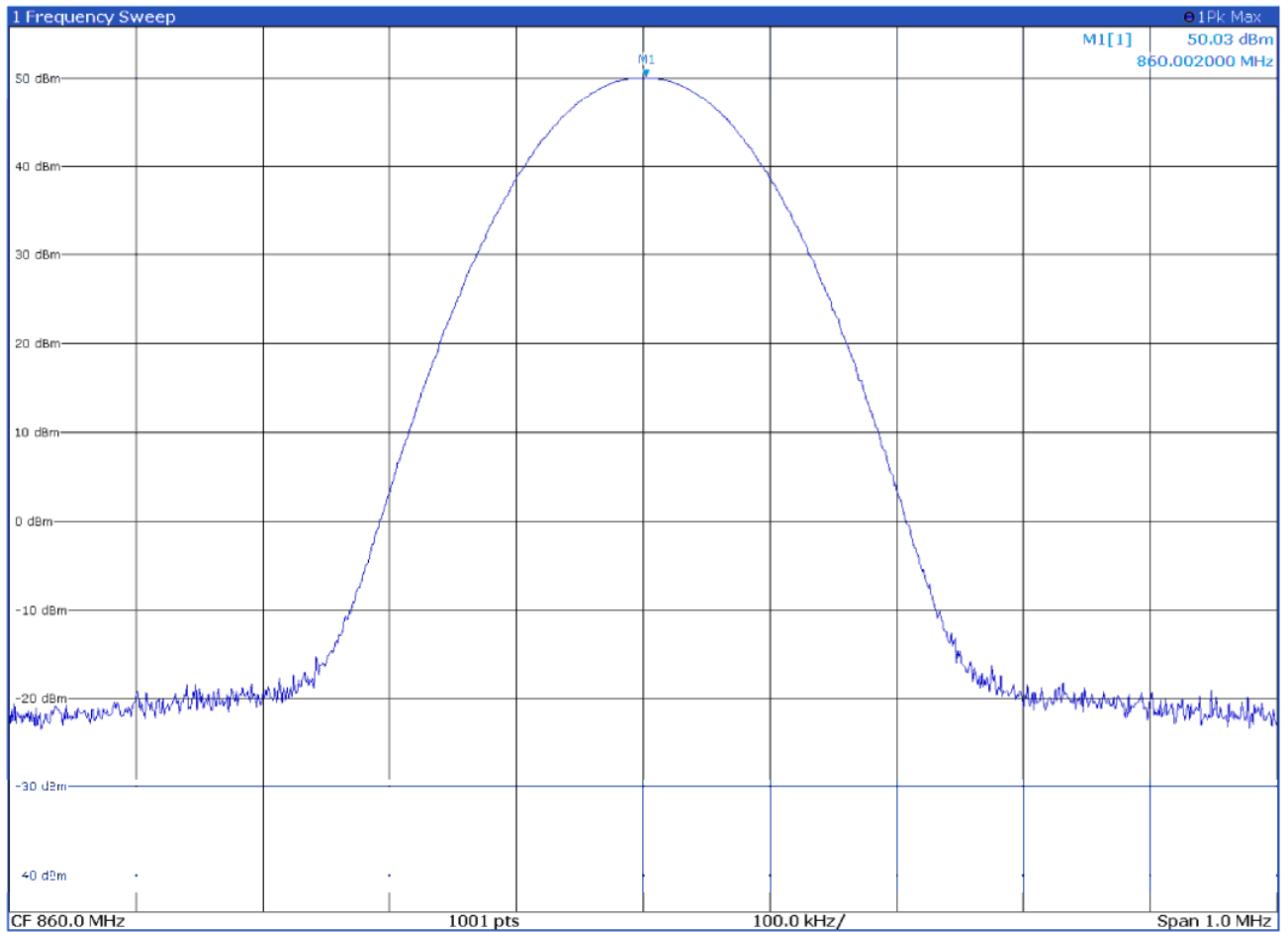
Test data, continued



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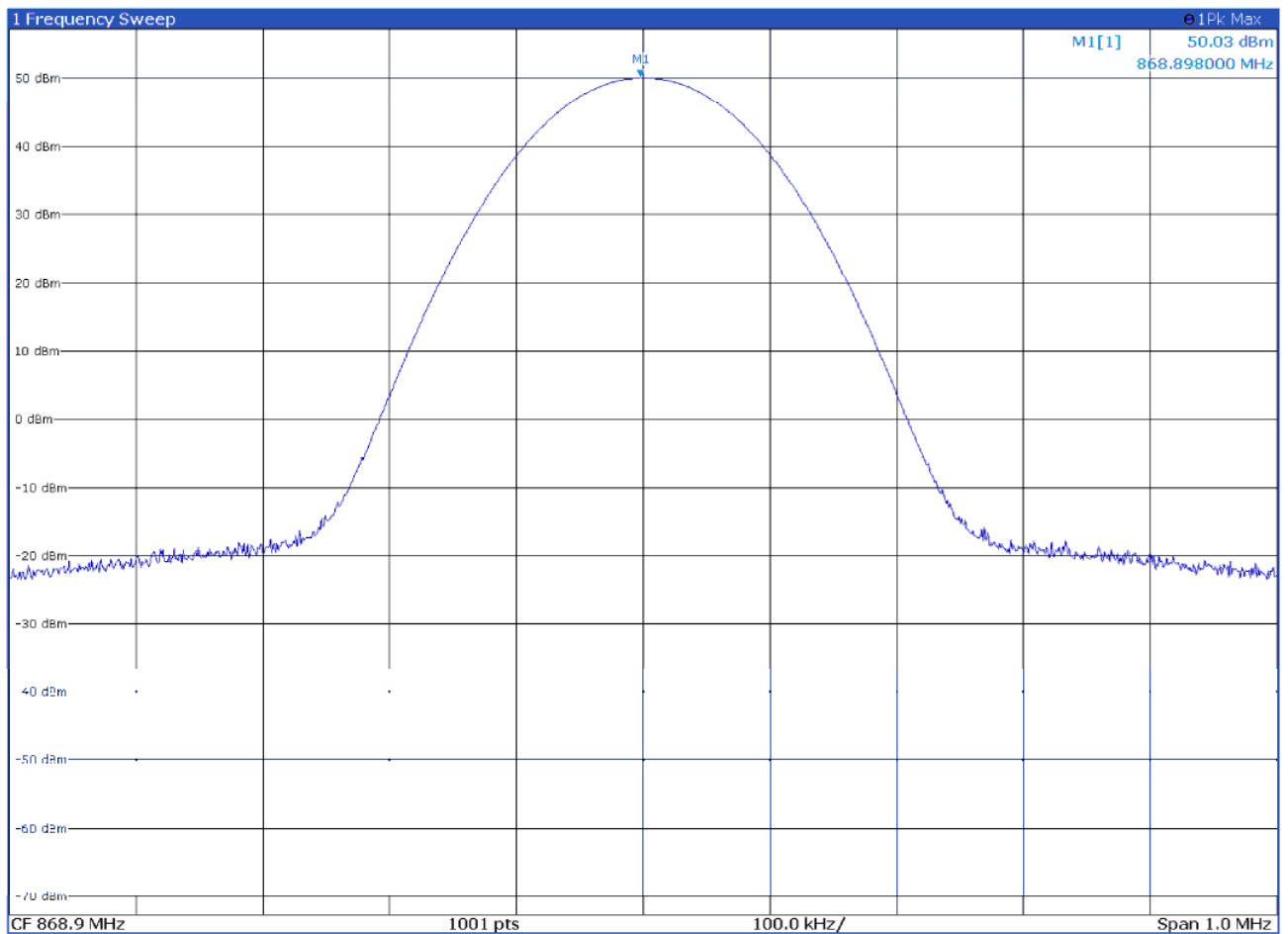
Output power with modulation DMR 4FSK at 851.1 MHz



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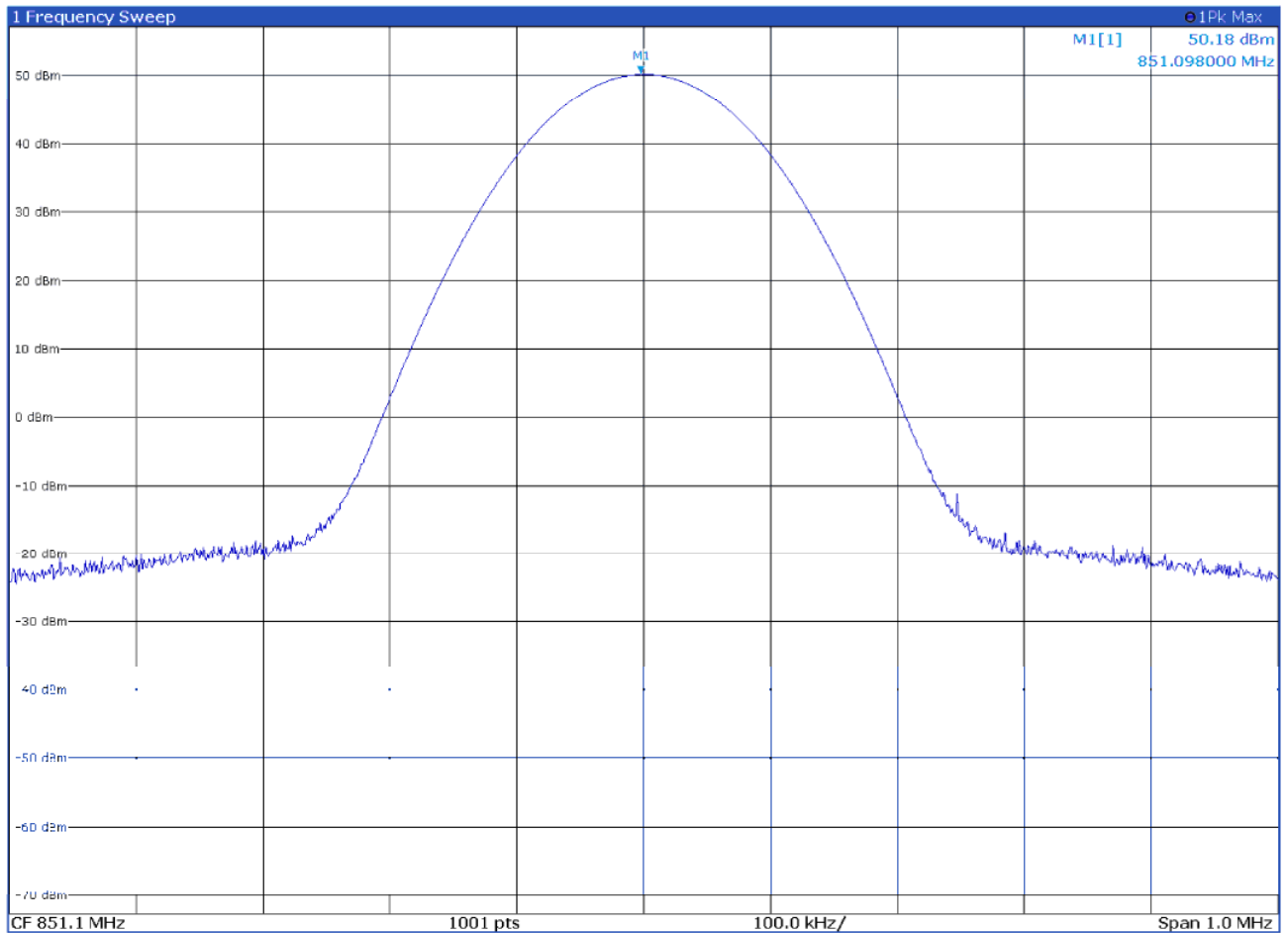
Output power with modulation DMR 4FSK at 860 MHz



16:23:42 24.08.2022

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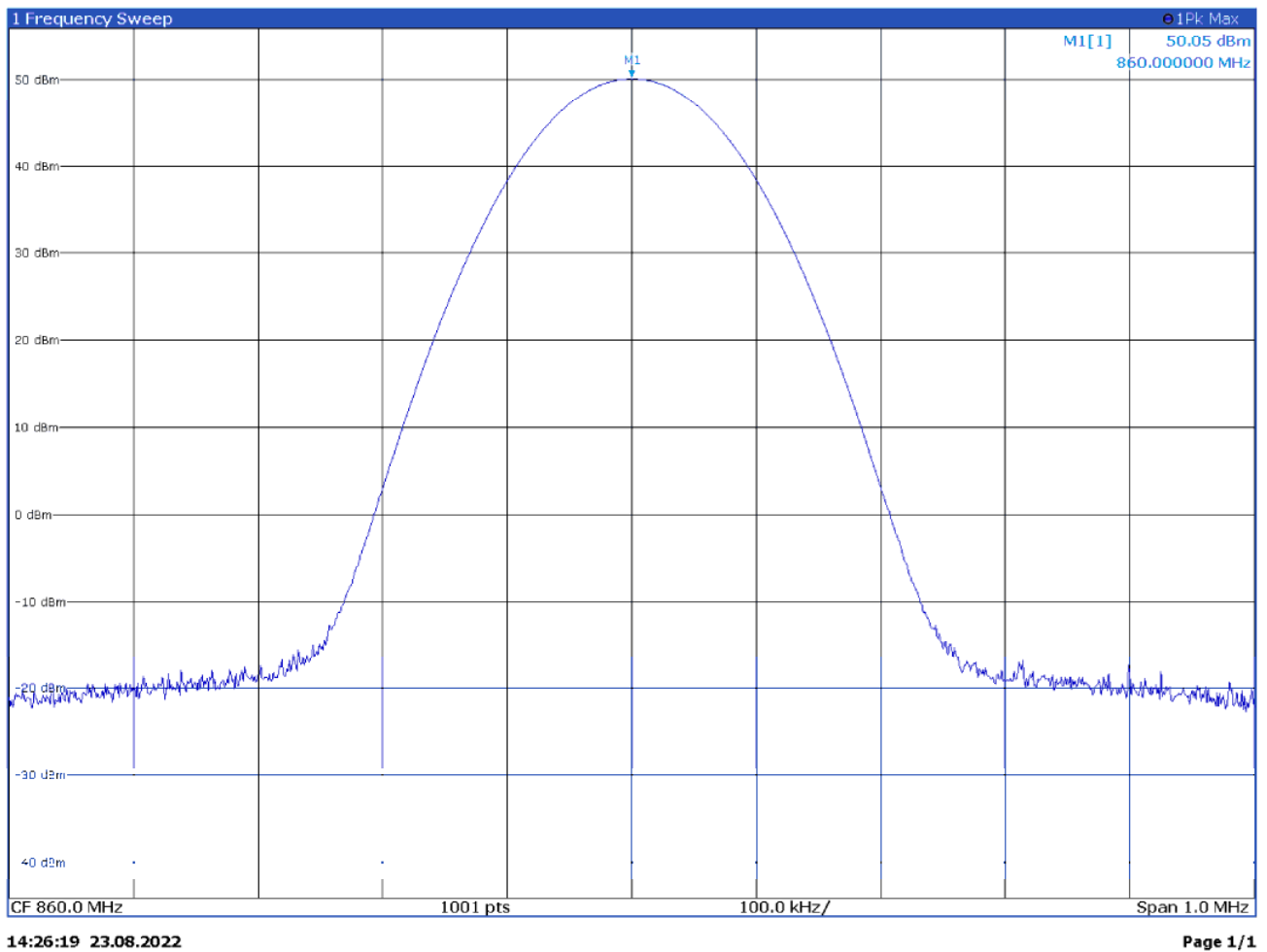
Output power with modulation DMR 4FSK at 868.9 MHz



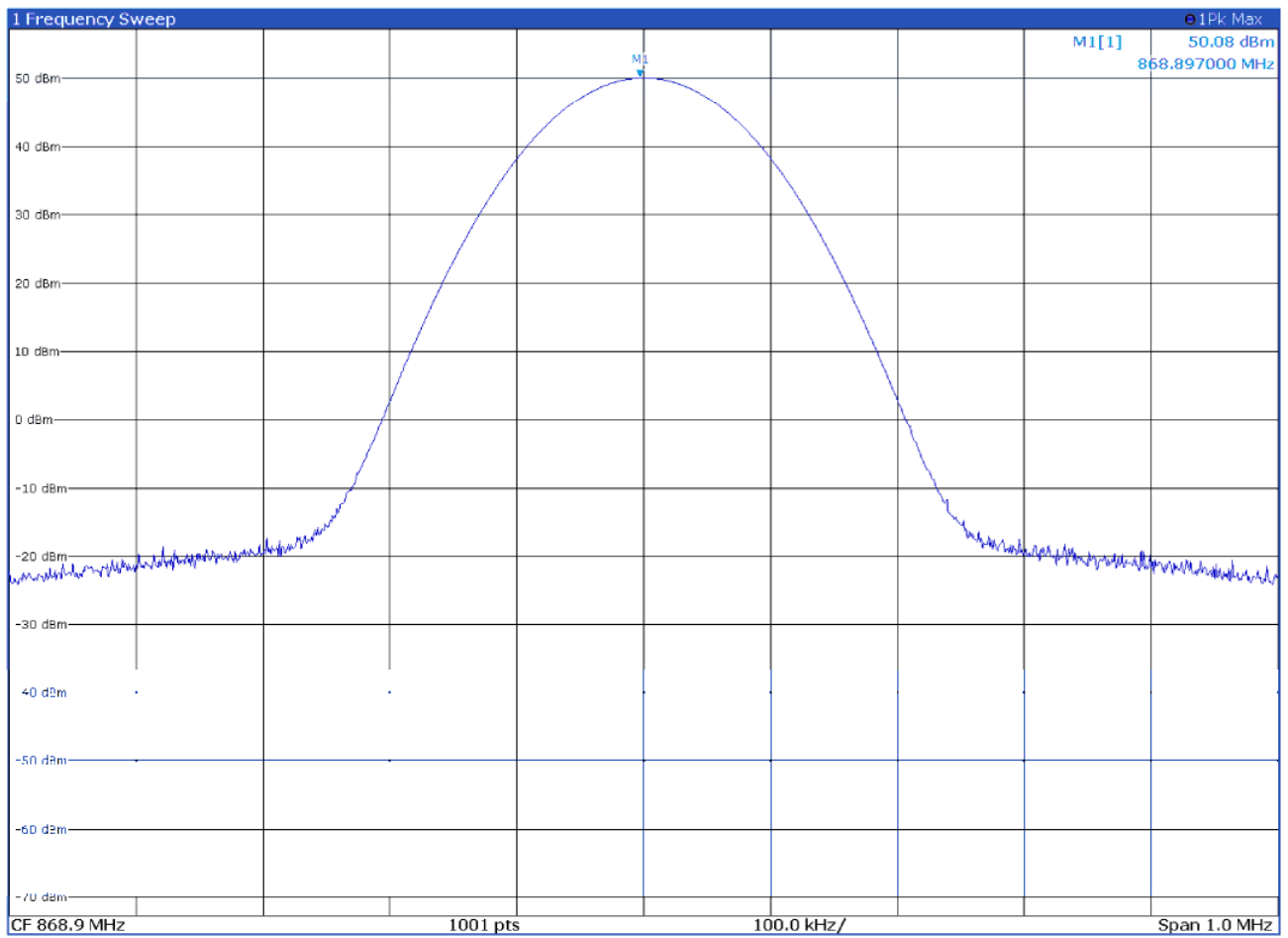
16:39:16 24.08.2022

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Output power with modulation FM 12.5 kHz at 851.1 MHz



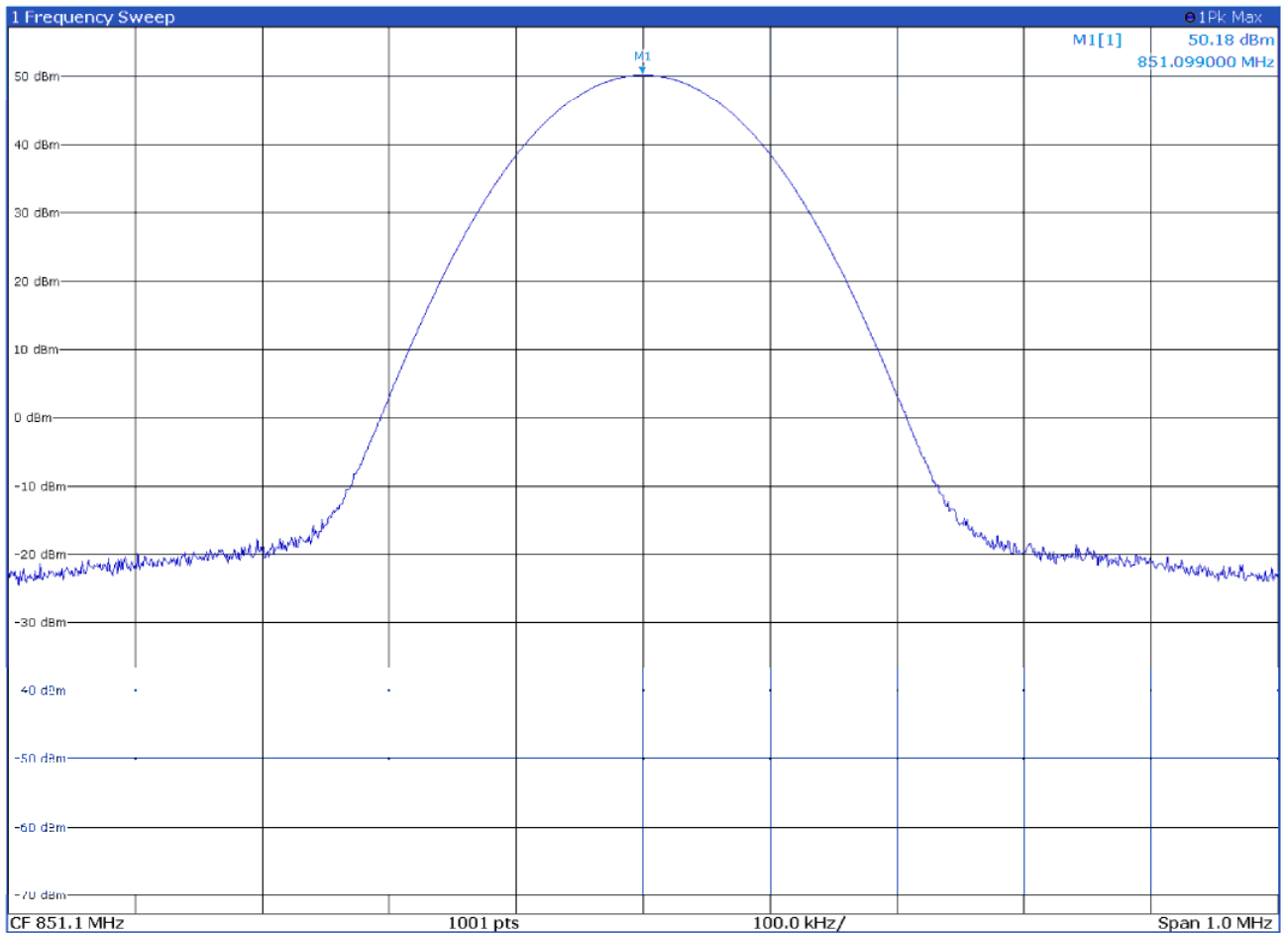
Output power with modulation FM 12.5 kHz at 860 MHz



16:32:32 24.08.2022

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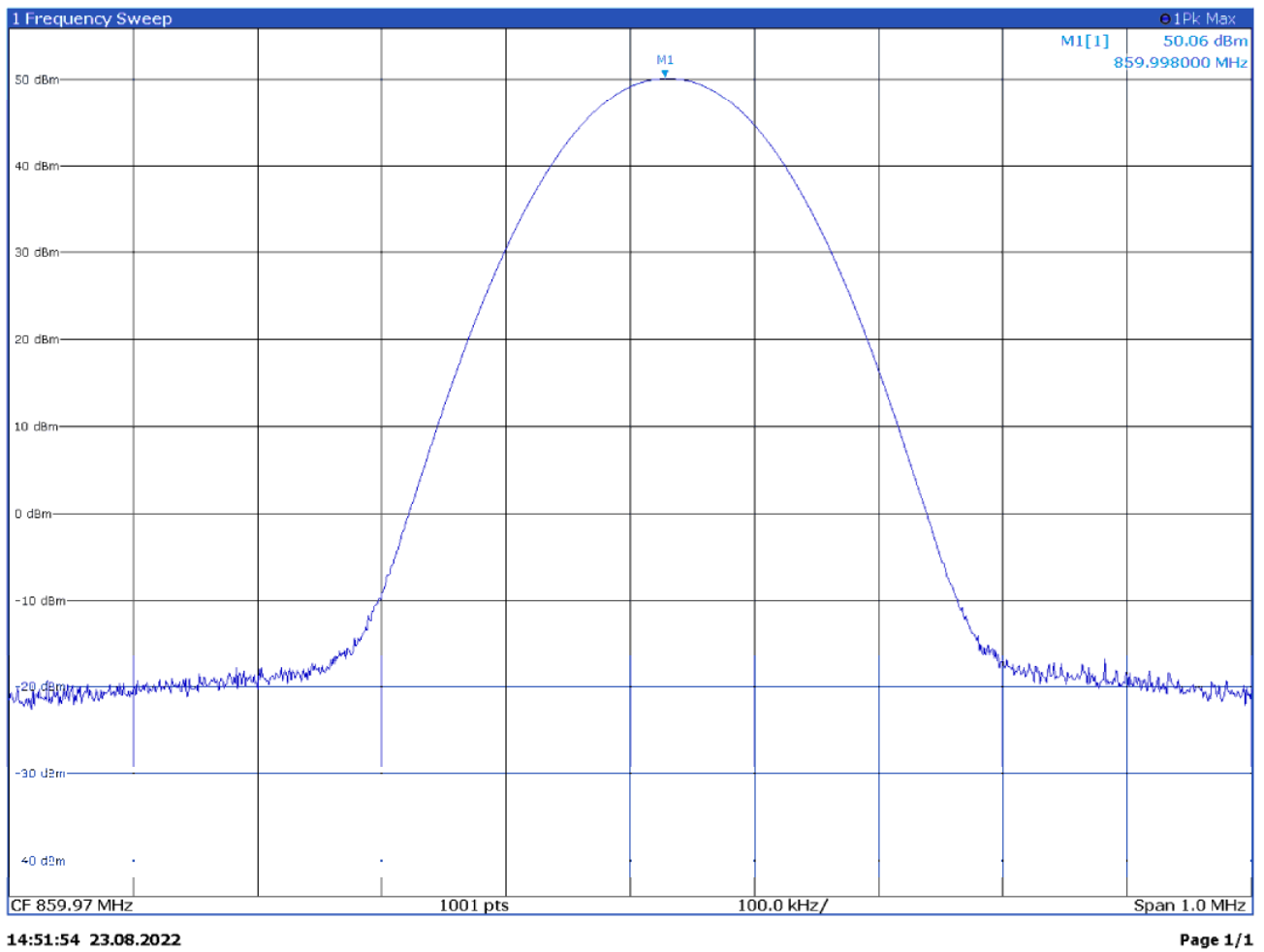
Output power with modulation FM 12.5 kHz at 868.9MHz



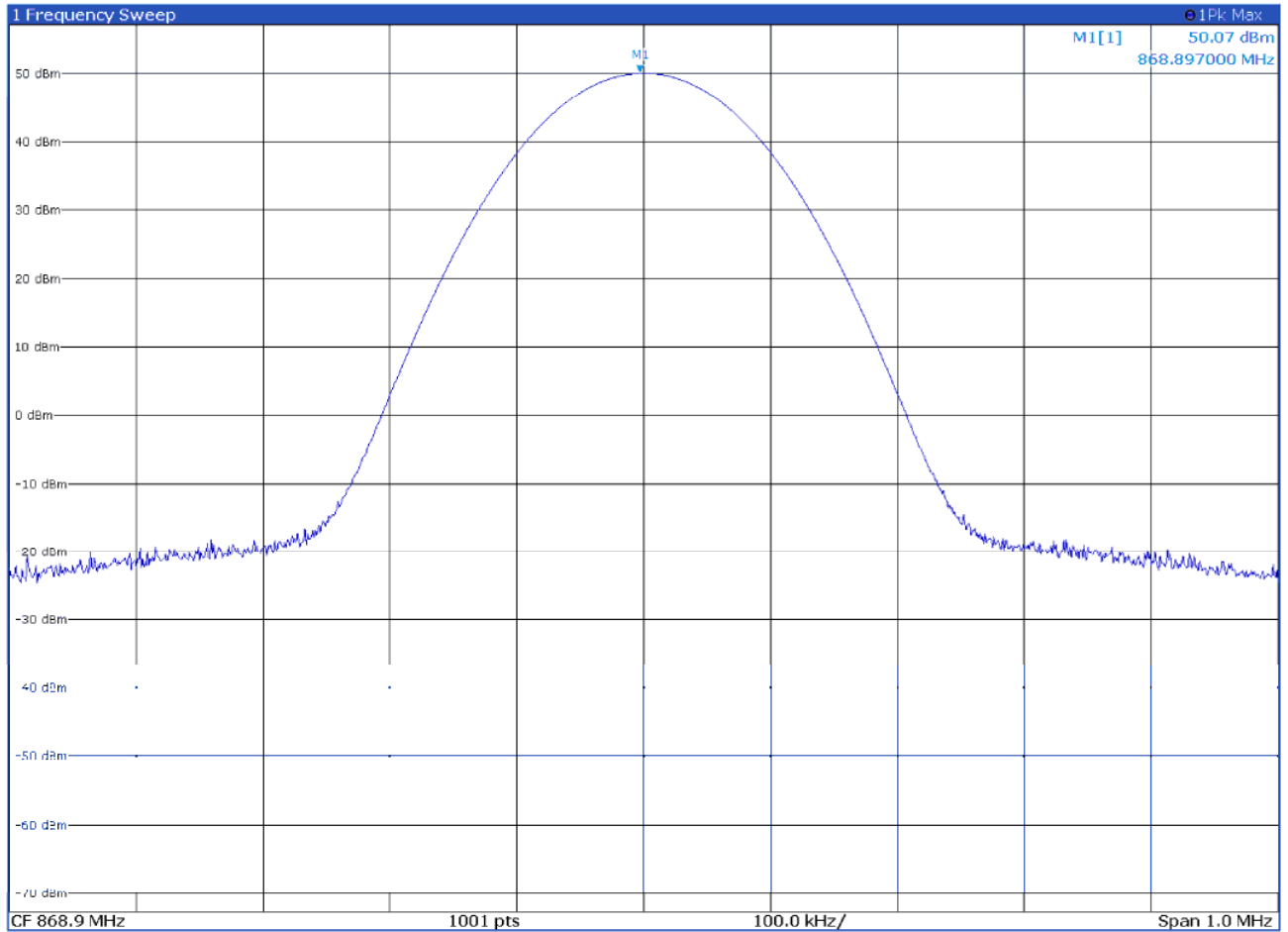
16:37:24 24.08.2022

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Output power with modulation FM 25 kHz at 851.1 MHz



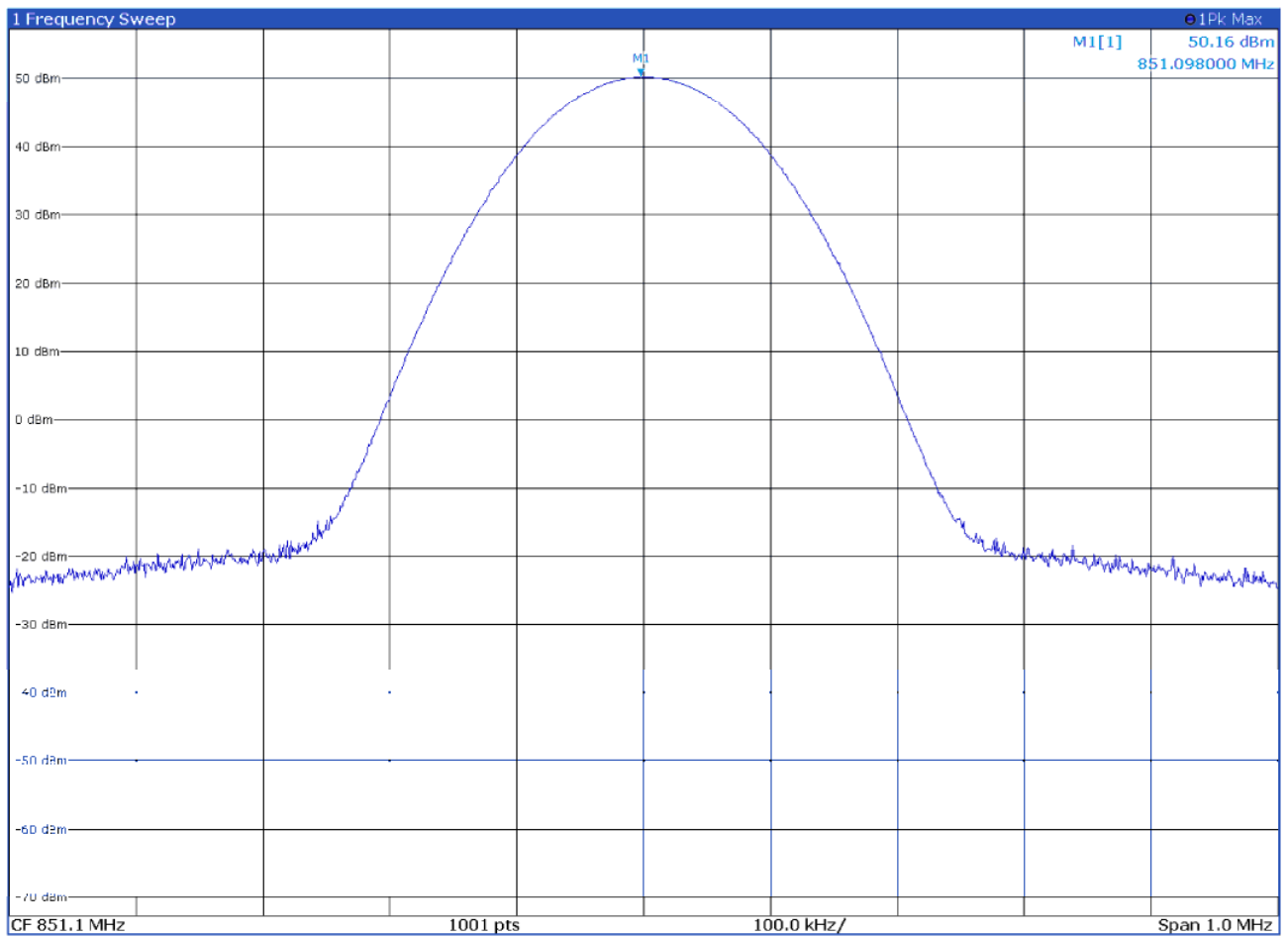
Output power with modulation FM 25 kHz at 860 MHz



16:35:13 24.08.2022

Page 1/1

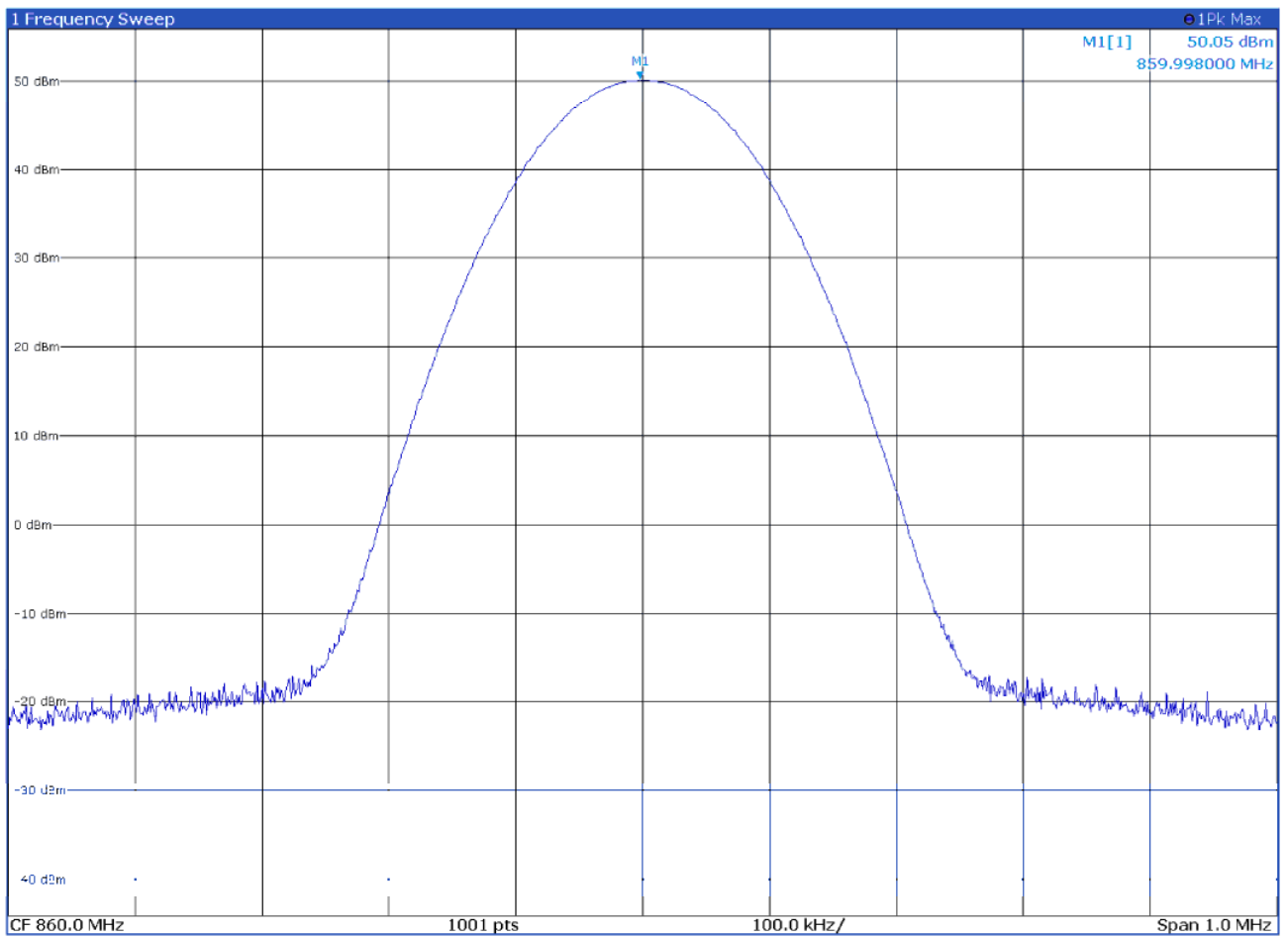
Output power with modulation FM 25 kHz at 868.9 MHz



16:44:48 24.08.2022

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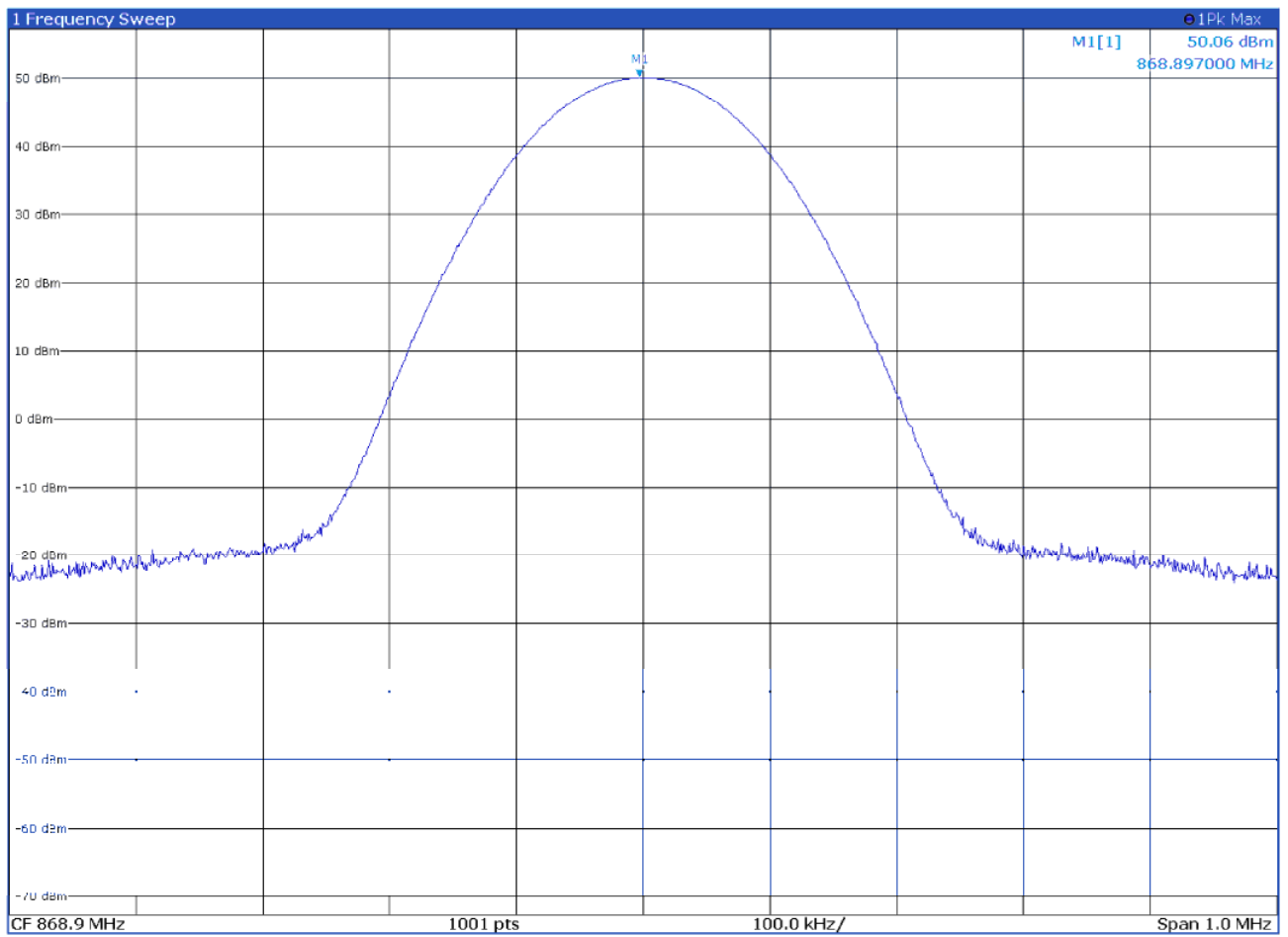
Output power with modulation P25 C4FM at 851.1 MHz



15:58:58 23.08.2022

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Output power with modulation P25 C4FM at 860 MHz



16:25:21 24.08.2022

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Output power with modulation P25 C4FM at 868.9 MHz

7.4 FCC 90.209(b) Bandwidth limitations

7.4.1 References, definitions and limits

FCC:

(b) The maximum authorized single channel bandwidth of emission corresponding to the type of emission specified in §90.207 is as follows:

(5) Unless specified elsewhere, channel spacings and bandwidths that will be authorized in the following frequency bands are given in the following table.

Frequency band (MHz)	Channel spacing (kHz)	Authorized bandwidth (kHz)
Below 25 ²		
25-50	20	20
72-76	20	20
150-174	¹ 7.5	^{1 3} 20/11.25/6
216-220 ⁵	6.25	20/11.25/6
220-222	5	4
406-512 ²	¹ 6.25	^{1 3 6} 20/11.25/6
806-809/851-854	12.5	20
809-817/854-862	12.5	⁶ 20/11.25
817-824/862-869	25	⁶ 20

Note:

¹ For stations authorized on or after August 18, 1995.

² Bandwidths for radiolocation stations in the 420-450 MHz band and for stations operating in bands subject to this footnote will be reviewed and authorized on a case-by-case basis.

³ Operations using equipment designed to operate with a 25 kHz channel bandwidth will be authorized a 20 kHz bandwidth. Operations using equipment designed to operate with a 12.5 kHz channel bandwidth will be authorized a 11.25 kHz bandwidth. Operations using equipment designed to operate with a 6.25 kHz channel bandwidth will be authorized a 6 kHz bandwidth. All stations must operate on channels with a bandwidth of 12.5 kHz or less beginning January 1, 2013, unless the operations meet the efficiency standard of § 90.203(j)(3).

⁴ The maximum authorized bandwidth shall be 12 MHz for non-multilateration LMS operations in the band 909.75-921.75 MHz and 2 MHz in the band 902.00-904.00 MHz. The maximum authorized bandwidth for multilateration LMS operations shall be 5.75 MHz in the 904.00-909.75 MHz band; 2 MHz in the 919.75-921.75 MHz band; 5.75 MHz in the 921.75-927.25 MHz band and its associated 927.25-927.50 MHz narrowband forward link; and 8.00 MHz if the 919.75-921.75 MHz and 921.75-927.25 MHz bands and their associated 927.25-927.50 MHz and 927.50-927.75 MHz narrowband forward links are aggregated.

⁵ See § 90.259.

⁶ Operations using equipment designed to operate with a 25 kilohertz channel bandwidth may be authorized up to a 20 kilohertz bandwidth unless the equipment meets the Adjacent Channel Power limits of § 90.221 in which case operations may be authorized up to a 22 kilohertz bandwidth. Operations using equipment designed to operate with a 12.5 kilohertz channel bandwidth may be authorized up to an 11.25 kilohertz bandwidth

(6)(i) Beginning January 1, 2011, no new applications for the 421–512 MHz bands will be acceptable for filing if the applicant utilizes channels with an authorized bandwidth exceeding 11.25 kHz, unless specified elsewhere or the operations meet the efficiency standards of §90.203(j)(3).



7.4.2 Test summary

Verdict	Pass				
Tested by	D. Guarnone	Test date	December 11, 2021		

7.4.3 Observations, settings and special notes

The test was performed as per ANSI C63.26, subclause 5.4.4.

Spectrum analyser settings:

Resolution bandwidth	1–5% of OBW
Video bandwidth	$\geq 3 \times \text{RBW}$
Frequency span	$1.5 \times \text{OBW}$
Detector mode	Peak
Trace mode	Max Hold

7.4.4 Test equipment list

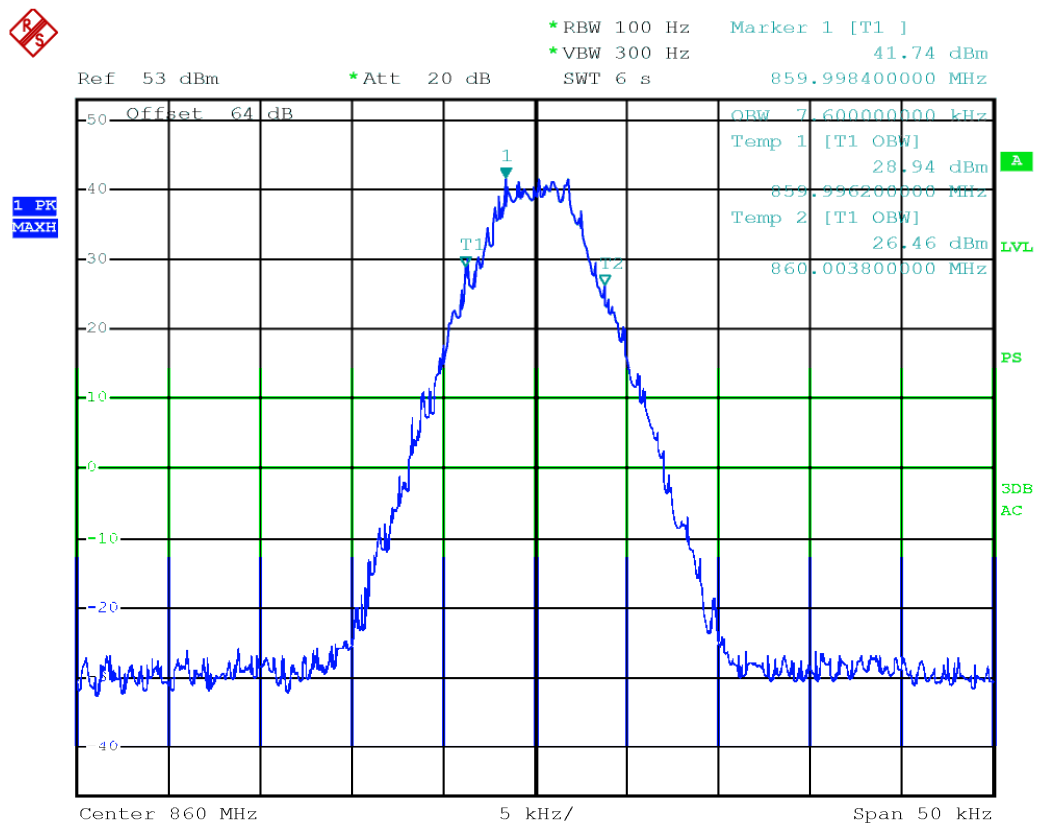
Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
EMI receiver	Rohde & Schwarz	ESU8	100202	2021-09	2022-09
Shielded room	Siemens	10m control room	1947	NCR	NCR

Note: NCR - no calibration required, VOU - verify on use

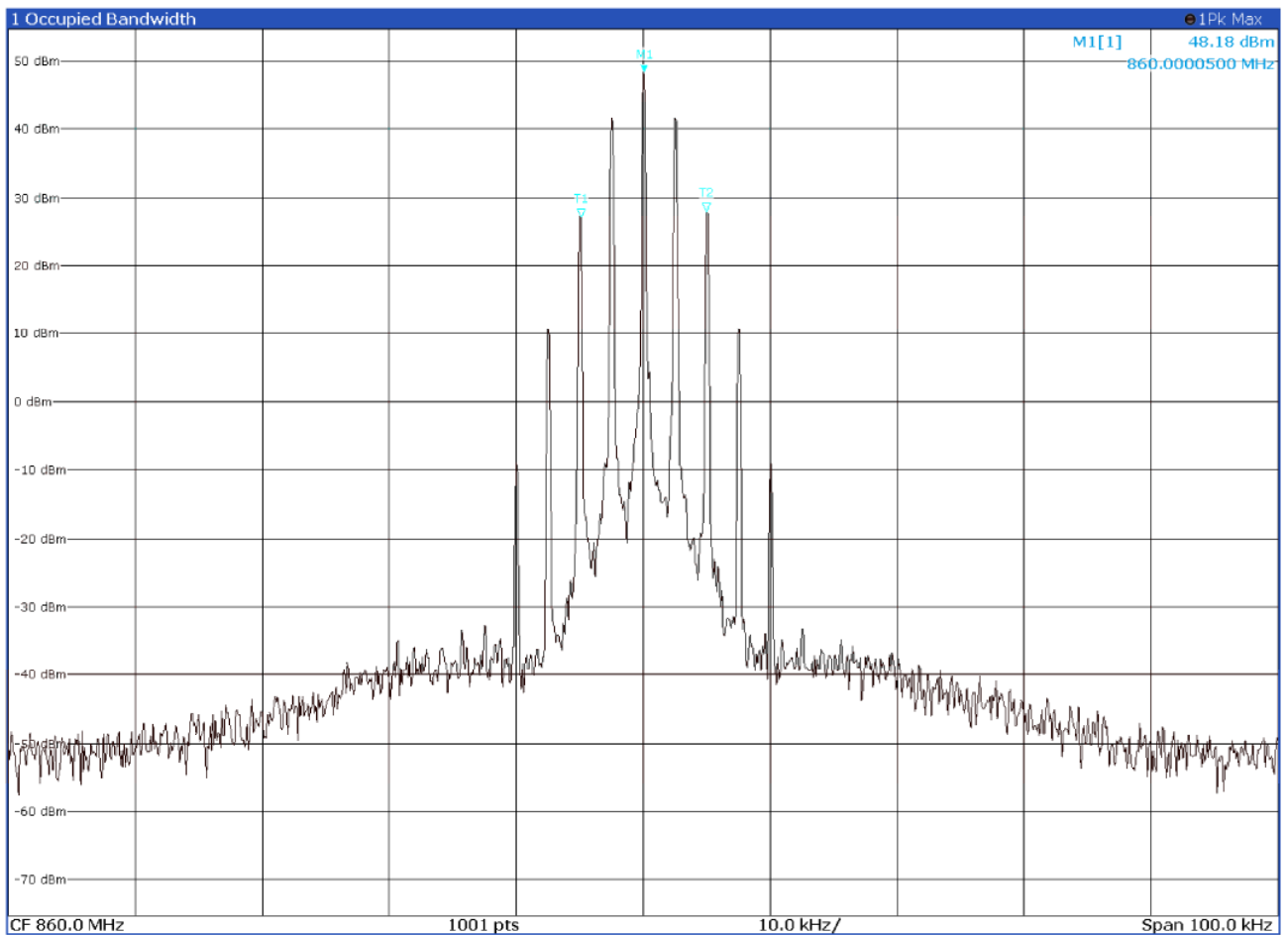
7.4.5 Test data

Table 7.4-1: 99% occupied bandwidth results

Modulation	Frequency, MHz	99% occupied bandwidth, kHz	Limit, kHz	Margin, kHz
FM 12.5 kHz	860	9.86	11.25	-1.39
FM 25.0 kHz	860	10.35	20.00	-9.65
DMR 4FSK	860	7.60	11.25	-3.19
P25 C4FM	860	8.02	11.25	-3.23



99% occupied bandwidth with modulation DMR 4FSK at 860 MHz

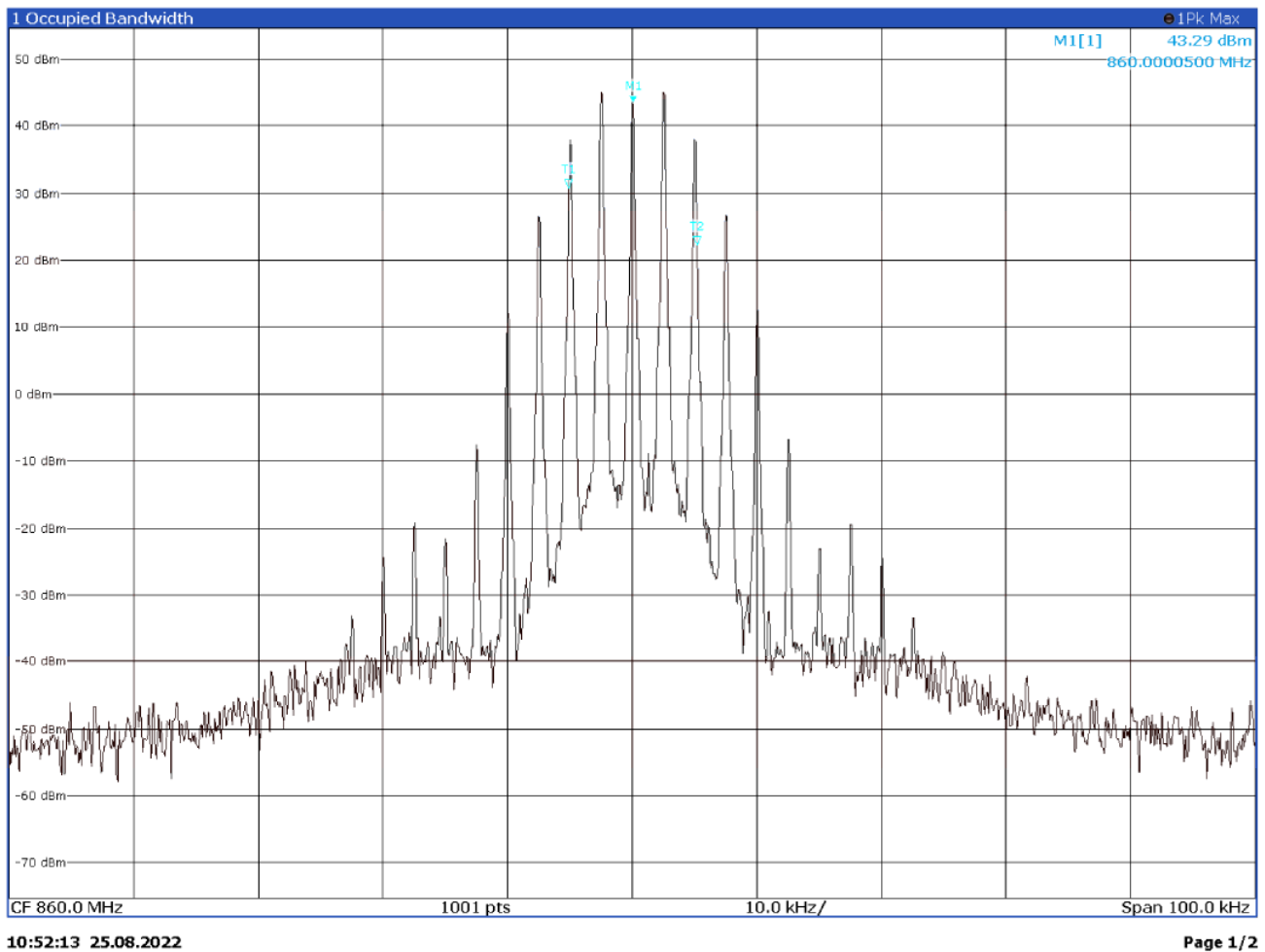


10:54:56 25.08.2022

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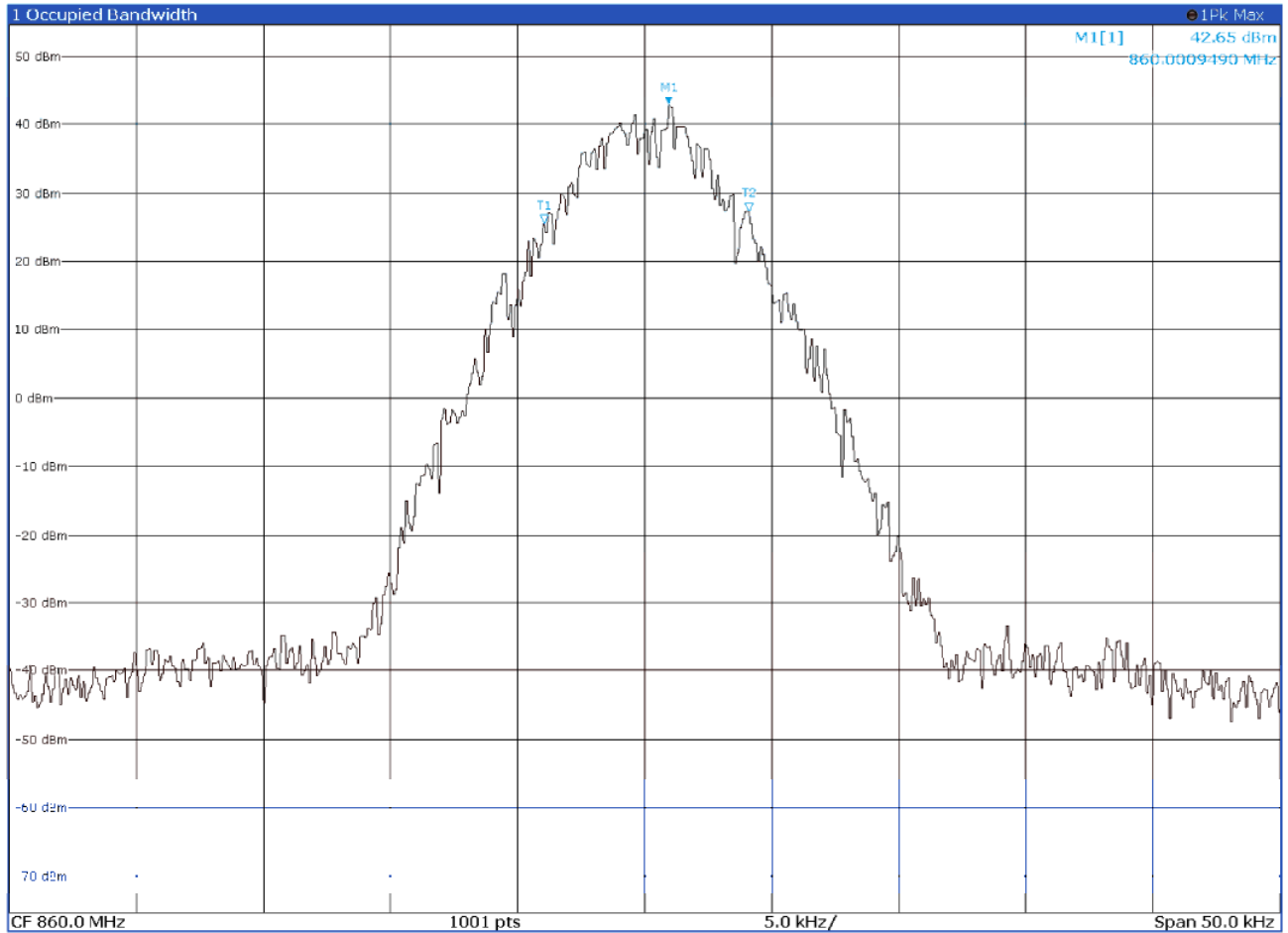
2 Marker Table						
Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1	1		860.00005 MHz	48.18 dBm	Occ Bw	9.862721575 kHz
T1	1		859.995113 MHz	27.11 dBm	Occ Bw Centroid	860.000044332 MHz
T2	1		860.0049757 MHz	27.94 dBm	Occ Bw Freq Offset	44.331960678 Hz

99% occupied bandwidth with modulation FM 12.5 kHz at 860 MHz



2 Marker Table						
Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1	:	:	860.00005 MHz	43.29 dBm	Occ Bw	10.355525313 kHz
T1	:	:	859.994862 MHz	30.85 dBm	Occ Bw Centroid	860.00003972 MHz
T2	:	:	860.0052175 MHz	22.22 dBm	Occ Bw Freq Offset	39.719736576 Hz

99% occupied bandwidth with modulation FM 25.0 kHz at 860 MHz



11:00:49 25.08.2022

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2 Marker Table						
Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	860.000949 MHz	42.65 dBm	Occ Bw	8.023956881 kHz
T1		1	859.9960623 MHz	25.51 dBm	Occ Bw Centroid	860.000074231 MHz
T2		1	860.0040862 MHz	27.34 dBm	Occ Bw Freq Offset	74.231034517 Hz

99% occupied bandwidth with modulation P25 C4FM at 860 MHz

7.5 FCC 90.210 Spectrum mask and spurious emissions

7.5.1 References, definitions and limits

Except as indicated elsewhere in this part, transmitters used in the radio services governed by this part must comply with the emission masks outlined in this section. Unless otherwise stated, per paragraphs (d)(4), (e)(4), and (o) of this section, measurements of emission power can be expressed in either peak or average values provided that emission powers are expressed with the same parameters used to specify the unmodulated transmitter carrier power. For transmitters that do not produce a full power unmodulated carrier, reference to the unmodulated transmitter carrier power refers to the total power contained in the channel bandwidth. Unless indicated elsewhere in this part, the table in this section specifies the emission masks for equipment operating under this part.

Table 8.5.1 Applicable emission Mask

Frequency band, MHz	Mask for equipment with audio low pass filter	Mask for equipment without audio low pass filter
806-809/851-854 ⁶	B	H
809-824/854-869 ^{3 5}	B, D	D, G

Notes:

³ Equipment used in this licensed to EA or non-EA systems shall comply with the emission mask provisions of § 90.691 of this chapter.

⁵ Equipment designed to operate on 25 kilohertz bandwidth channels must meet the requirements of either Emission Mask B or G, whichever is applicable, while equipment designed to operate on 12.5 kilohertz bandwidth channels must meet the requirements of Emission Mask D. Equipment designed to operate on 25 kilohertz bandwidth channels may alternatively meet the Adjacent Channel Power limits of § 90.221.

⁶ Transmitters utilizing analog emissions that are equipped with an audio low-pass filter must meet Emission Mask B. All transmitters utilizing digital emissions and those transmitters using analog emissions without an audio low-pass filter must meet Emission Mask H.

(b) Emission Mask B. For transmitters that are equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:

- (1) On any frequency removed from the assigned frequency by more than 50 percent, but not more than 100 percent of the authorized bandwidth: At least 25 dB.
- (2) On any frequency removed from the assigned frequency by more than 100 percent, but not more than 250 percent of the authorized bandwidth: At least 35 dB.
- (3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least $43 + 10 \log (P)$ dB.

(d) Emission Mask D—12.5 kHz channel bandwidth equipment. For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

- (1) On any frequency from the center of the authorized bandwidth f_0 to 5.625 kHz removed from f_0 : Zero dB.
- (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least $7.27(f_d - 2.88 \text{ kHz})$ dB.
- (3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: At least $50 + 10 \log (P)$ dB or 70 dB, whichever is the lesser attenuation.
- (4) The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide (usually two or three times the channel bandwidth) to capture the true peak emission of the equipment under test. In order to show compliance with the emission mask up to and including 50 kHz removed from the edge of the authorized bandwidth, adjust the resolution bandwidth to 100 Hz with the measuring instrument in a peak hold mode. A sufficient number of sweeps must be measured to insure that the emission profile is developed. If video filtering is used, its bandwidth must not be less than the instrument resolution bandwidth. For emissions beyond 50 kHz from the edge of the authorized bandwidth, see paragraph (o) of this section. If it can be shown that use of the above instrumentation settings do not accurately represent the true interference potential



of the equipment under test, an alternate procedure may be used provided prior Commission approval is obtained

(g) Emission Mask G. For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:

- (1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 10 kHz, but no more than 250 percent of the authorized bandwidth: At least $116 \log(f_d/6.1)$ dB, or $50 + 10 \log(P)$ dB, or 70 dB, whichever is the lesser attenuation;
- (2) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least $43 + 10 \log(P)$ dB.

(h) Emission Mask H. For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:

- (1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of 4 kHz or less: Zero dB.
- (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 4 kHz, but no more than 8.5 kHz: At least $107 \log(f_d/4)$ dB;
- (3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 8.5 kHz, but no more than 15 kHz: At least $40.5 \log(f_d/1.16)$ dB;
- (4) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 15 kHz, but no more than 25 kHz: At least $116 \log(f_d/6.1)$ dB;
- (5) On any frequency removed from the center of the authorized bandwidth by more than 25 kHz: At least $43 + 10 \log(P)$ dB.



7.5.2 Test summary

Verdict	Pass		
Tested by	D. Guarnone	Test date	August 25, 2022

7.5.3 Observations, settings and special notes

Spectrum analyser settings for spectrum mask:

Resolution bandwidth:	100 Hz / 300 Hz
Video bandwidth:	> RBW
Detector mode:	Peak
Trace mode:	Max Hold

Spectrum analyser settings for spurious emissions:

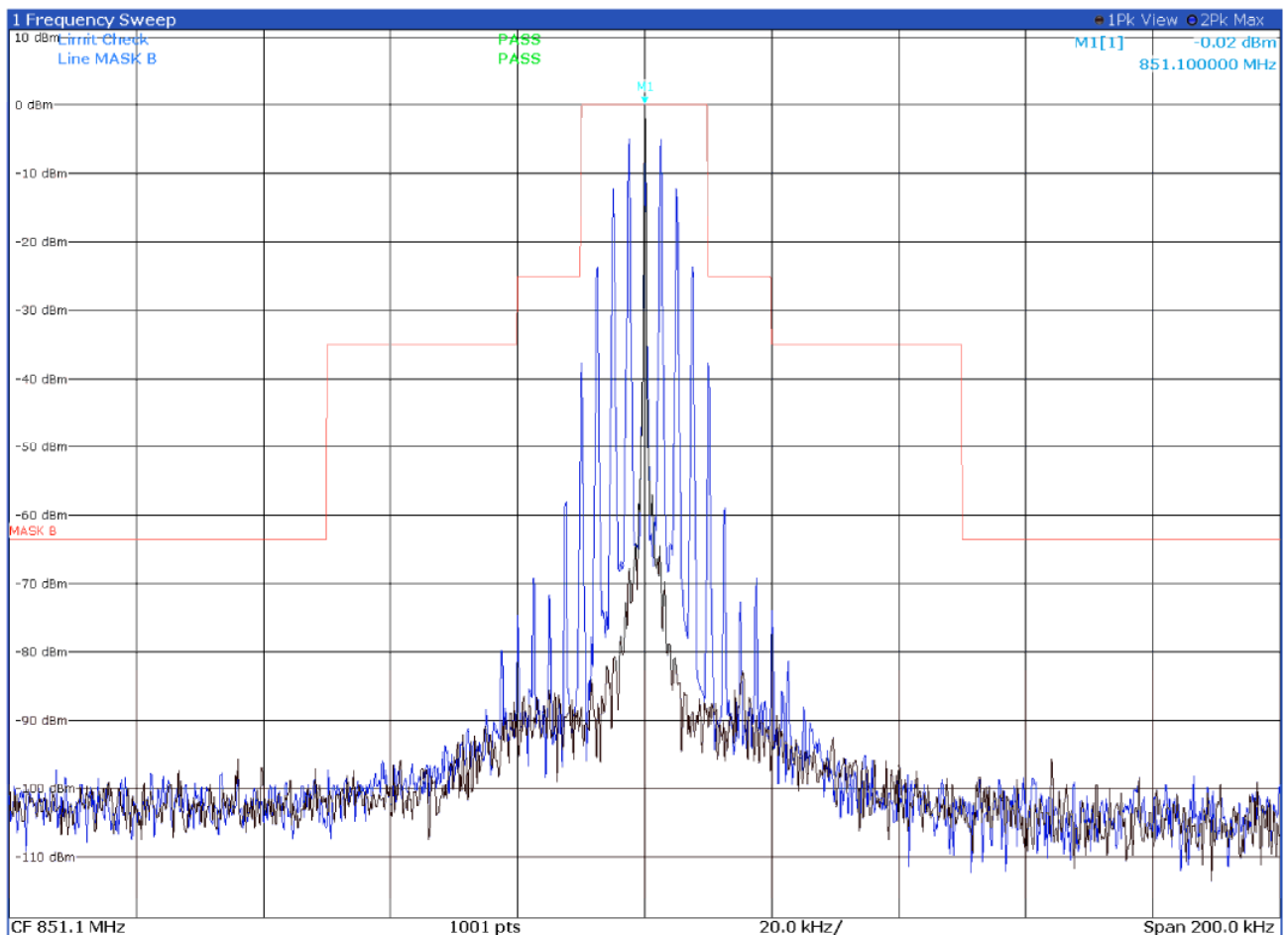
Resolution bandwidth:	100k Hz (below 1 GHz); 1 MHz (above 1 GHz)
Video bandwidth:	> RBW
Detector mode:	Peak
Trace mode:	Max Hold

7.5.4 Test equipment list

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
EMI receiver	Rohde & Schwarz	ESU8	100202	2021-09	2022-09
EMI receiver	Rohde & Schwarz	ESW44	101620	2021-08	2022-08
Trilog Broadband Antenna	Schwarzbeck	VULB 9162	9162-025	2021-07	2024-07
Bilog antenna (1 ÷ 18 GHz)	Schwarzbeck	STLP 9148	9148-152	2021-09	2024-09
Preamplifier (1 ÷ 18 GHz)	Schwarzbeck	BBV9718	9718-137	2022-04	2023-04
Controller	Maturo	FCU3.0	10041	NCR	NCR
Tilt antenna mast	Maturo	TAM4.0-E	10042	NCR	NCR
Turntable	Maturo	TT4.0-5T	2.527	NCR	NCR
Semi-anechoic chamber	Nemko	10m semi-anechoic chamber	530	2021-09	2023-09
Shielded room	Siemens	10m control room	1947	NCR	NCR

Note: NCR - no calibration required, VOU - verify on use

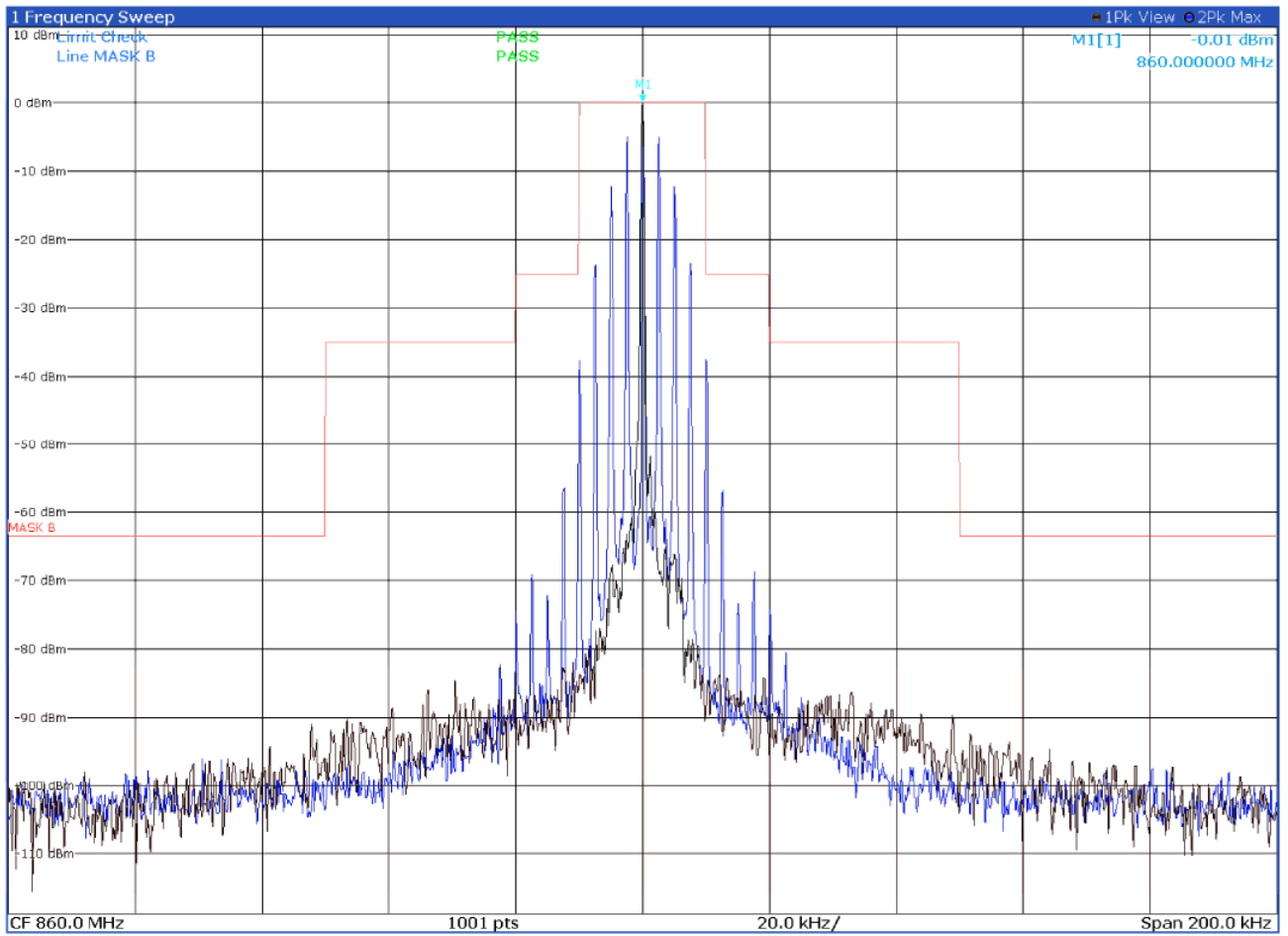
7.5.5 Test data



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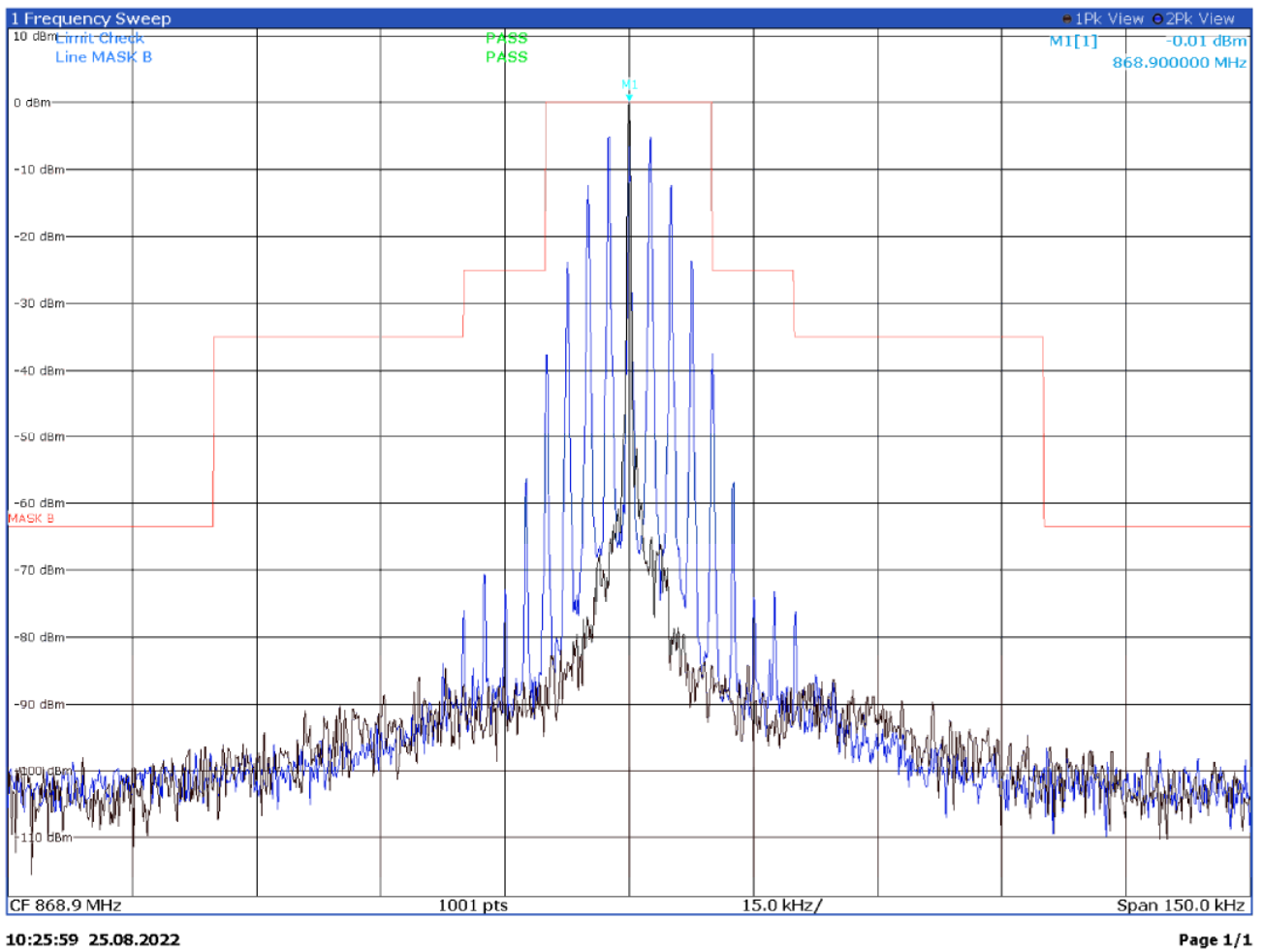
Emission mask B with modulation FM 25.0 kHz at 851.1 MHz



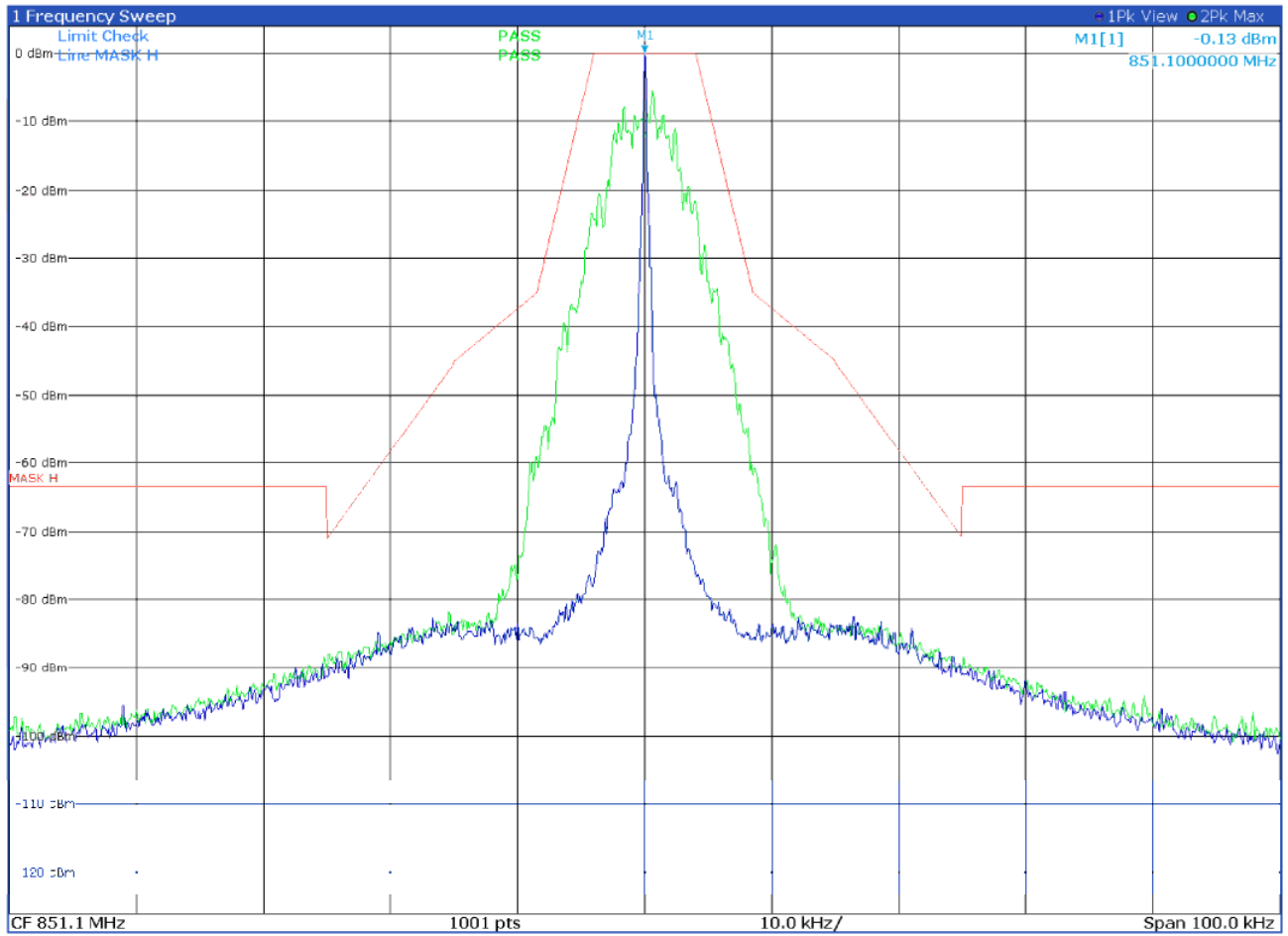
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Emission mask B with modulation FM 25.0 kHz at 860 MHz



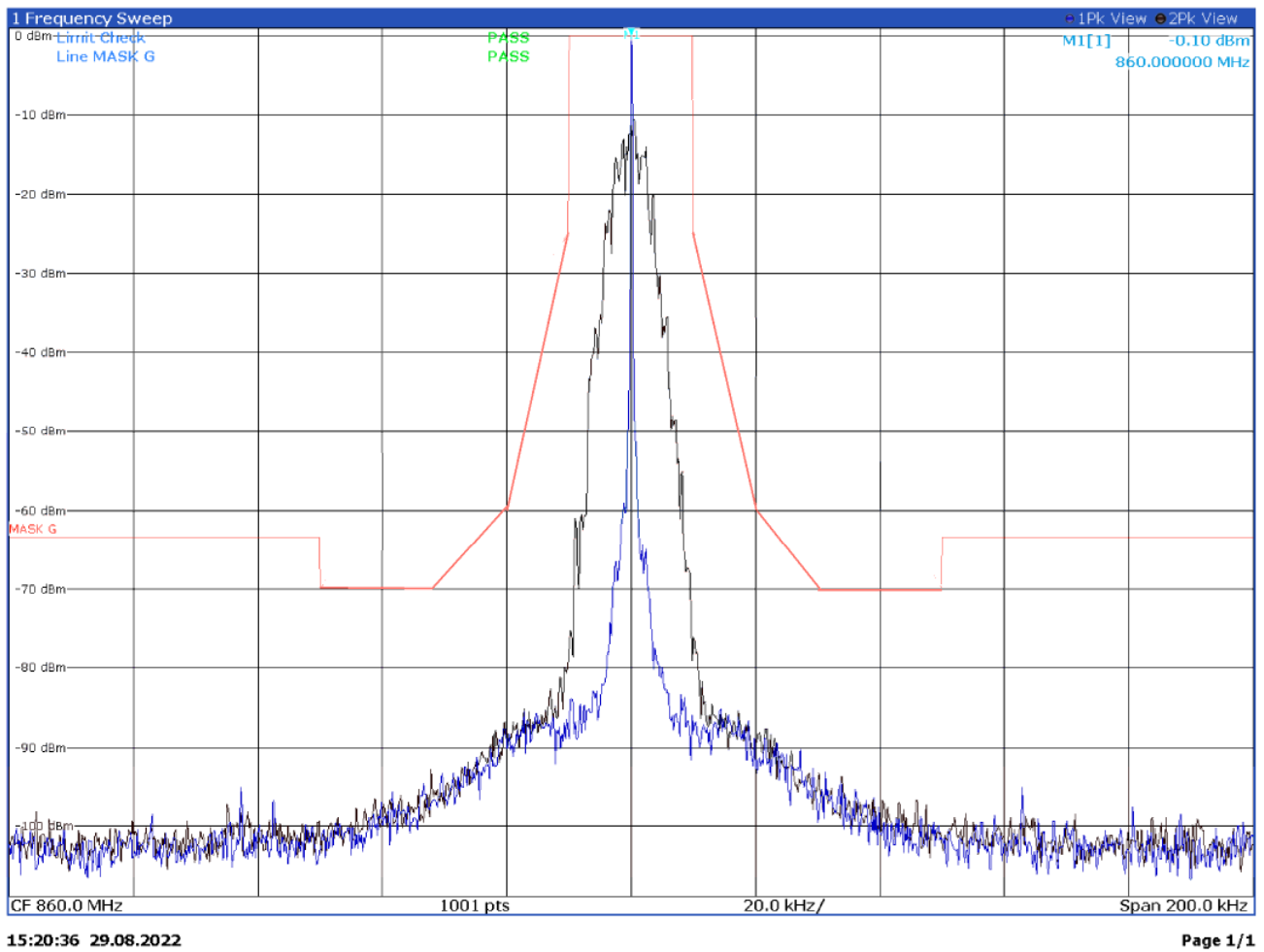
Emission mask B with modulation FM 25.0 kHz at 868.9 MHz



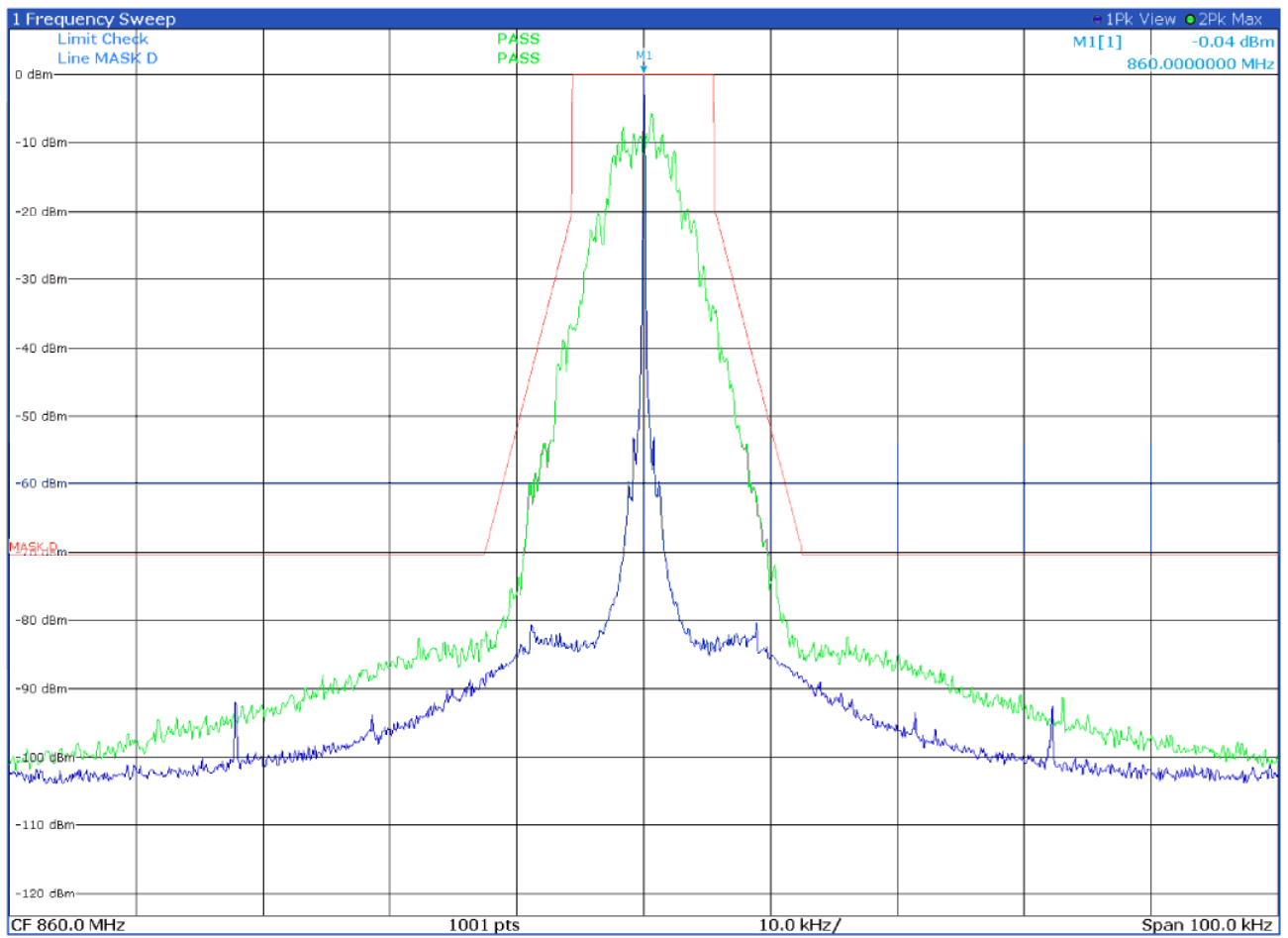
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Emission mask H with modulation DMR 4FSK at 851.1 MHz



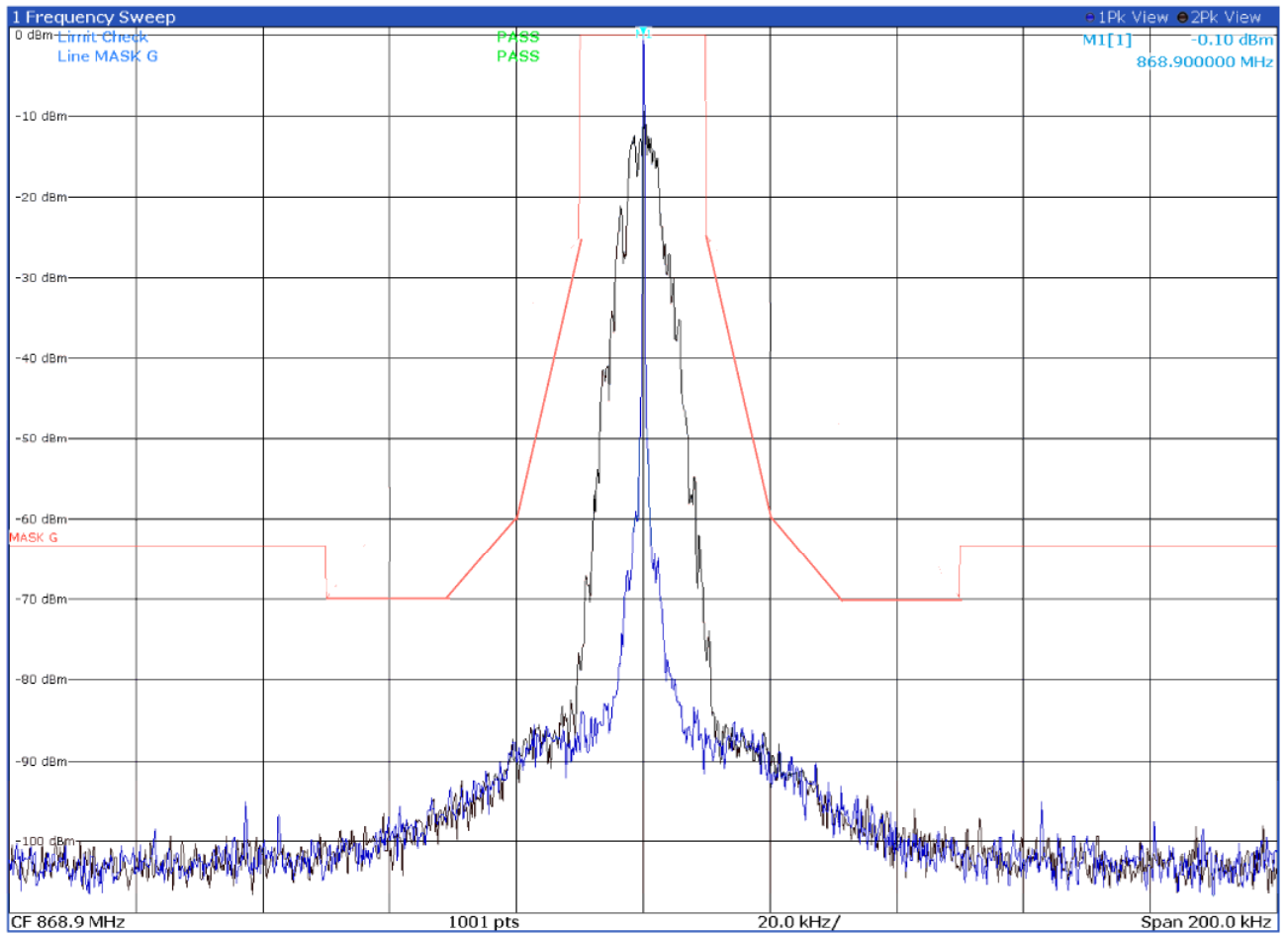
Emission mask G with modulation DMR 4FSK at 860 MHz



12:23:44 24.08.2022

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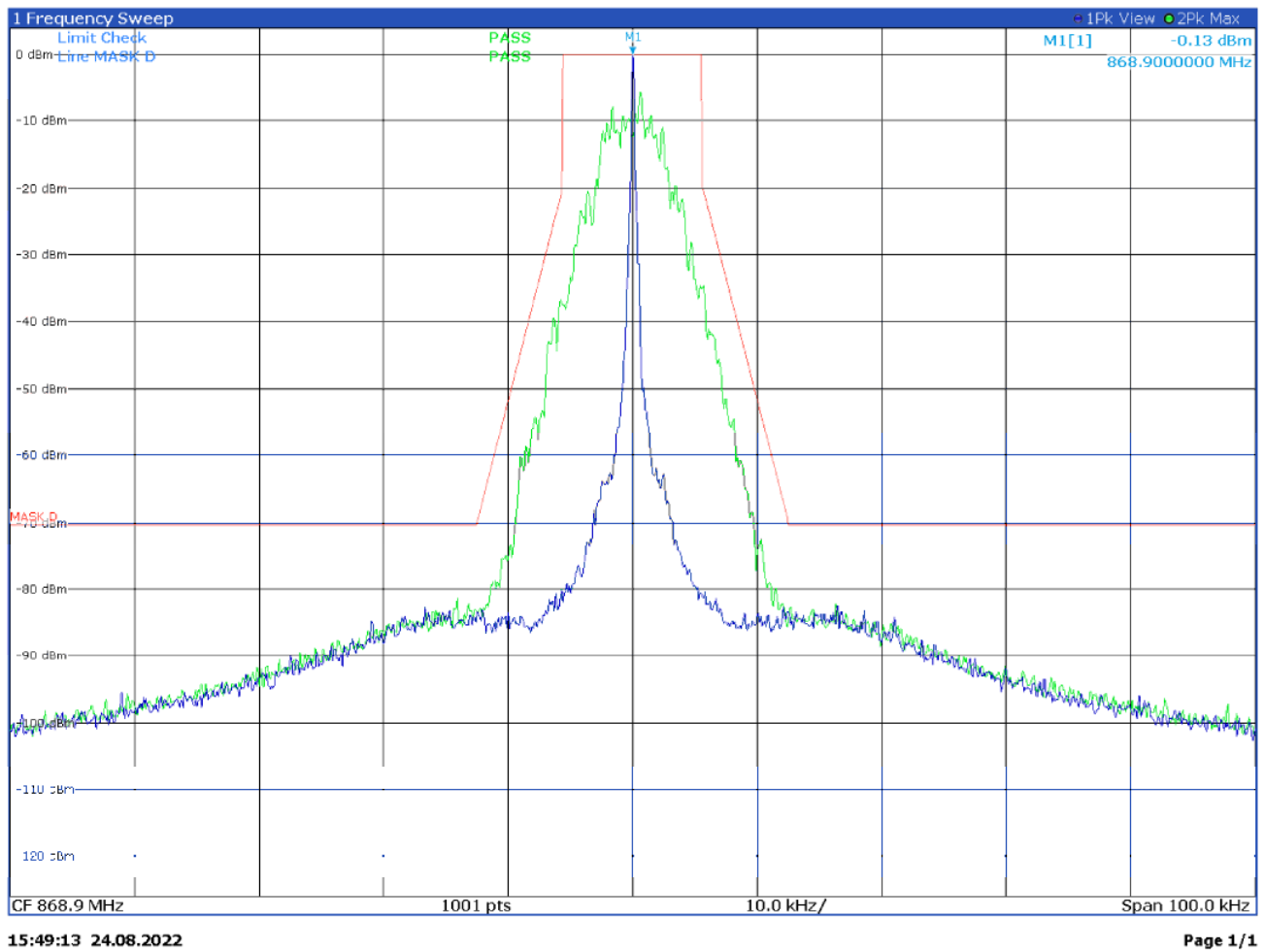
Emission mask D with modulation DMR 4FSK at 860 MHz



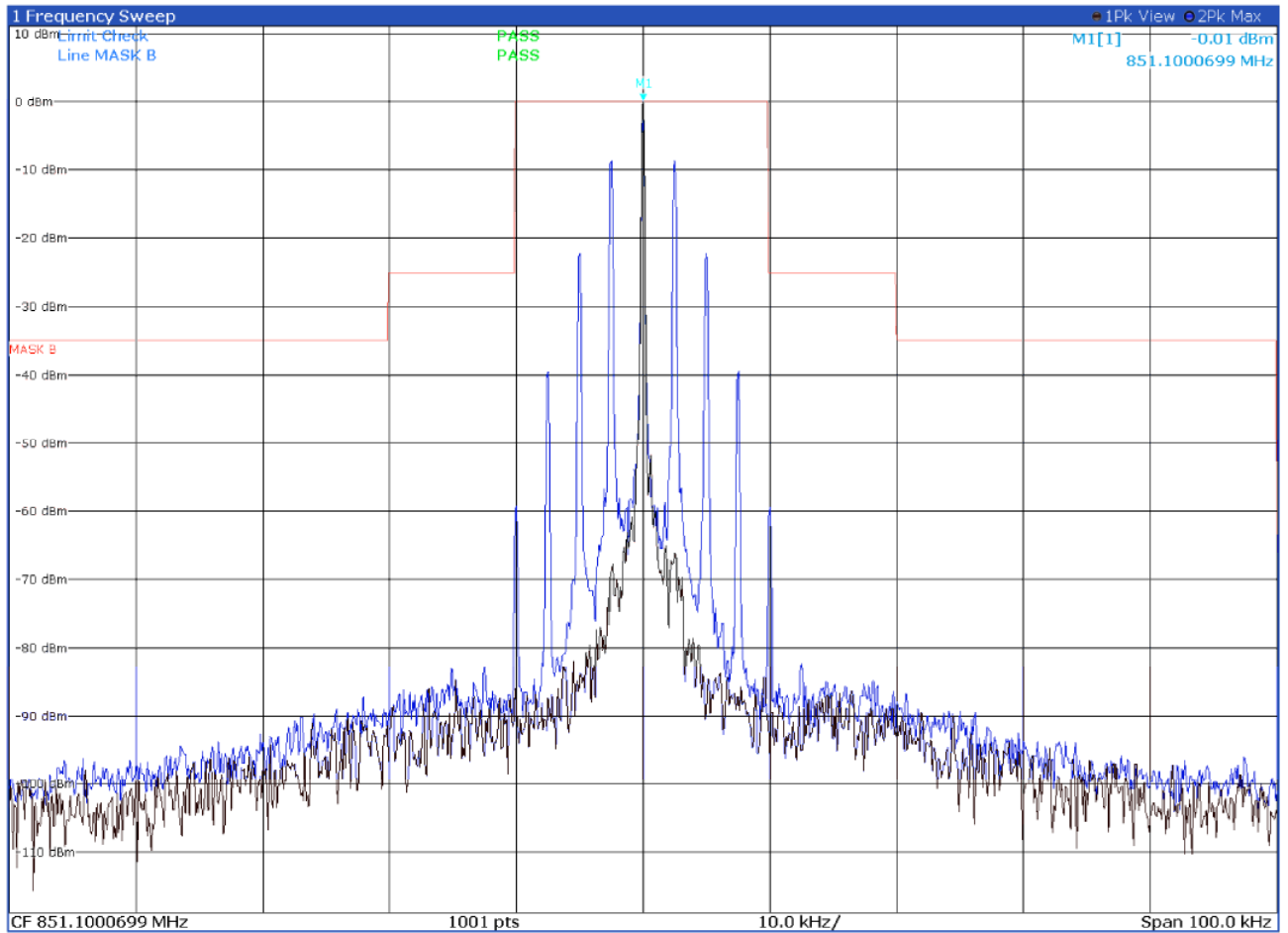
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Emission mask G with modulation DMR 4FSK at 868.9 MHz



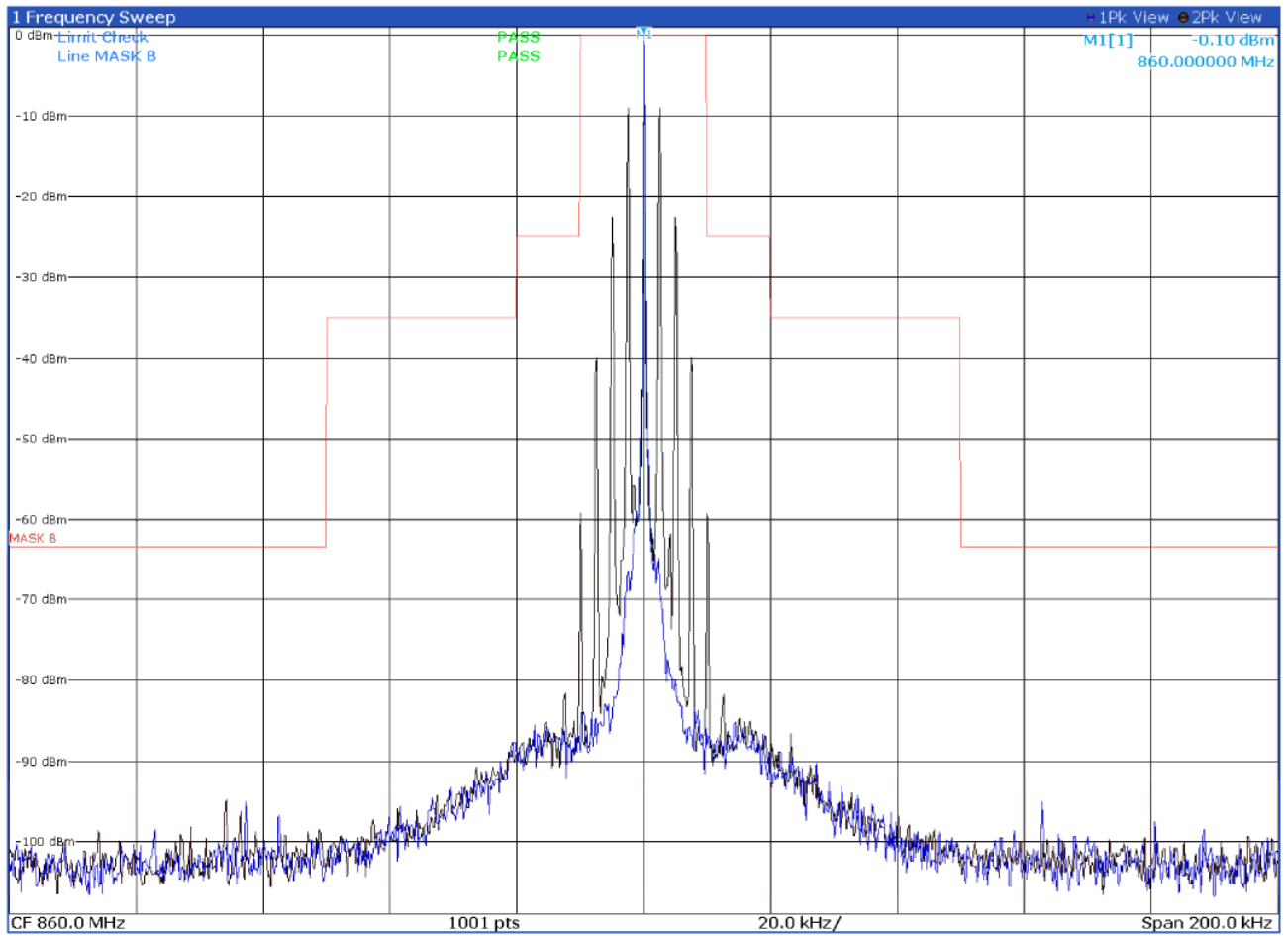
Emission mask D with modulation DMR 4FSK at 868.9 MHz



09:48:36 25.08.2022

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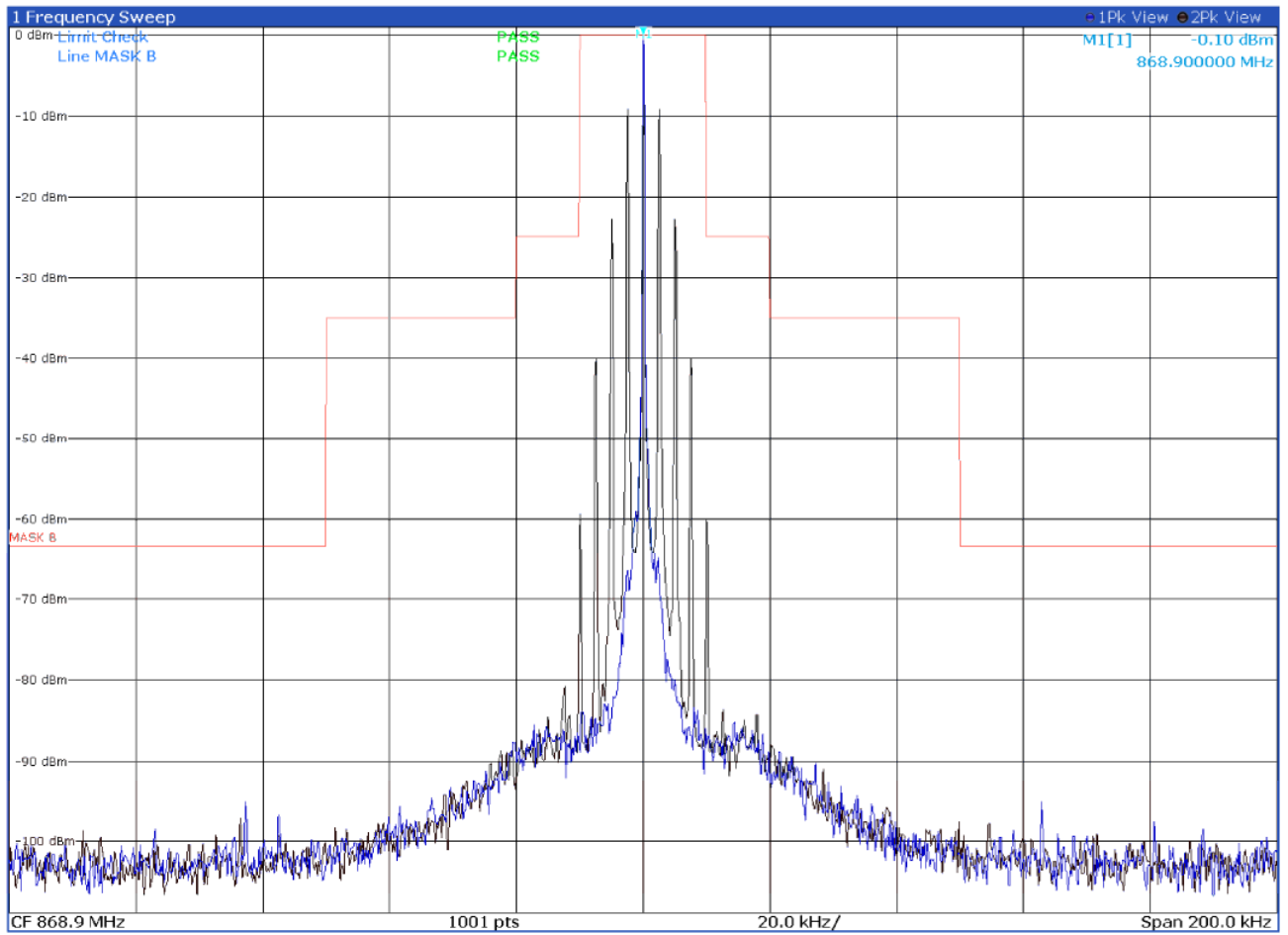
Emission mask B with modulation FM 12.5 kHz at 851.1 MHz



15:51:59 29.08.2022

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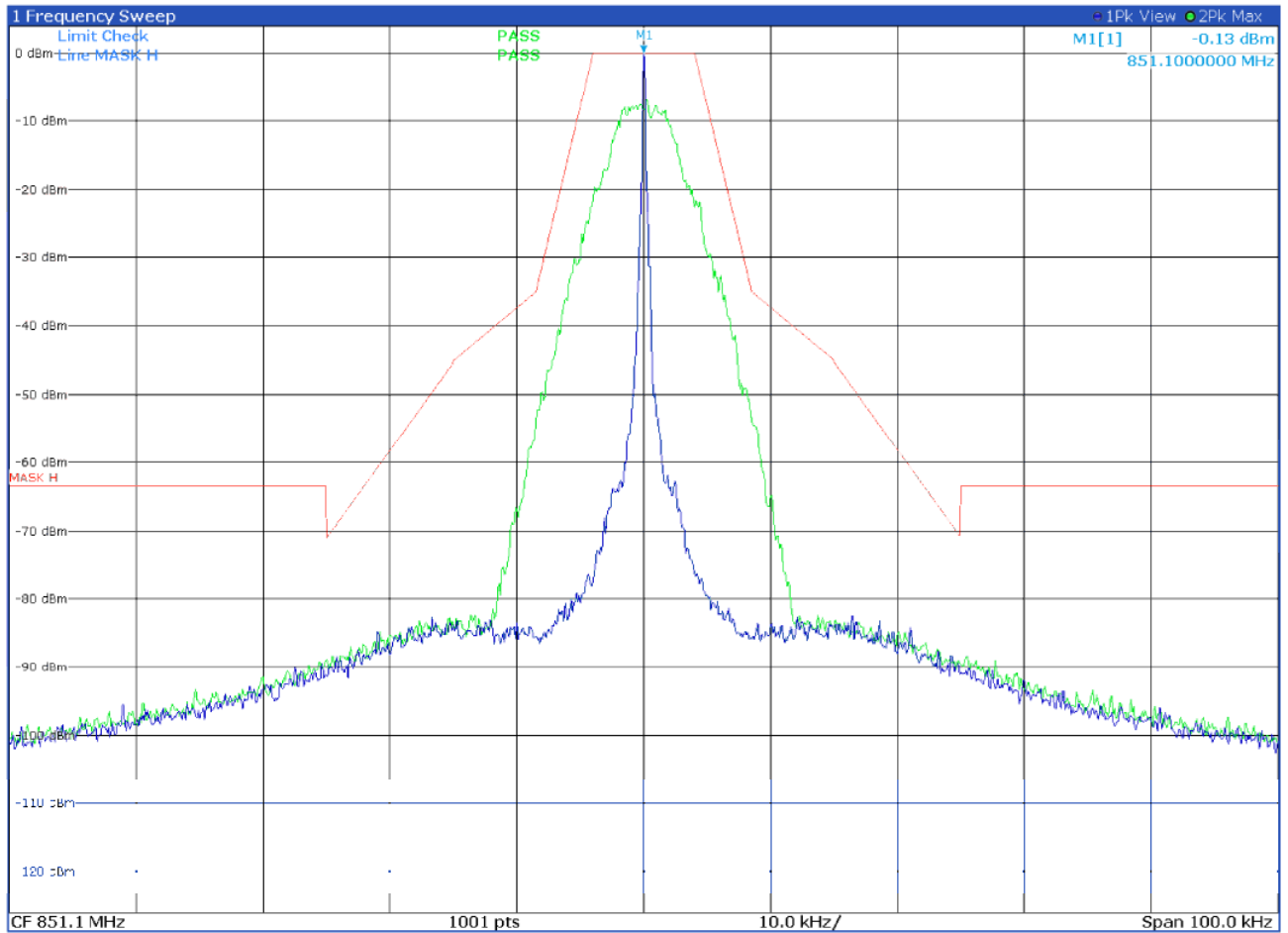
Emission mask B with modulation FM 12.5 kHz at 860 MHz



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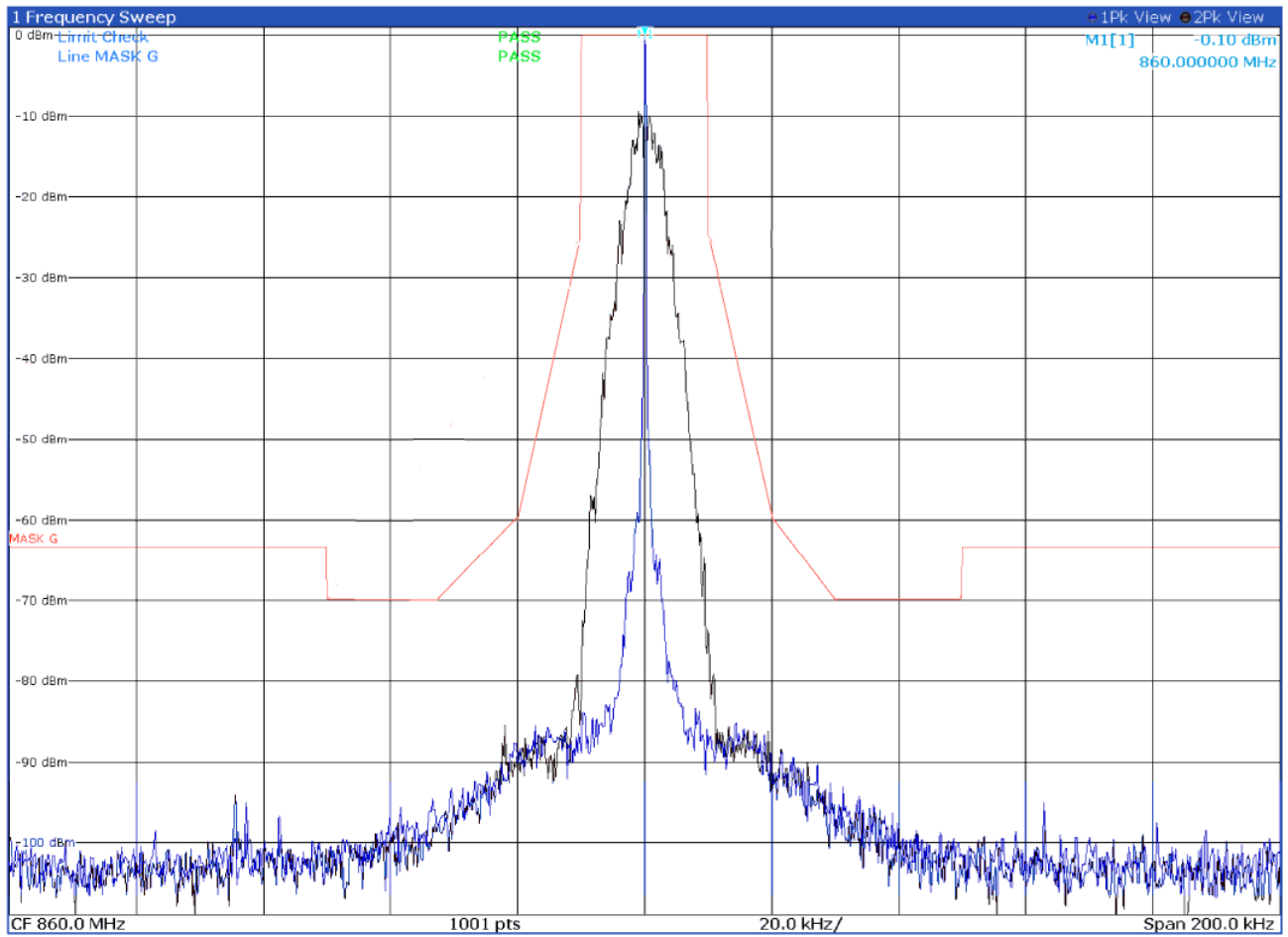
Emission mask B with modulation FM 12.5 kHz at 868.9 MHz



15:30:57 24.08.2022

Page 1/1

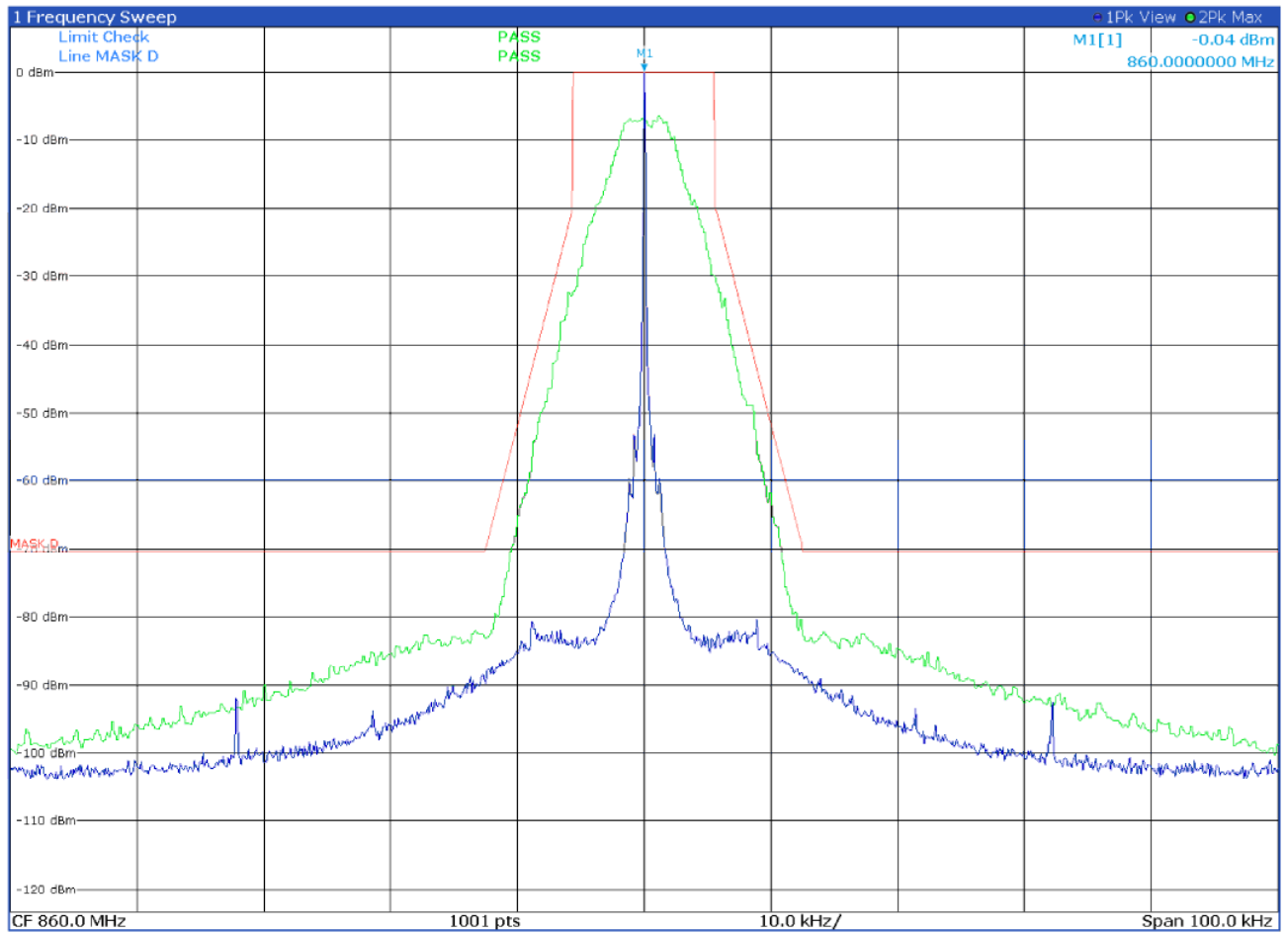
Emission mask H with modulation P25 C4FM at 851.1 MHz



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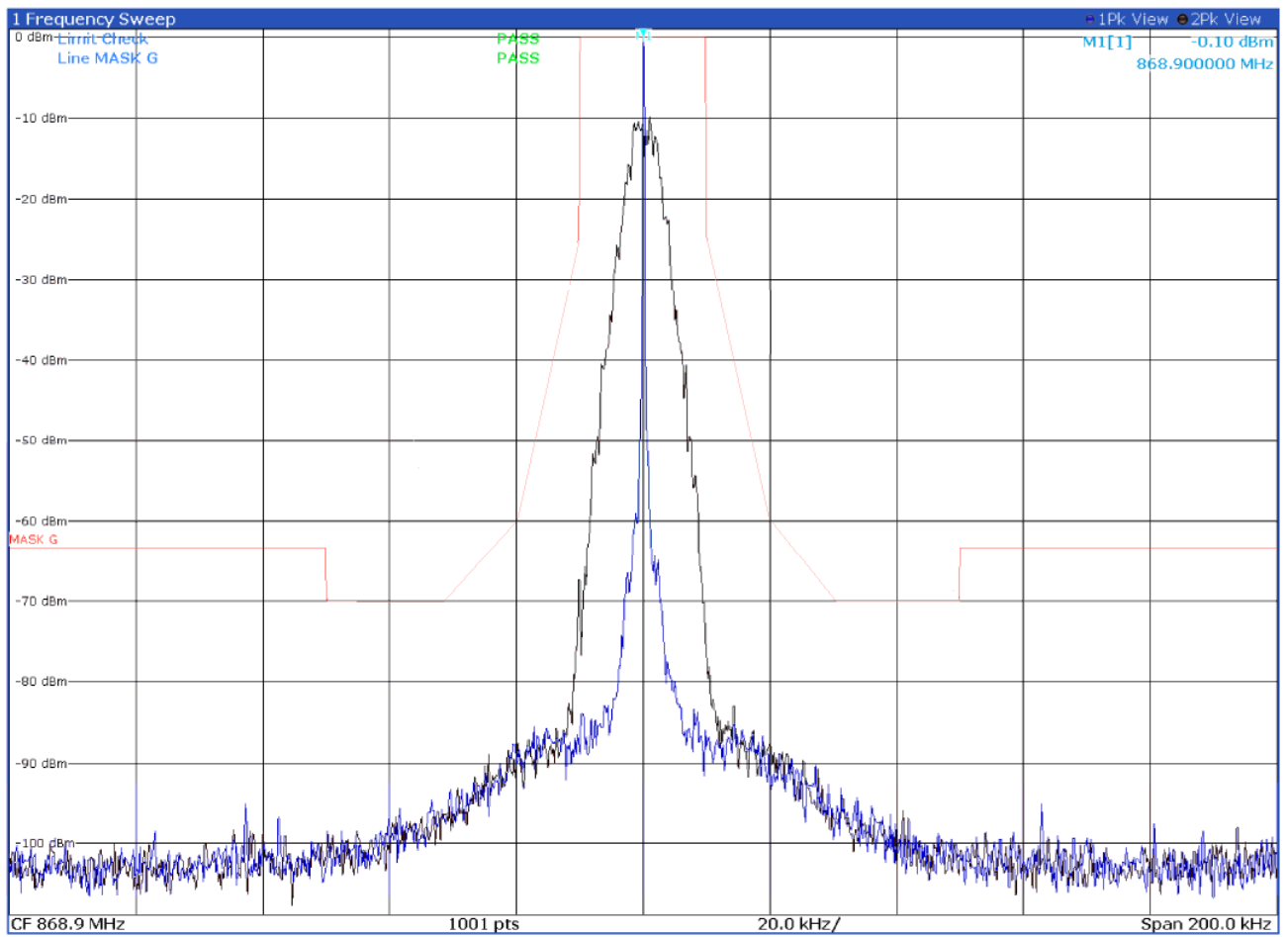
Emission mask G with modulation P25 C4FM at 860 MHz



12:16:33 24.08.2022

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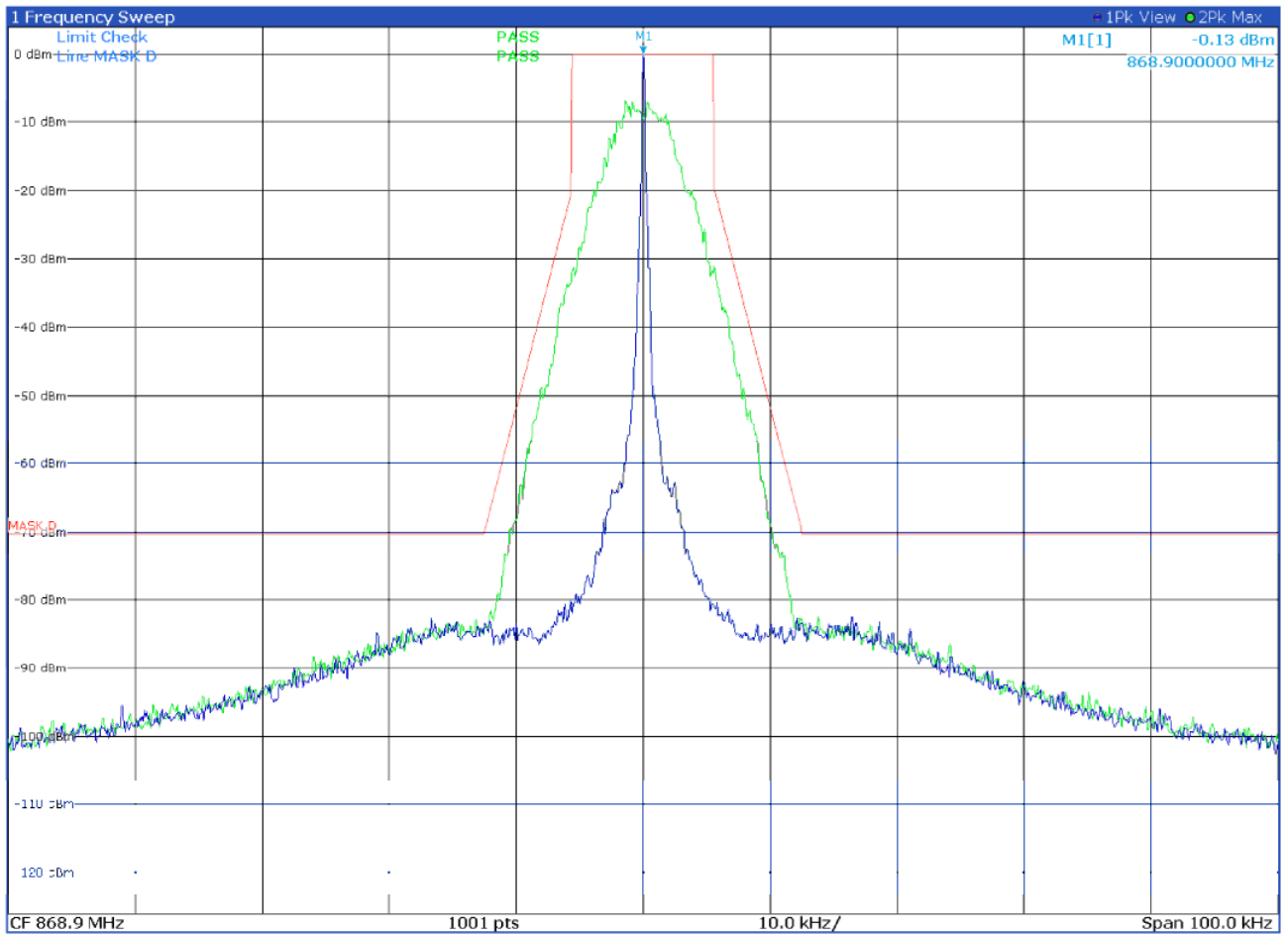
Emission mask D with modulation P25 C4FM at 860 MHz



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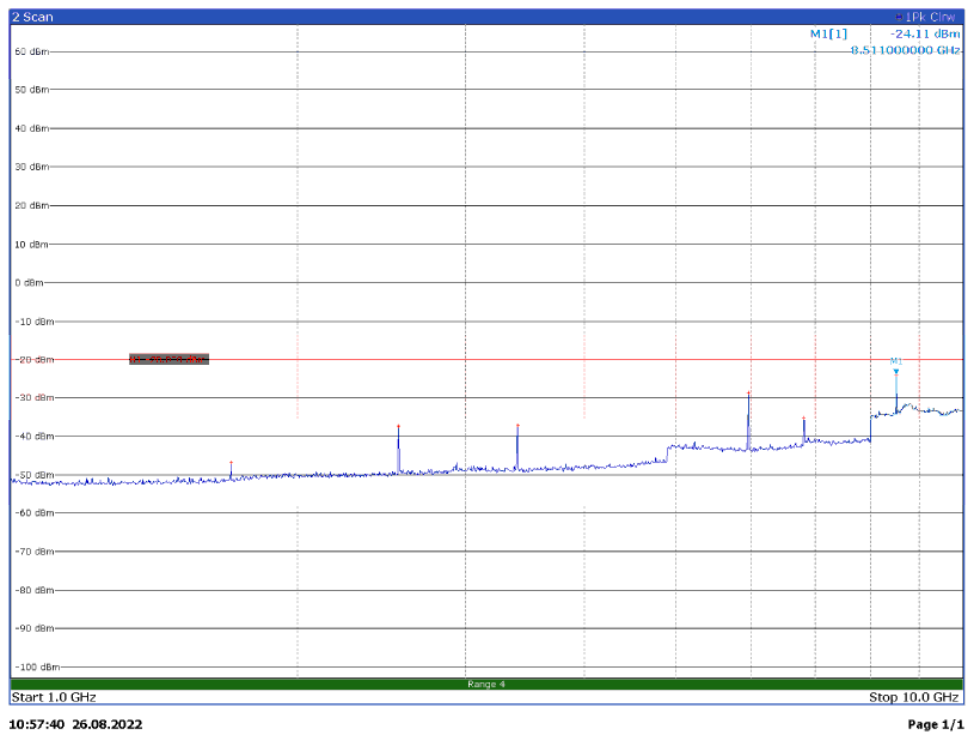
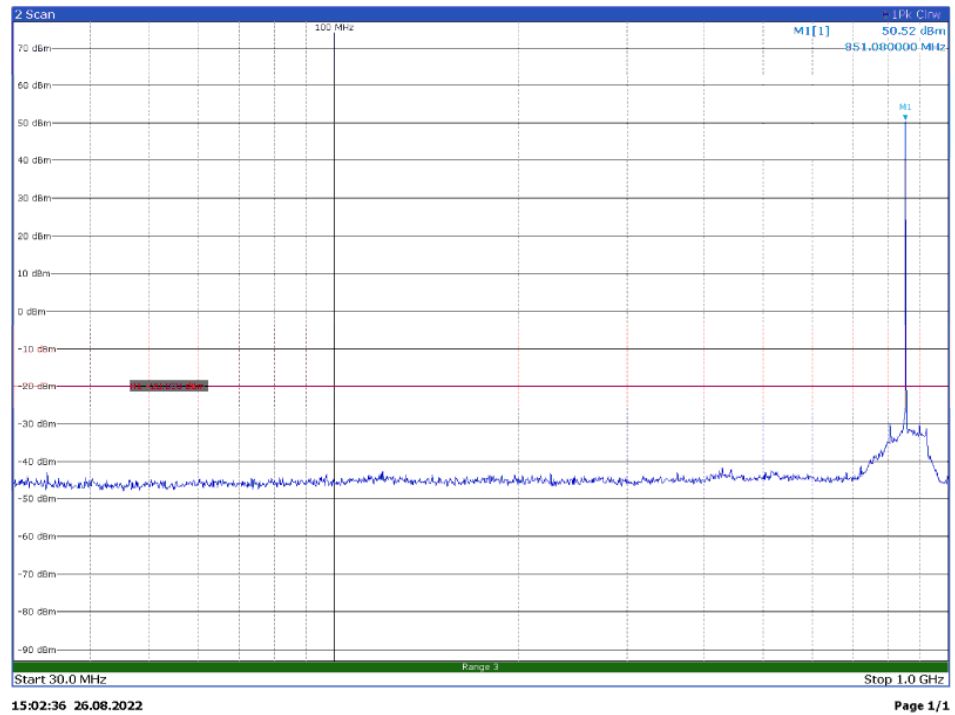
Emission mask G with modulation P25 C4FM at 868.9 MHz



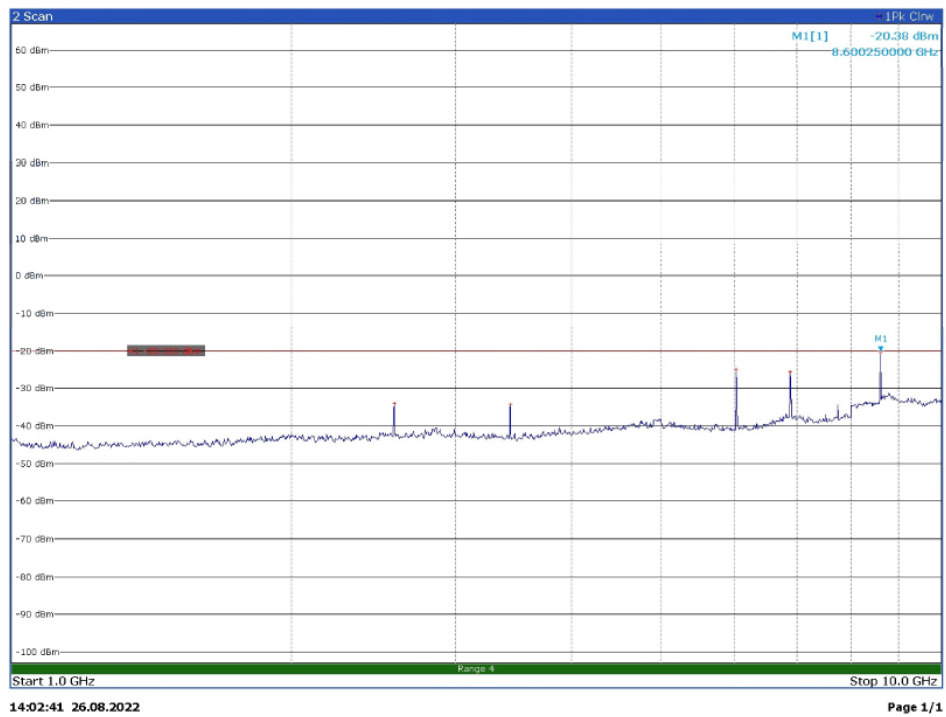
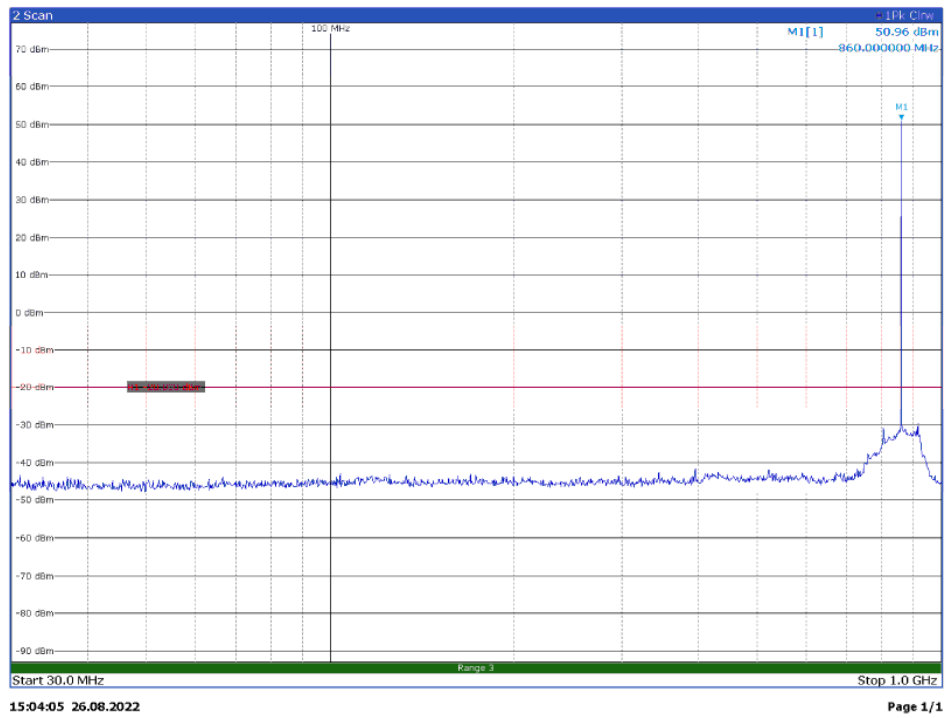
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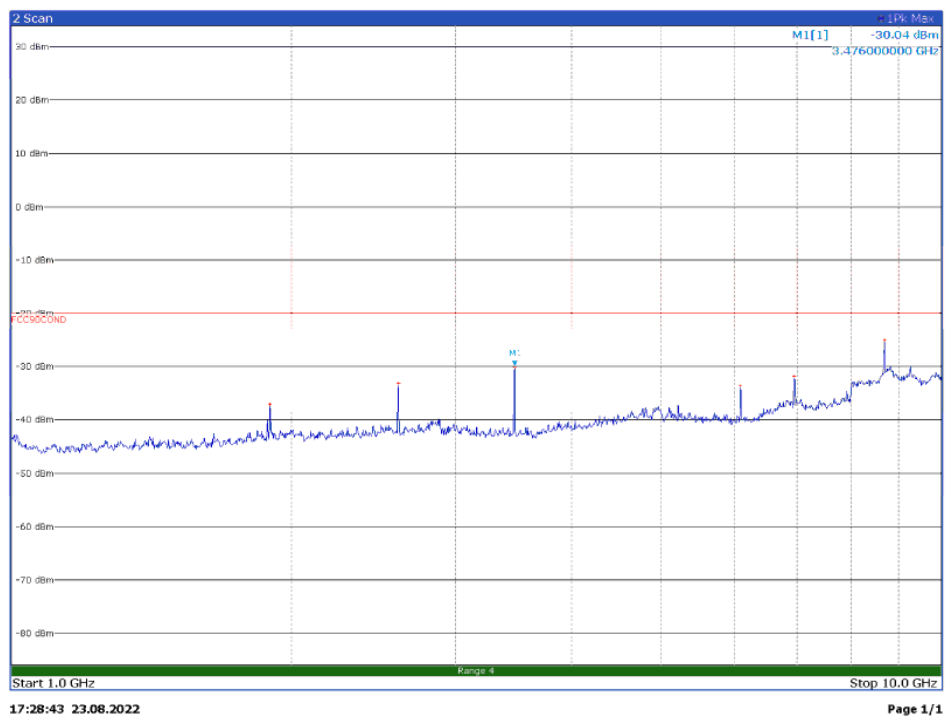
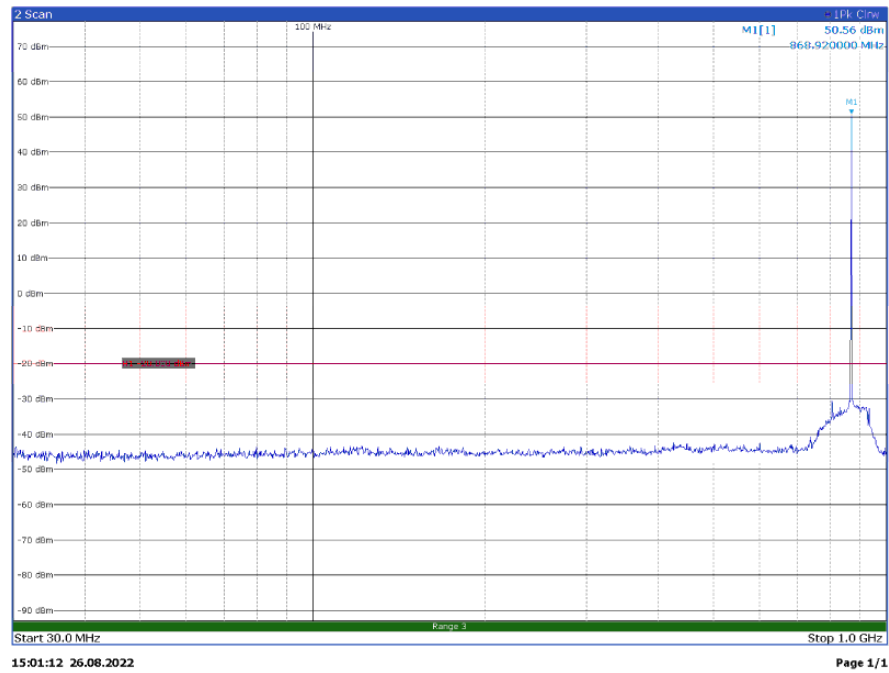
Emission mask D with modulation P25 C4FM at 868.9 MHz



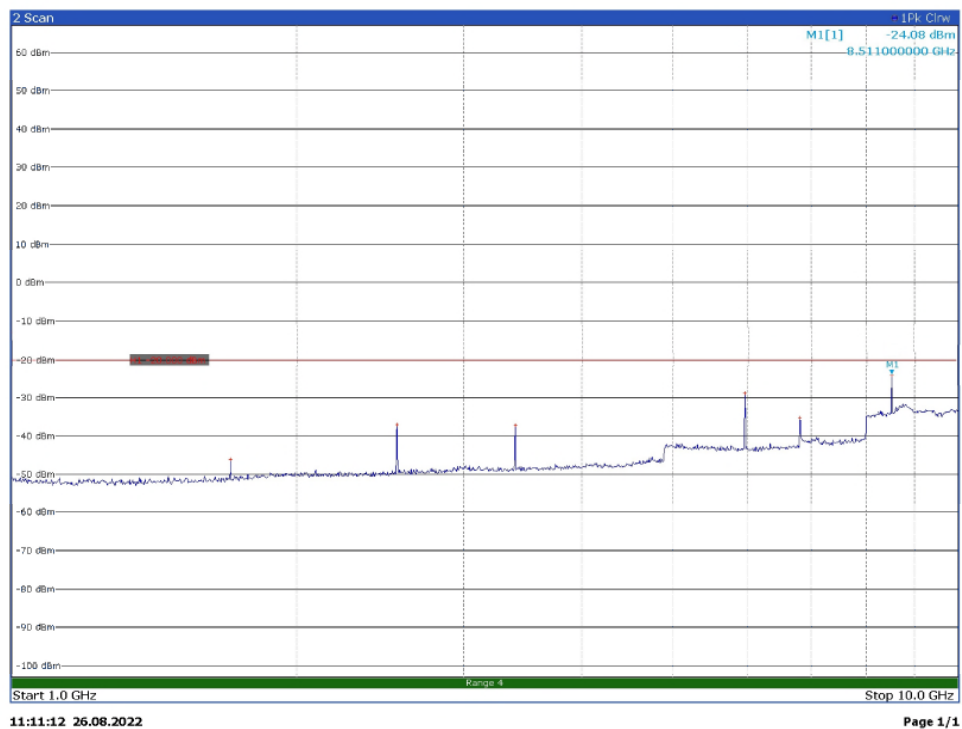
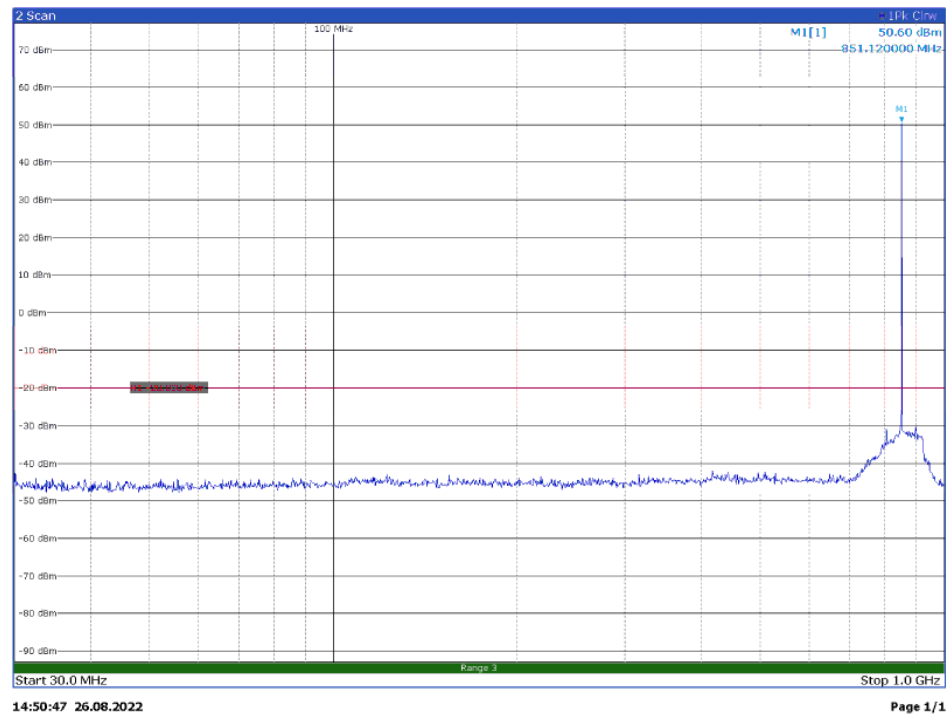
Conducted spurious emissions with modulation DMR 4FSK at 851.1 MHz
Limit exceeded by the carrier



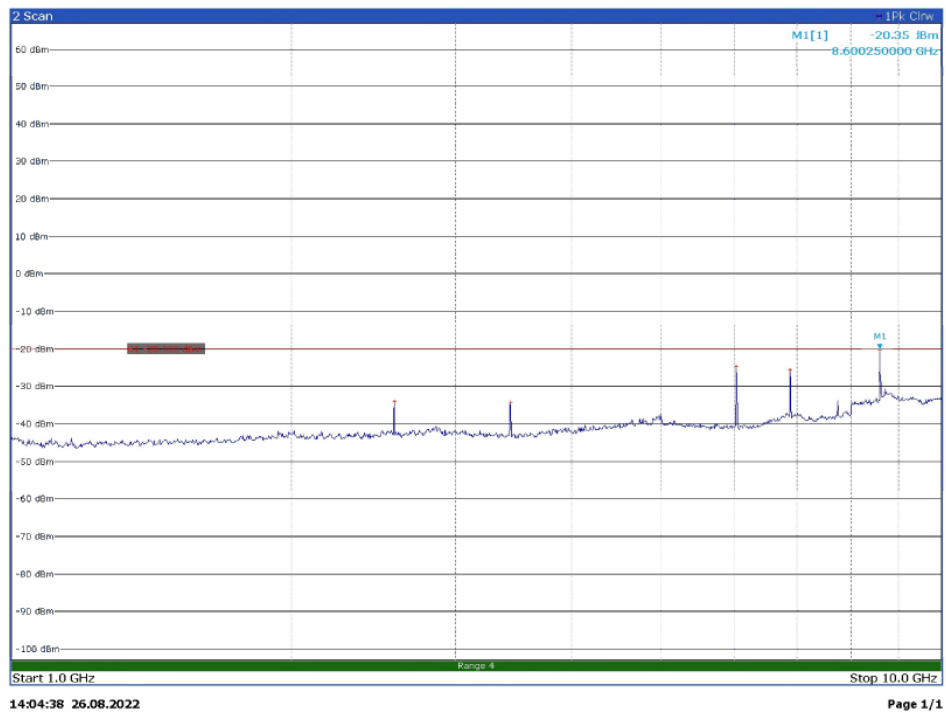
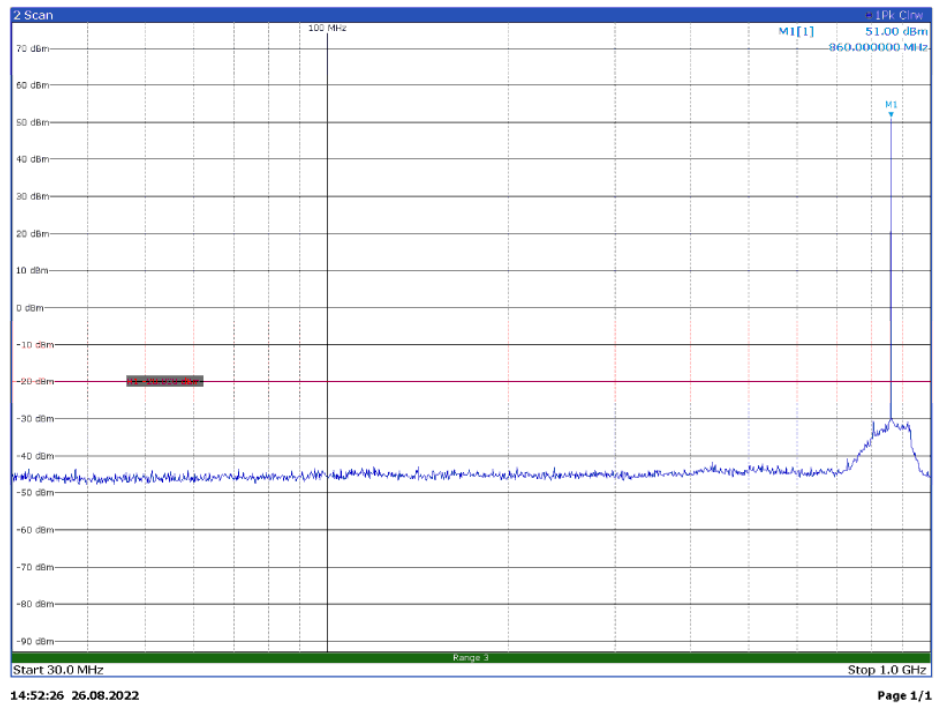
Conducted spurious emissions with modulation DMR 4FSK at 860 MHz, Limit exceeded by the carrier



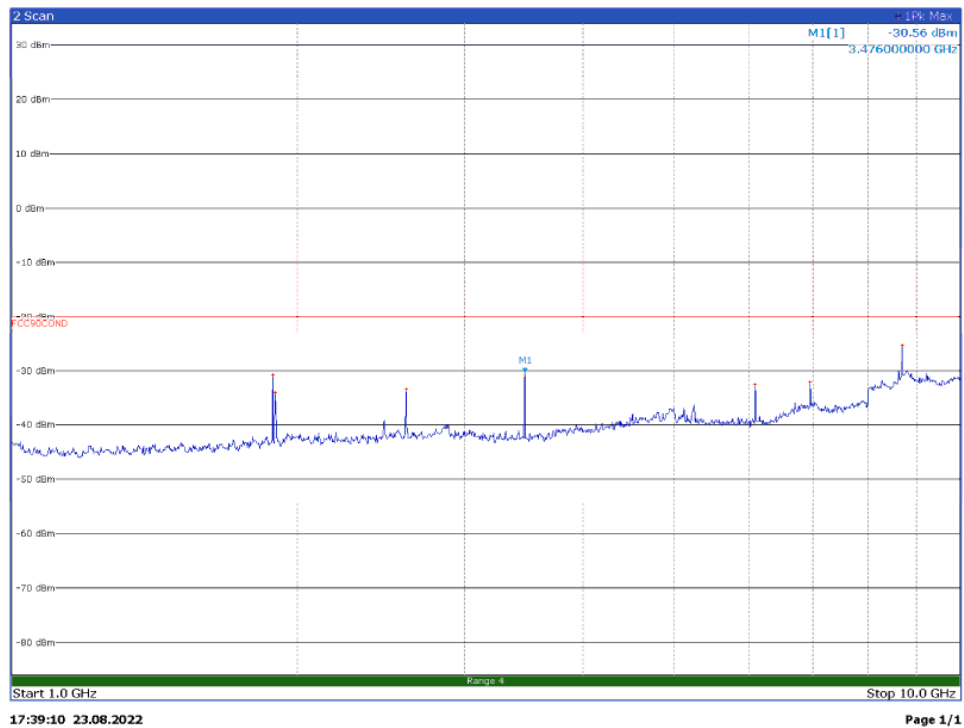
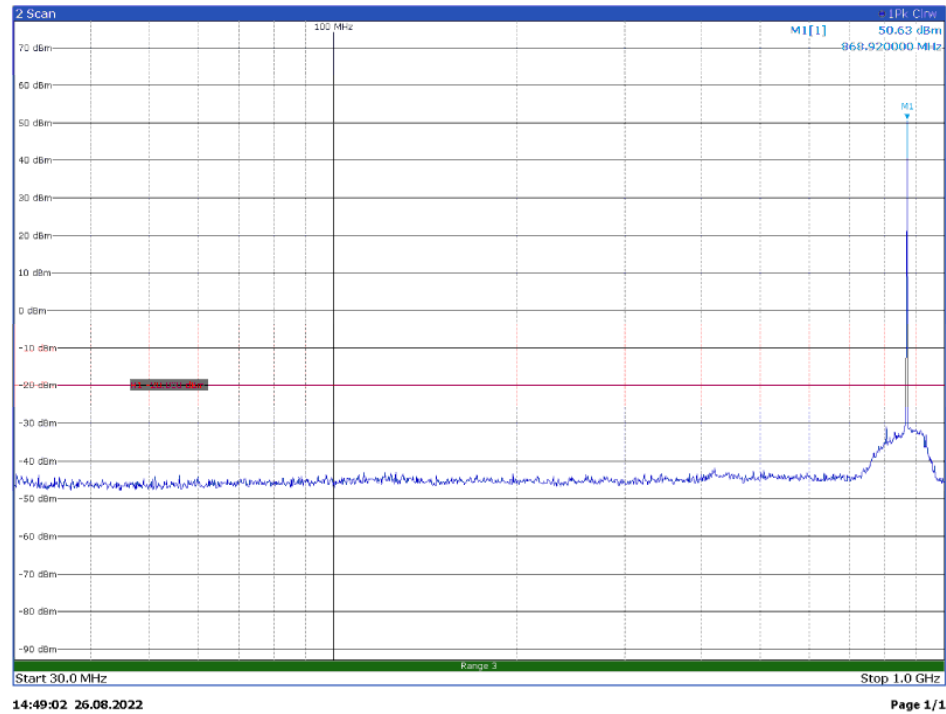
Conducted spurious emissions with modulation DMR 4FSK at 868.9 MHz, Limit exceeded by the carrier



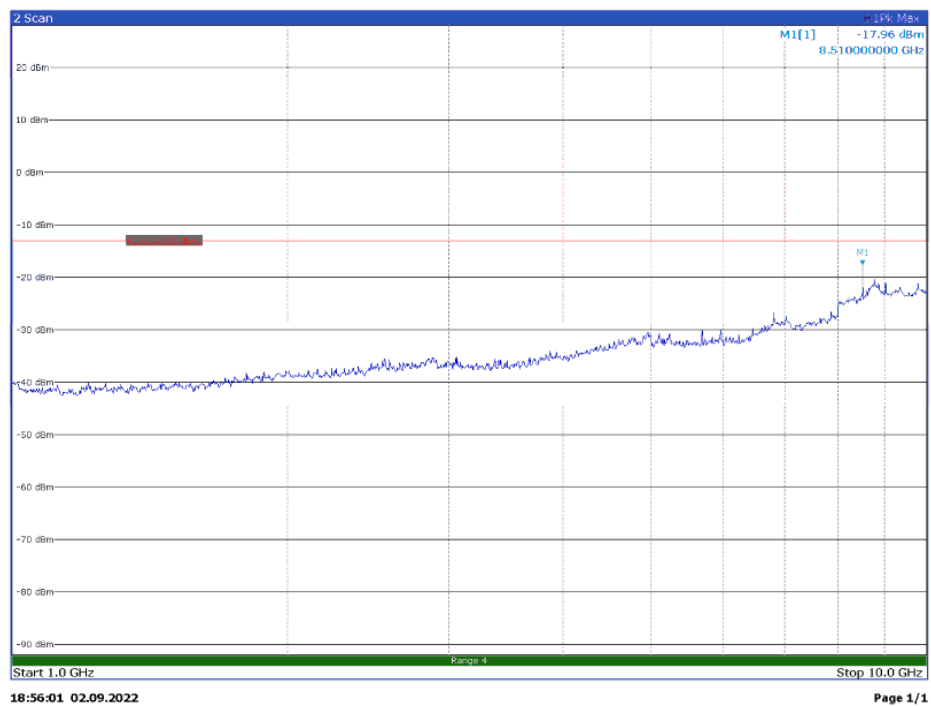
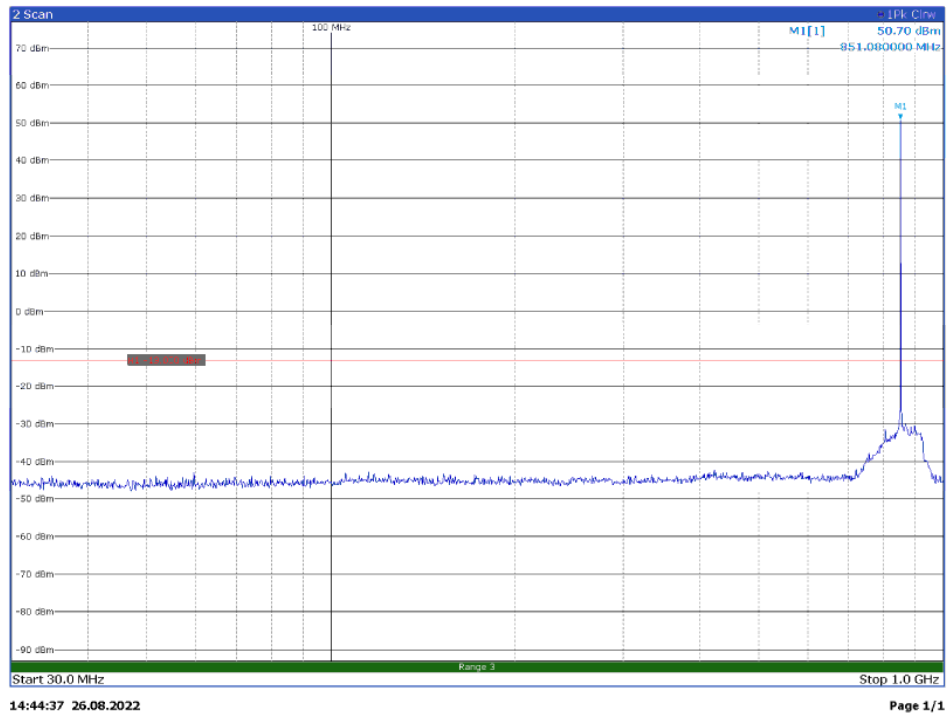
Conducted spurious emissions with modulation FM 12.5 kHz at 851.1 MHz, Limit exceeded by the carrier



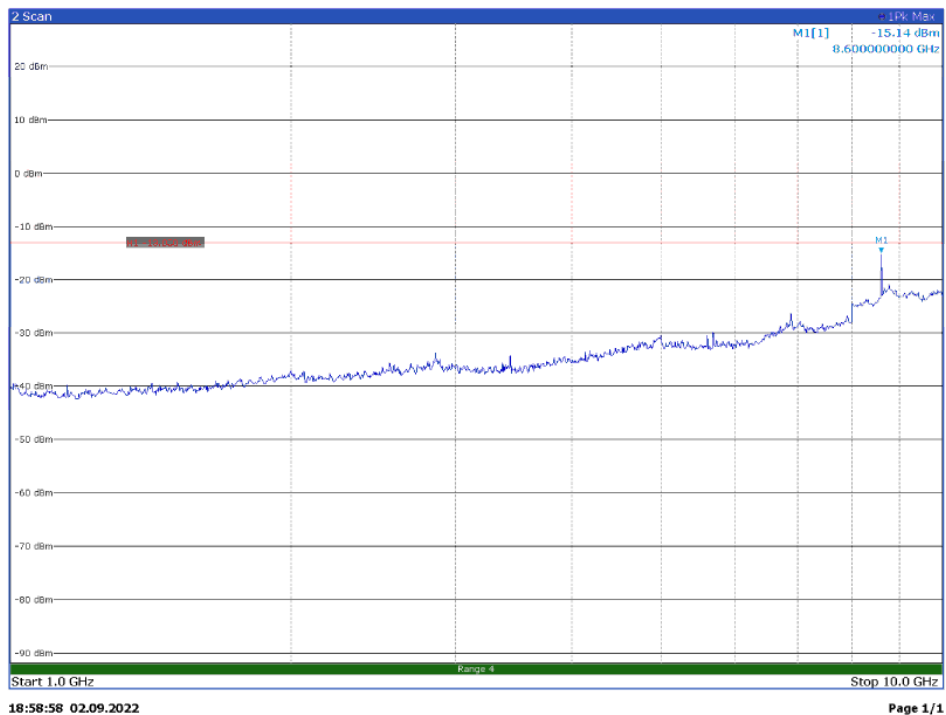
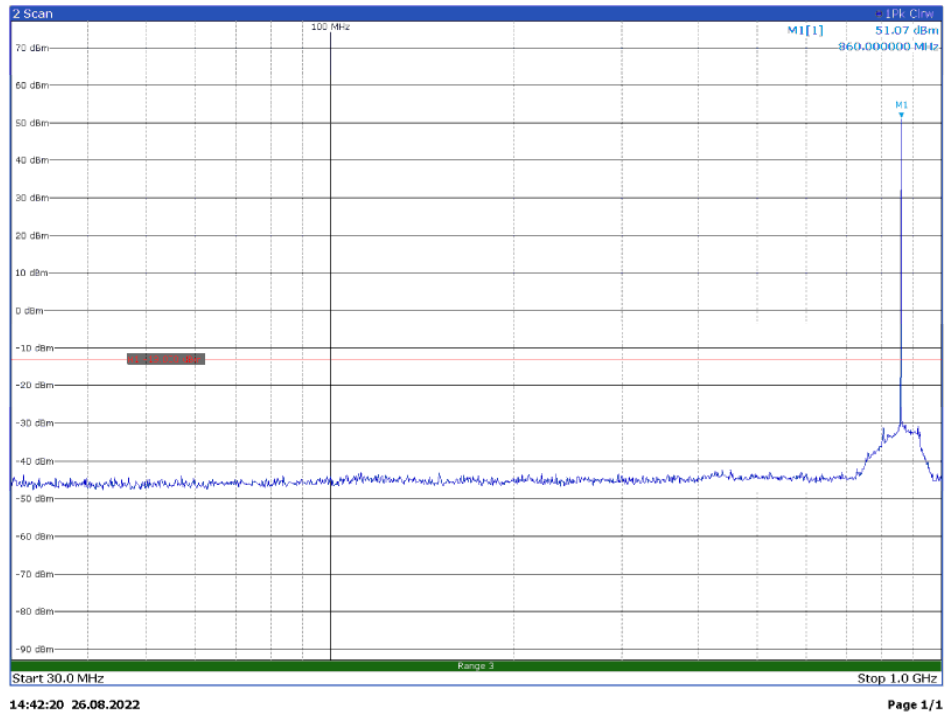
Conducted spurious emissions with modulation FM 12.5 kHz at 860 MHz, Limit exceeded by the carrier



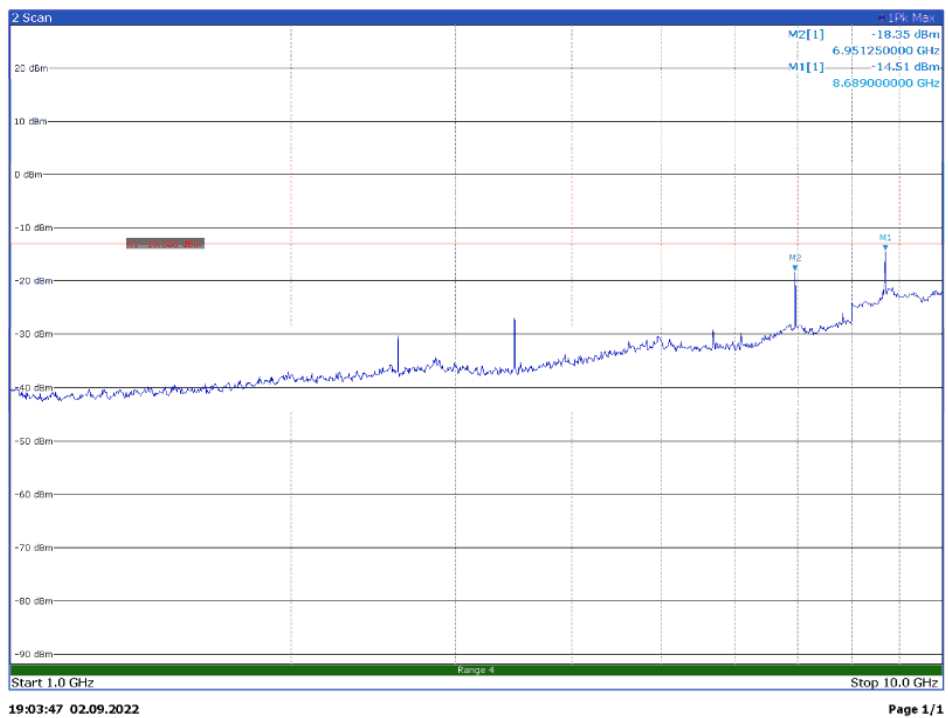
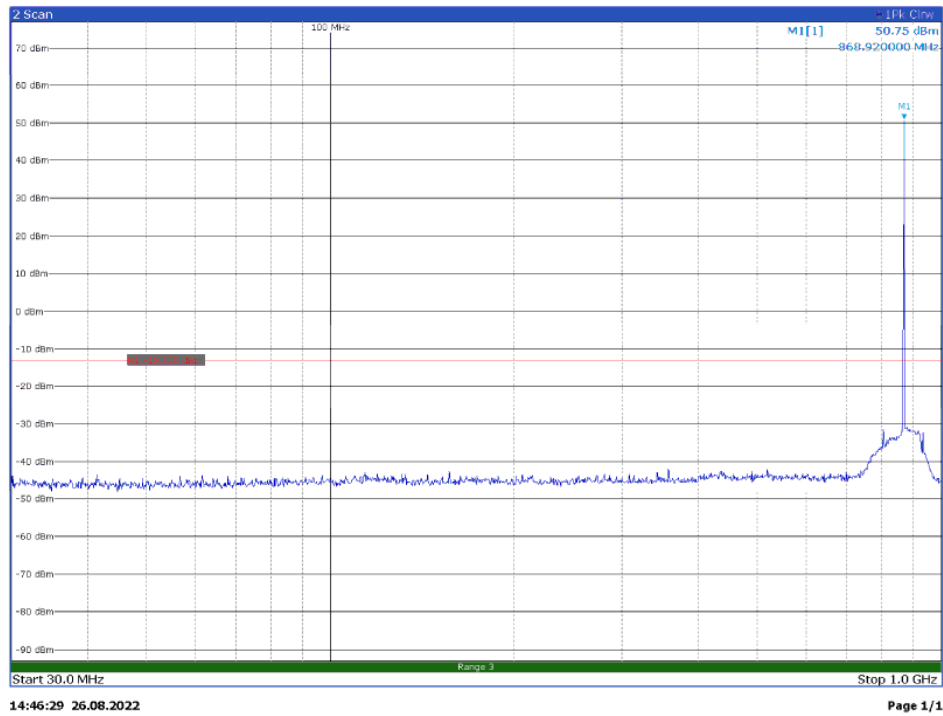
Conducted spurious emissions with modulation FM 12.5 kHz at 868.9 MHz, Limit exceeded by the carrier



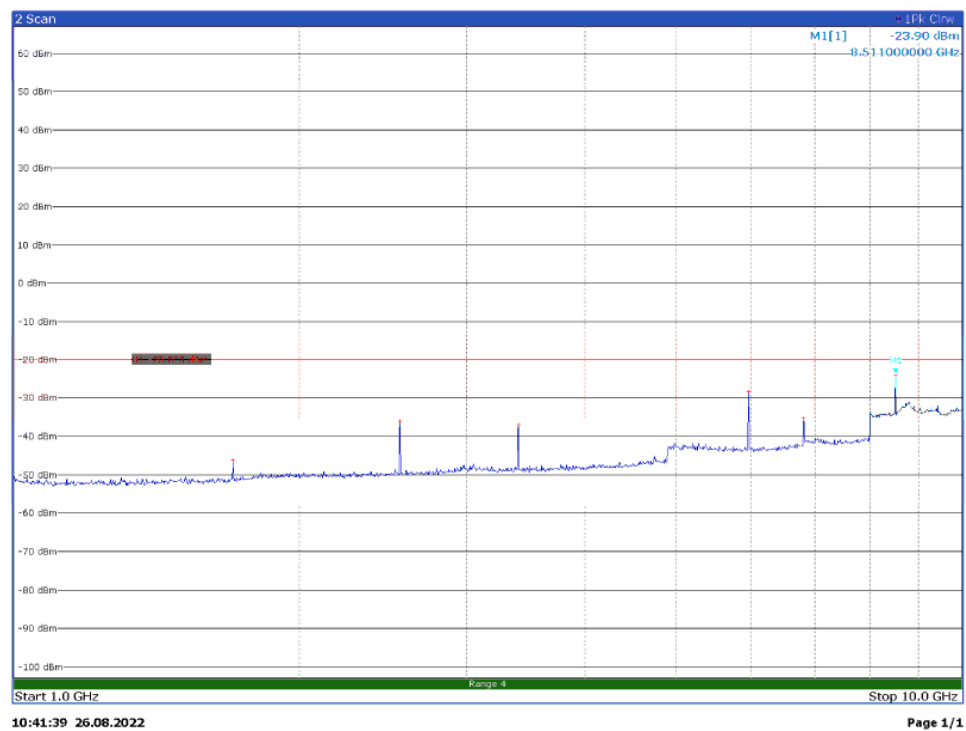
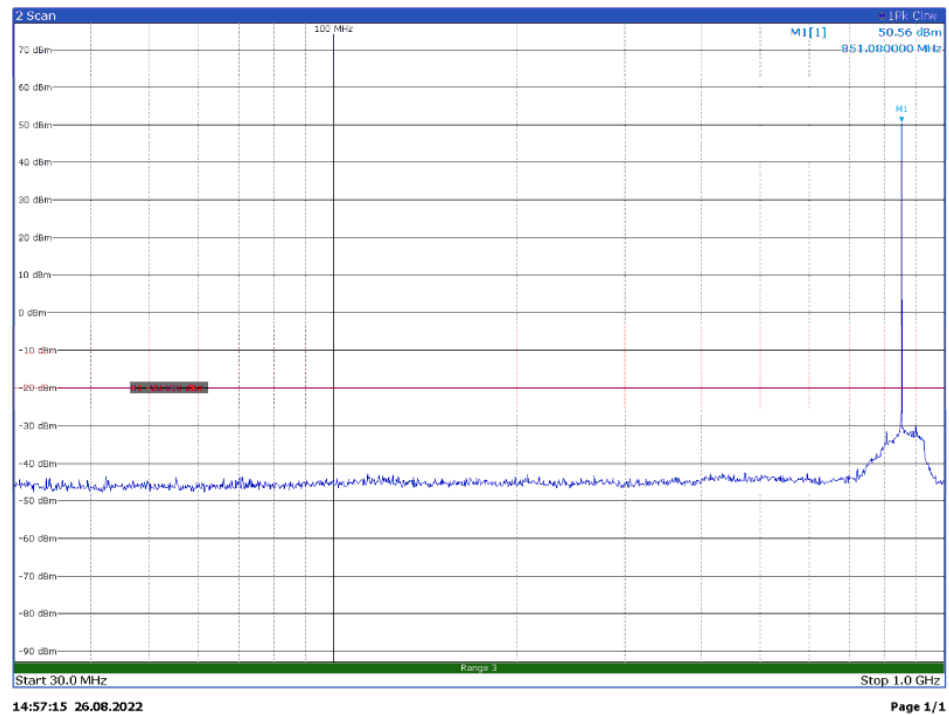
Conducted spurious emissions with modulation FM 25.0 kHz at 851.1 MHz, Limit exceeded by the carrier



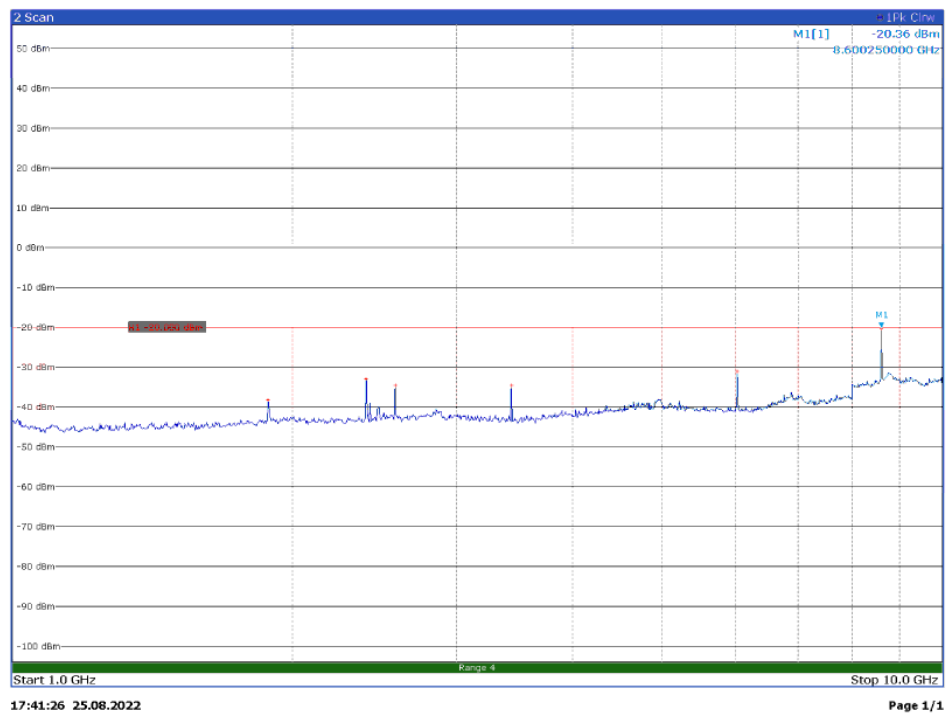
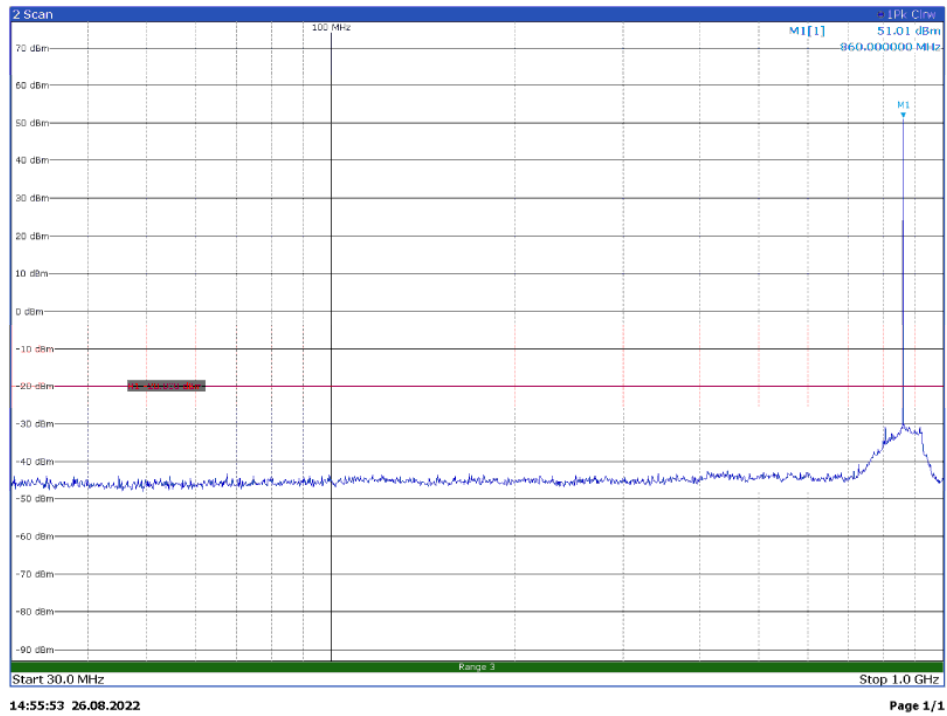
Conducted spurious emissions with modulation FM 25.0 kHz at 860 MHz, Limit exceeded by the carrier



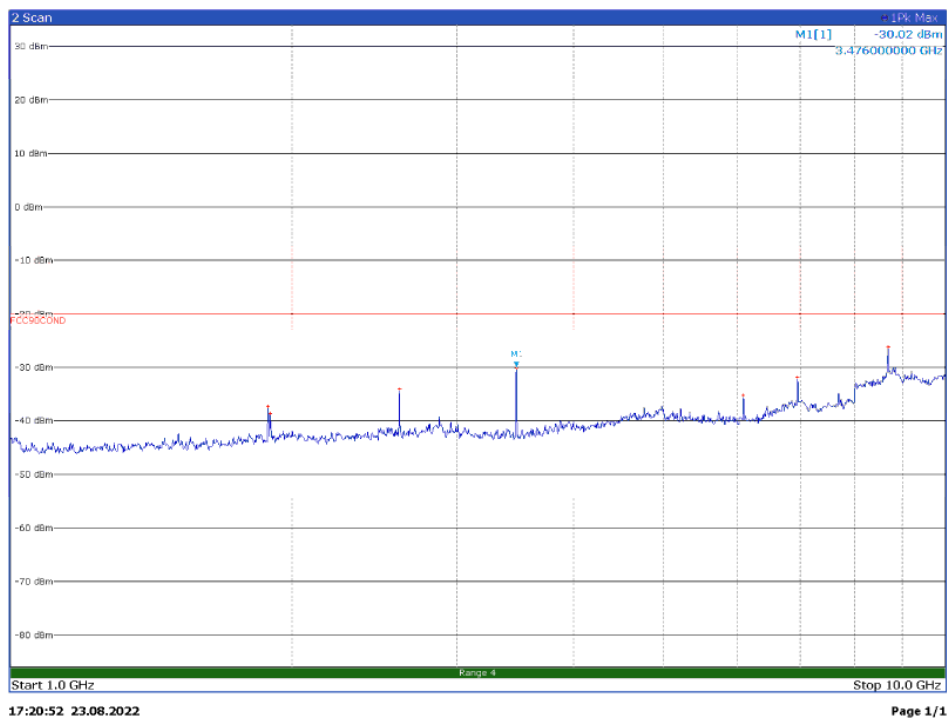
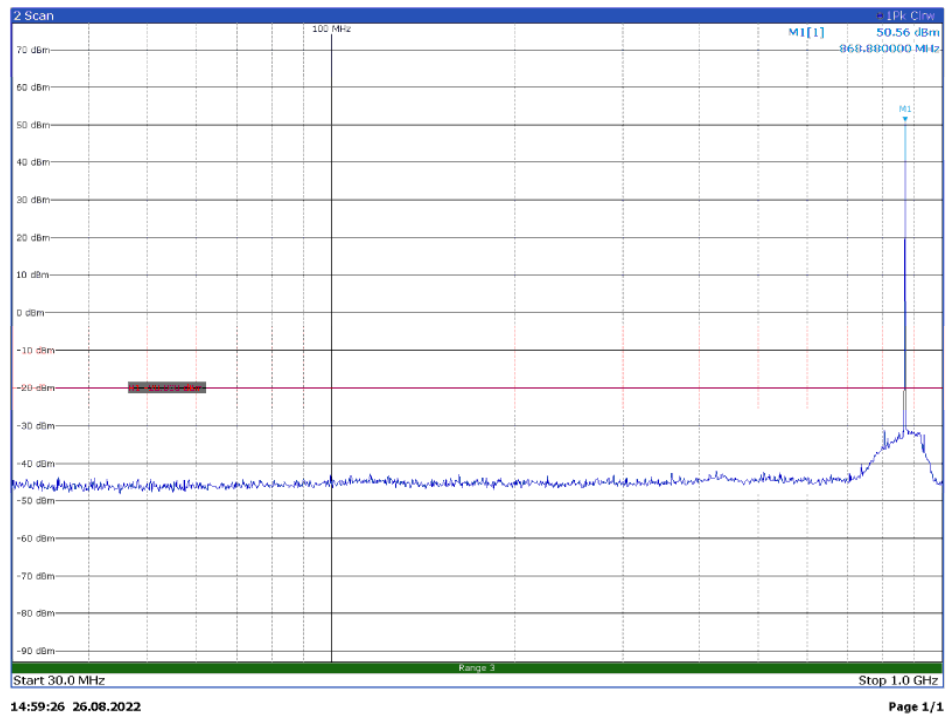
Conducted spurious emissions with modulation FM 25.0 kHz at 868.9 MHz, Limit exceeded by the carrier



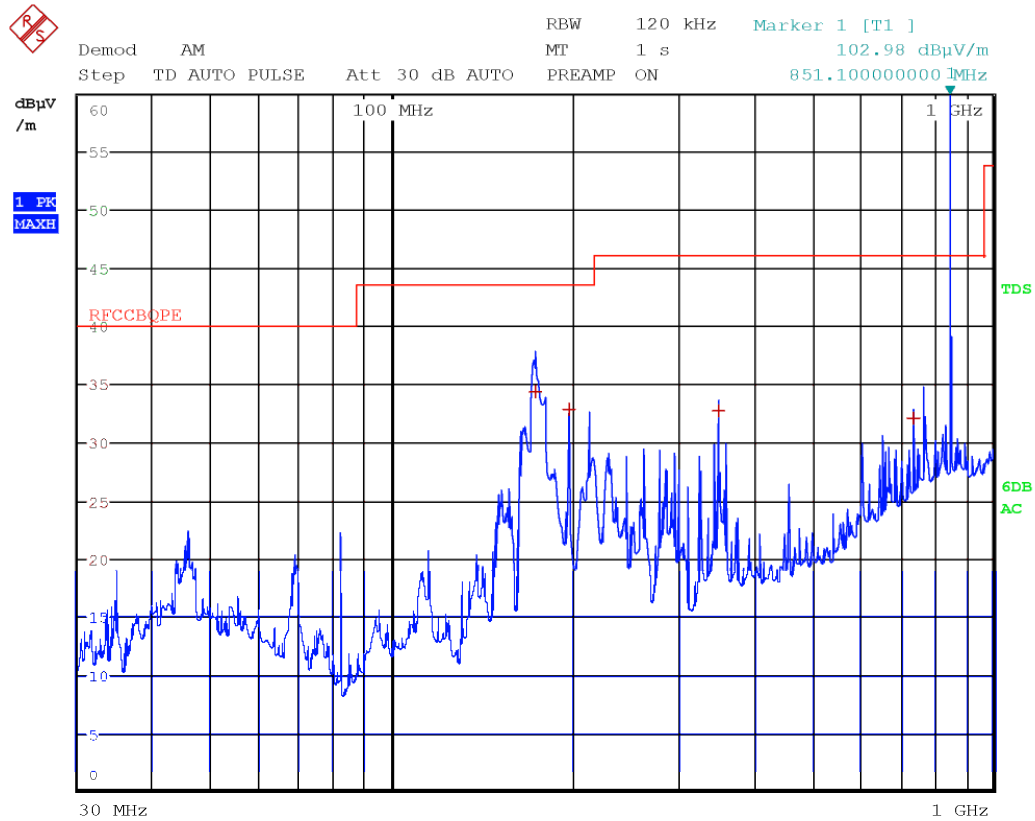
Conducted spurious emissions with modulation P25 C4FM at 851.1 MHz, Limit exceeded by the carrier



Conducted spurious emissions with modulation P25 C4FM at 860 MHz, Limit exceeded by the carrier



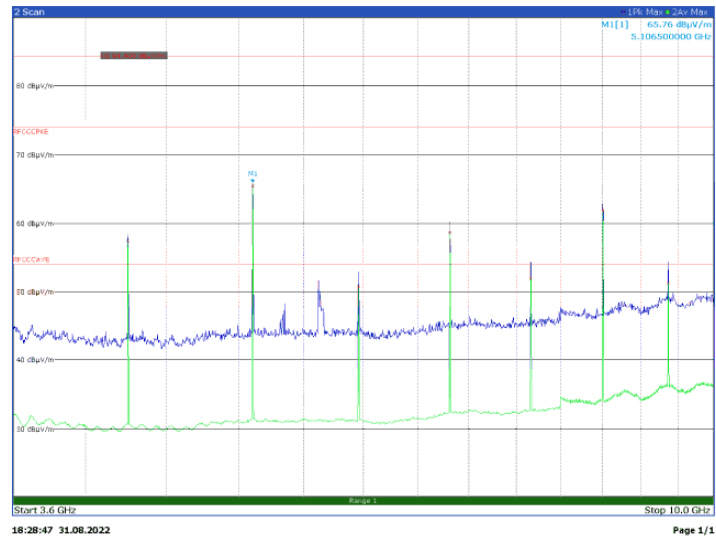
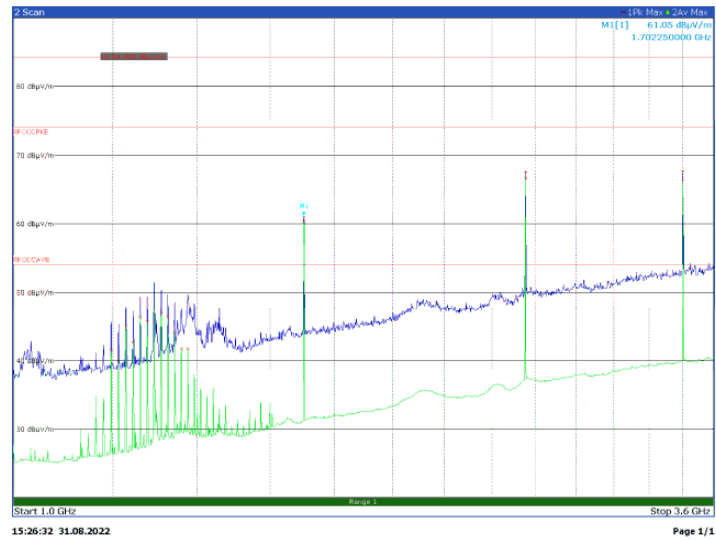
Conducted spurious emissions with modulation P25 C4FM at 868.9 MHz, Limit exceeded by the carrier



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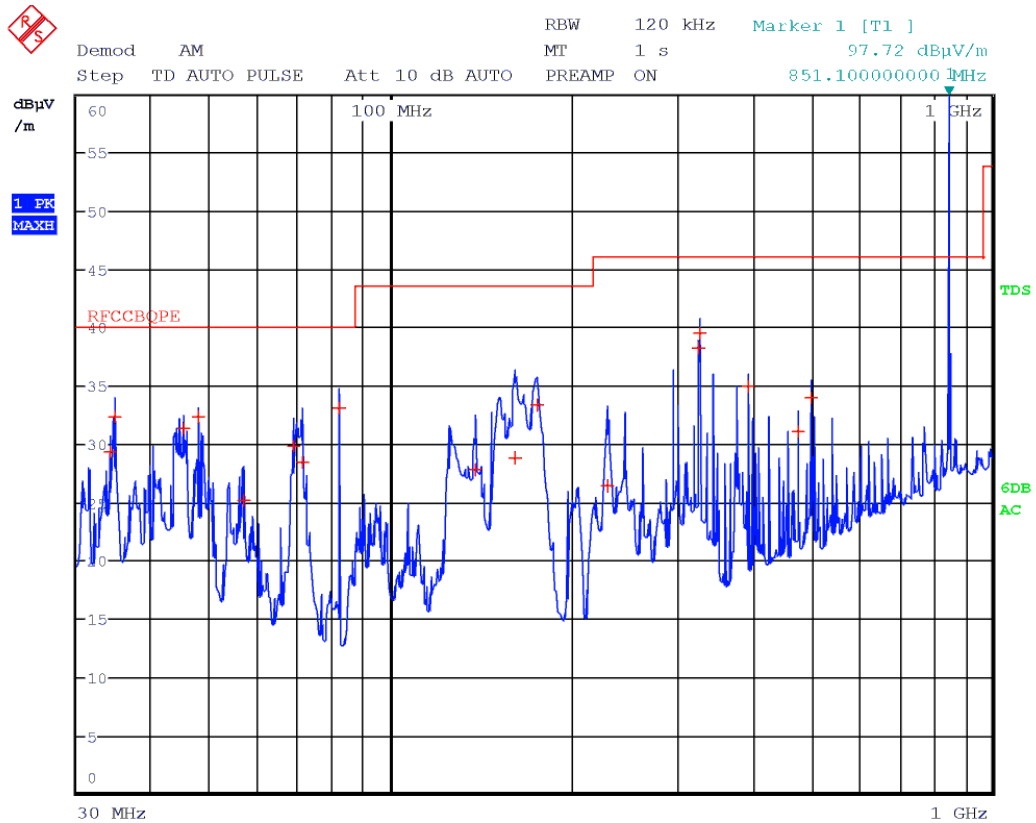
Limit -20 dBm erp = 77.4 dBμV/m at 3 m, limit exceeded by carrier

Radiated spurious emissions with modulation DMR 4FSK at 851.1 MHz – Frequency range 30 to 1000 MHz with antenna in horizontal polarization



Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
1702.25000	61.1	77.4	-16.3	Pk	-36.3	-20.0	-16.3	Pk
2553.25000	67.7	77.4	-9.7	Pk	-29.7	-20.0	-9.7	Pk
3404.50000	67.8	77.4	-9.6	Pk	-29.6	-20.0	-9.6	Pk
5106.50000	65.8	77.4	-11.6	Pk	-31.6	-20.0	-11.6	Pk

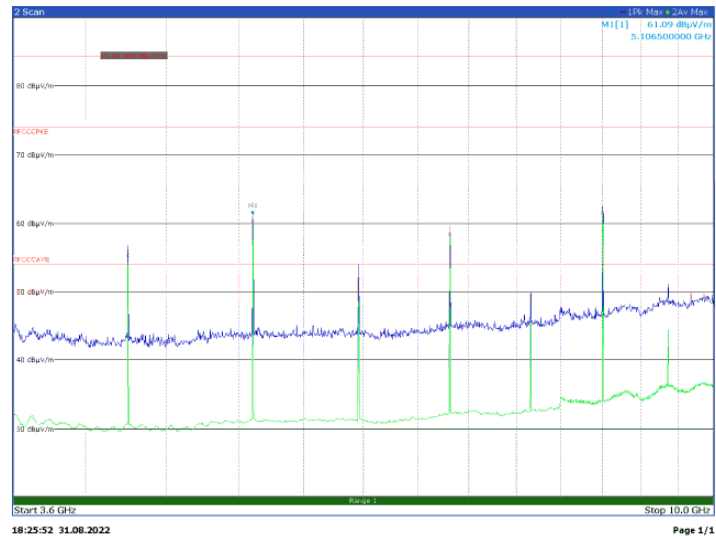
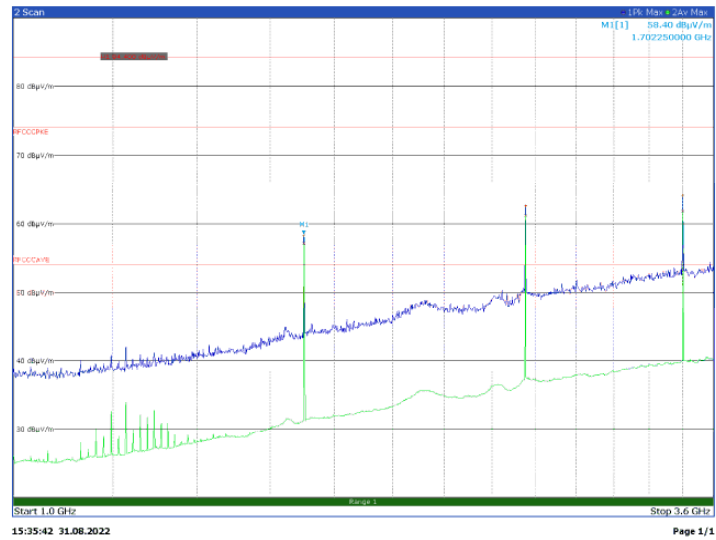
Radiated spurious emissions with modulation DMR 4FSK at 851.1 MHz – Frequency range 1 GHz to 10 GHz with antenna in horizontal polarization



Date: 30.AUG.2022 19:31:06

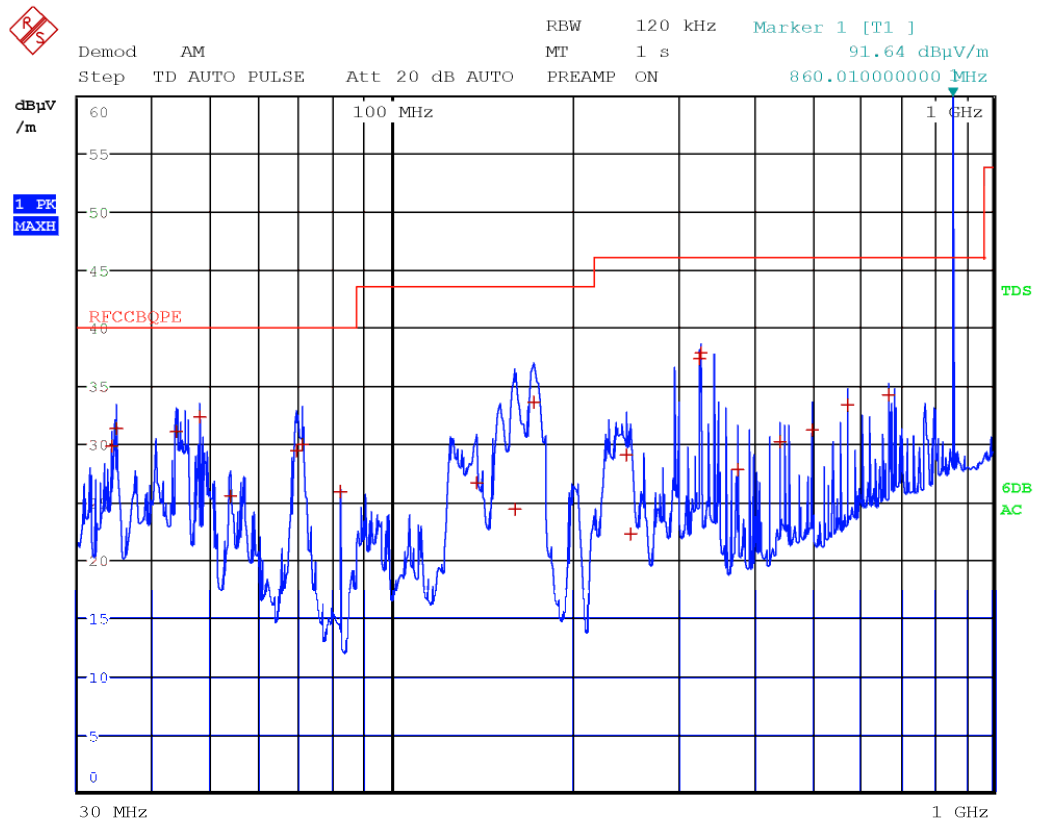
Radiated spurious emissions with modulation DMR 4FSK at 851.1 MHz – Frequency range 30 to 1000 MHz with antenna in vertical polarization

Limit -20 dBm erp = 77.4 dBμV/m at 3 m, limit exceeded by carrier



Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
1702.25000	58.4	77.4	-19.0	Pk	-39.0	-20.0	-19.0	Pk
2553.25000	62.6	77.4	-14.8	Pk	-34.8	-20.0	-14.8	Pk
3404.50000	64.2	77.4	-13.2	Pk	-33.2	-20.0	-13.2	Pk
5106.50000	61.1	77.4	-16.3	Pk	-36.3	-20.0	-16.3	Pk

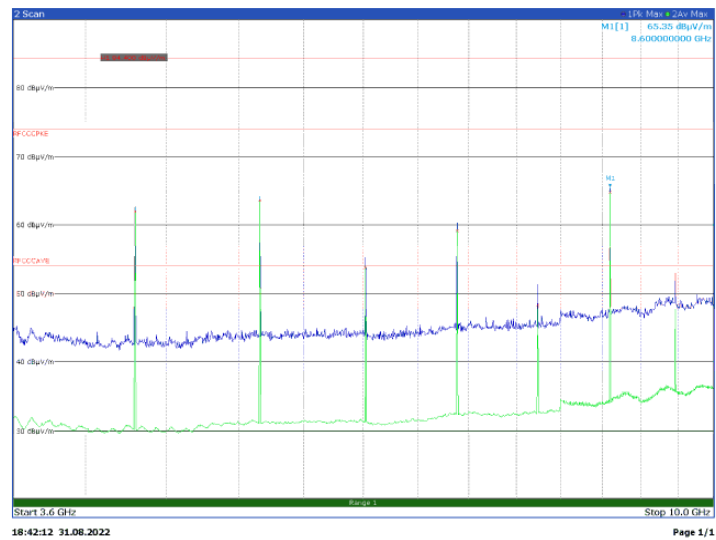
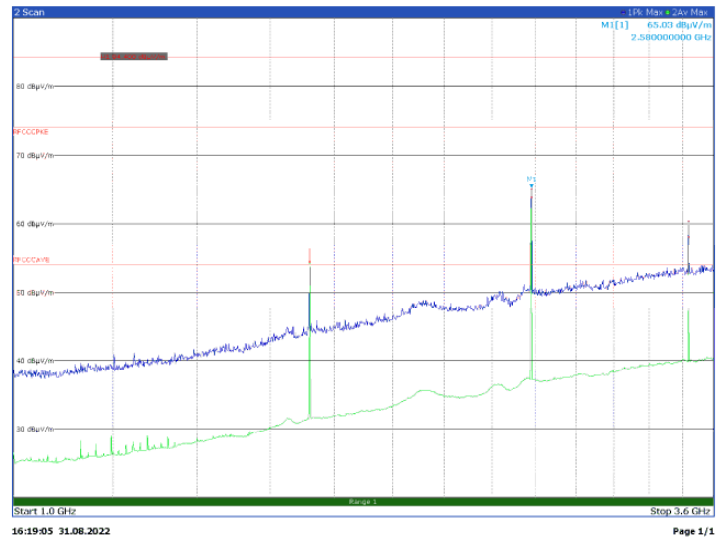
Radiated spurious emissions with modulation DMR 4FSK at 851.1 MHz – Frequency range 1 GHz to 10 GHz with antenna in vertical polarization



Date: 30.AUG.2022 20:21:12

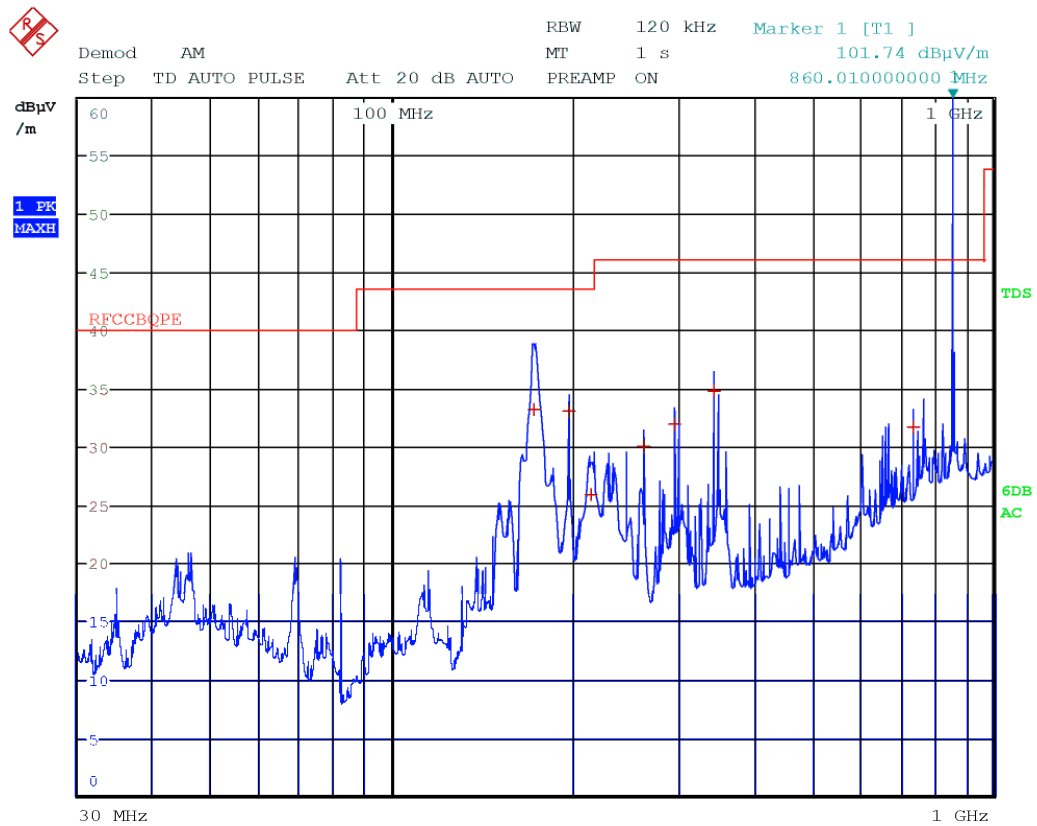
Radiated spurious emissions with modulation DMR 4FSK at 860 MHz – Frequency range 30 to 1000 MHz with antenna in vertical polarization

Limit -20 dBm erp = 77.4 dBμV/m at 3 m, limit exceeded by carrier



Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
1720.00000	56.2	77.4	-21.2	Pk	-41.2	-20.0	-21.2	Pk
2580.00000	65.1	77.4	-12.3	Pk	-32.3	-20.0	-12.3	Pk
3440.00000	60.4	77.4	-17.0	Pk	-37.0	-20.0	-17.0	Pk
8600.00000	65.4	77.4	-12.0	Pk	-32.0	-20.0	-12.0	Pk

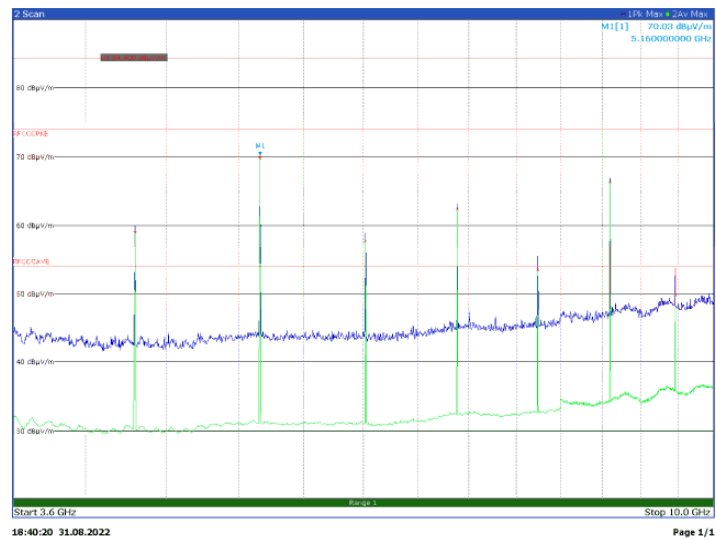
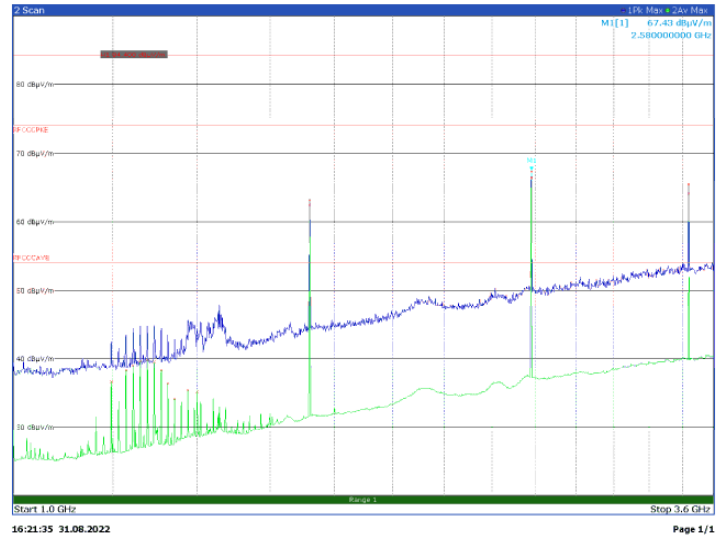
Radiated spurious emissions with modulation DMR 4FSK at 860 MHz – Frequency range 1 GHz to 10 GHz with antenna in vertical polarization



Date: 30.AUG.2022 20:14:54

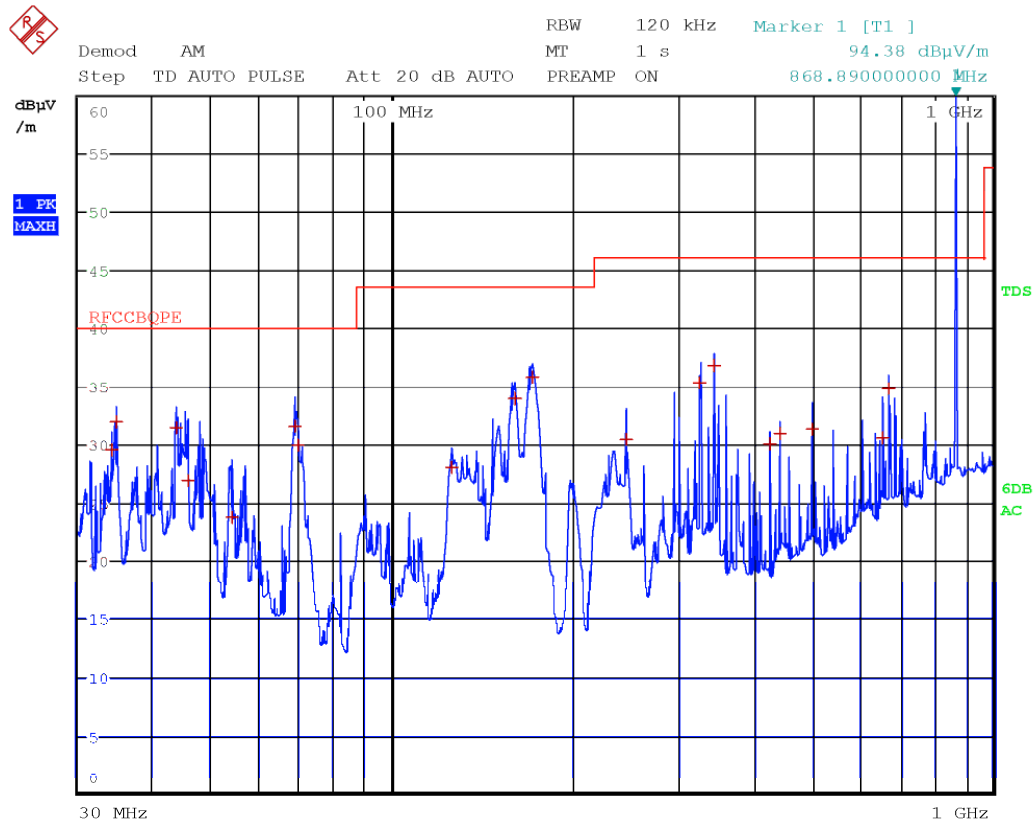
Radiated spurious emissions with modulation DMR 4FSK at 860 MHz – Frequency range 30 to 1000 MHz with antenna in horizontal polarization

Limit -20 dBm erp = 77.4 dBμV/m at 3 m, limit exceeded by carrier



Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
1720.00000	63.2	77.4	-14.2	Pk	-34.2	-20.0	-14.2	Pk
2580.00000	67.5	77.4	-9.9	Pk	-29.9	-20.0	-9.9	Pk
3440.00000	65.5	77.4	-11.9	Pk	-31.9	-20.0	-11.9	Pk
5160.00000	70.3	77.4	-7.1	Pk	-27.1	-20.0	-7.1	Pk

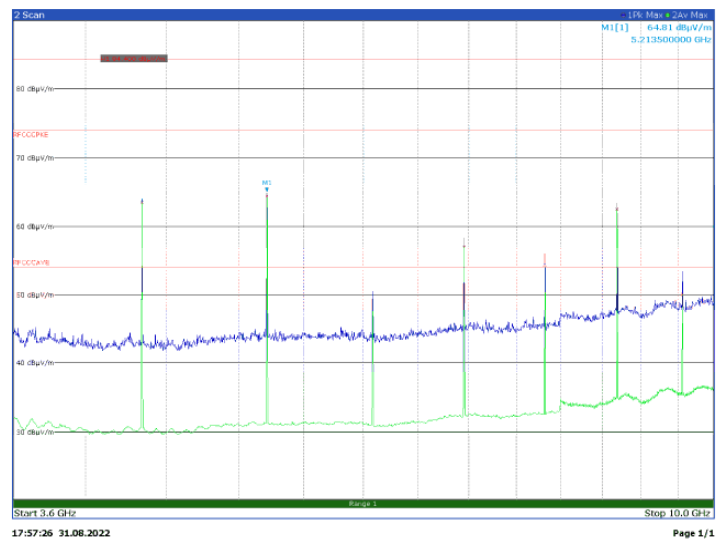
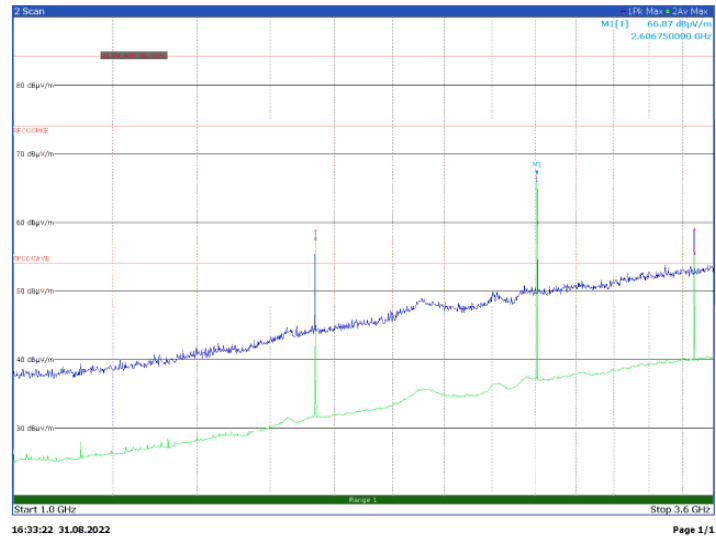
Radiated spurious emissions with modulation DMR 4FSK at 860 MHz – Frequency range 1 GHz to 10 GHz with antenna in horizontal polarization



Date: 30.AUG.2022 20:33:59

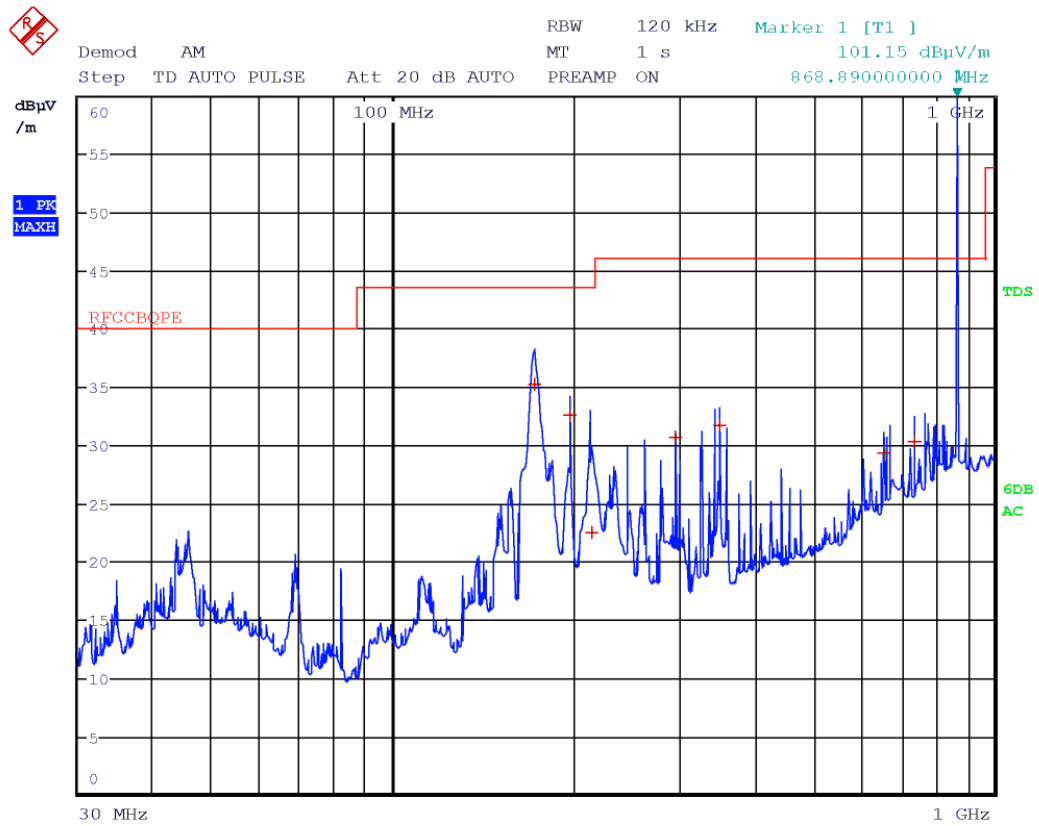
Limit -20 dBm erp = 77.4 dBμV/m at 3 m, limit exceeded by carrier

Radiated spurious emissions with modulation DMR 4FSK at 868.9MHz – Frequency range 30 to 1000 MHz with antenna in vertical polarization



Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
1737.75000	58.9	77.4	-18.5	Pk	-38.5	-20.0	-18.5	Pk
2606.75000	66.9	77.4	-10.5	Pk	-30.5	-20.0	-10.5	Pk
3475.50000	59.0	77.4	-18.4	Pk	-38.4	-20.0	-18.4	Pk
5213.50000	64.8	77.4	-12.6	Pk	-32.6	-20.0	-12.6	Pk

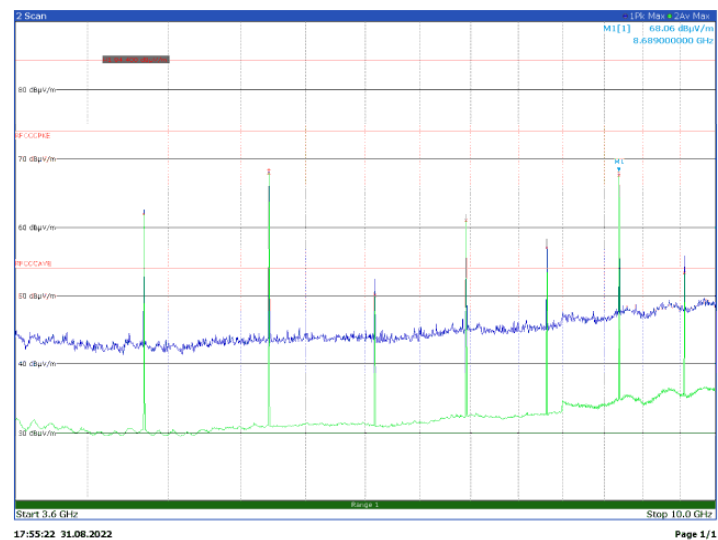
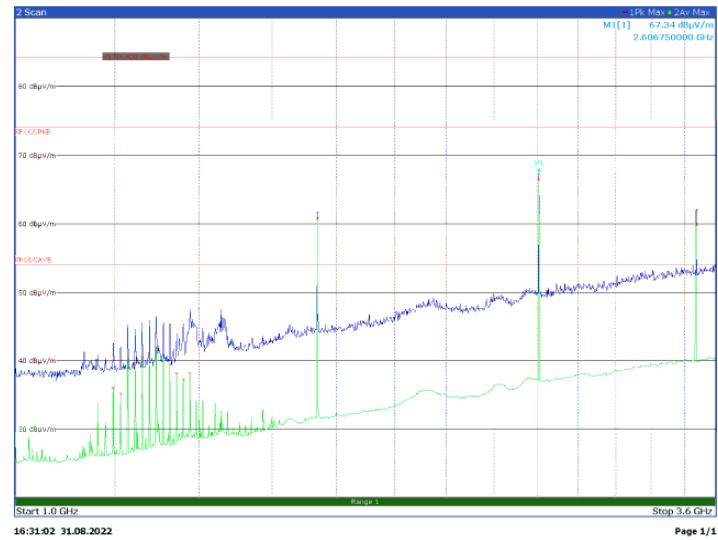
Radiated spurious emissions with modulation DMR 4FSK at 868.9MHz – Frequency range 1 GHz to 10 GHz with antenna in vertical polarization



Date: 30.AUG.2022 20:46:02

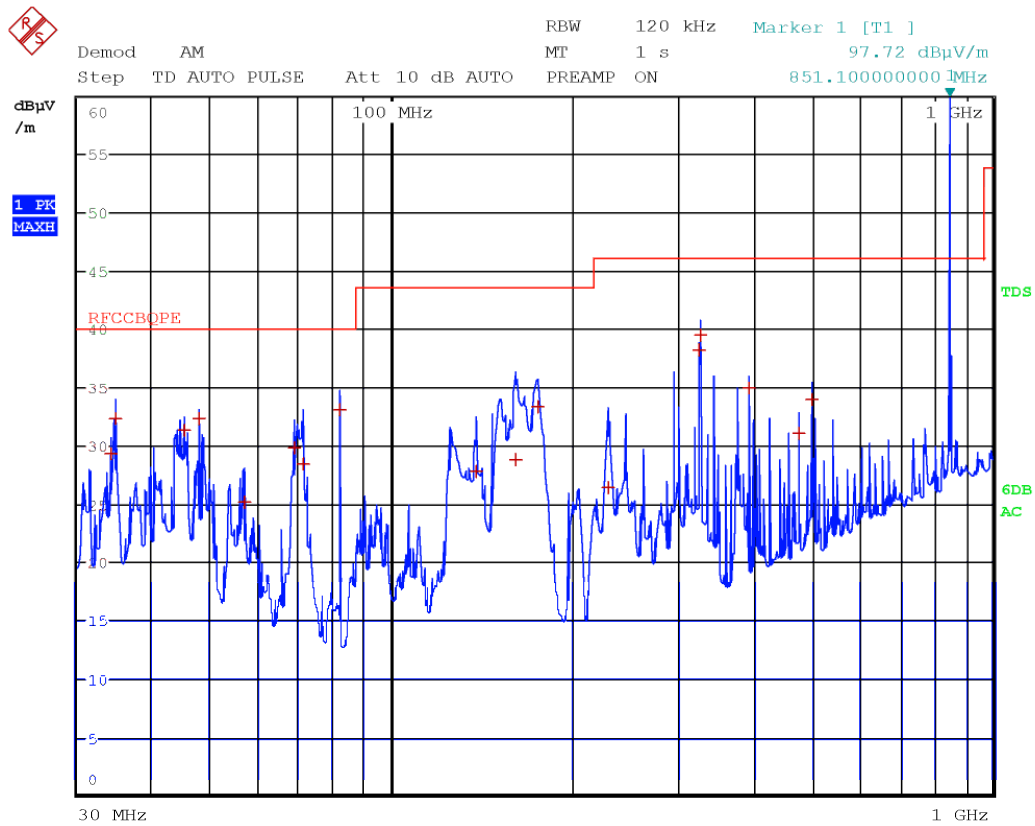
Limit -20 dBm erp = 77.4 dBμV/m at 3 m, limit exceeded by carrier

Radiated spurious emissions with modulation DMR 4FSK at 868.9MHz – Frequency range 30 to 1000 MHz with antenna in horizontal polarization



Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
1737.75000	61.6	77.4	-15.8	Pk	-35.8	-20.0	-15.8	Pk
2606.75000	67.4	77.4	-10.0	Pk	-30.0	-20.0	-10.0	Pk
3475.50000	62.1	77.4	-15.3	Pk	-35.3	-20.0	-15.3	Pk
5213.50000	68.4	77.4	-9.0	Pk	-29.0	-20.0	-9.0	Pk
8689.00000	68.1	77.4	-15.8	Pk	-29.3	-20.0	-15.8	Pk

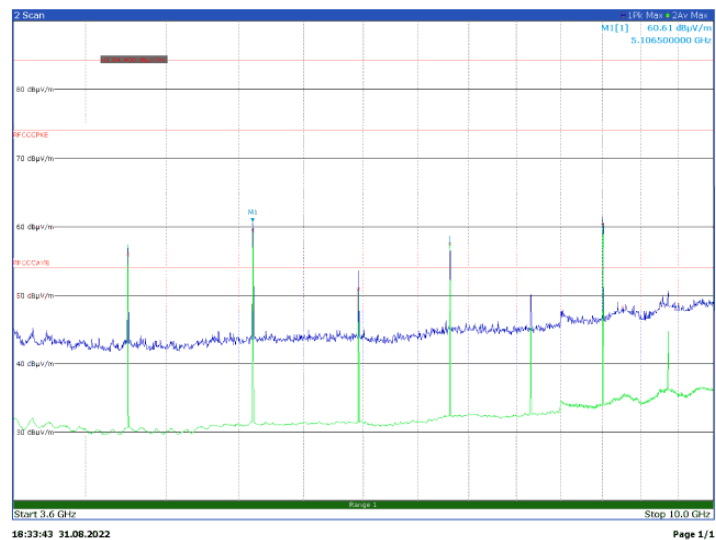
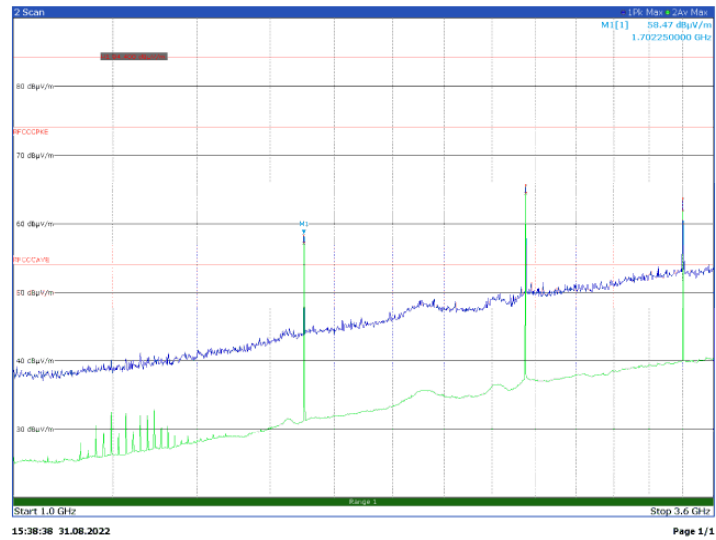
Radiated spurious emissions with modulation DMR 4FSK at 868.9MHz – Frequency range 1 GHz to 10 GHz with antenna in horizontal polarization



Date: 30.AUG.2022 19:33:42

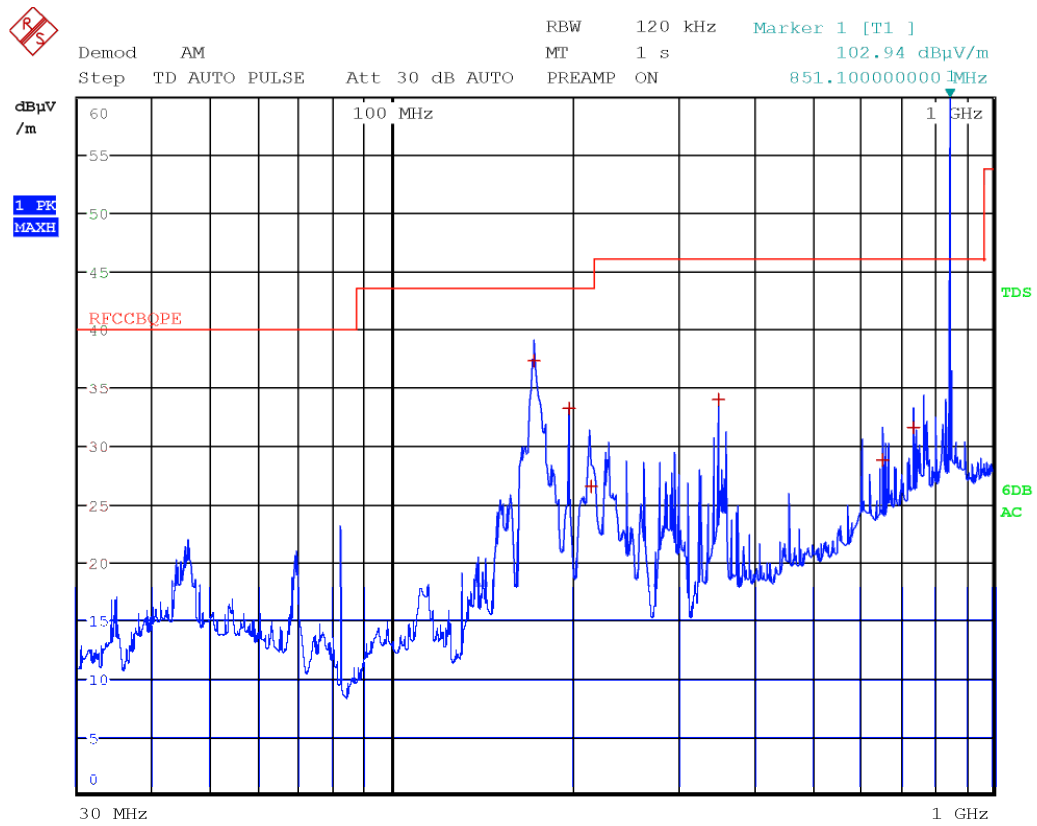
Limit -20 dBm erp = 77.4 dBμV/m at 3 m, limit exceeded by carrier

Radiated spurious emissions with modulation P25 C4FM at 851.1MHz – Frequency range 30 MHz to 1 GHz with antenna in vertical polarization



Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
1702.25000	58.5	77.4	-18.9	Pk	-38.9	-20.0	-18.9	Pk
2553.25000	65.6	77.4	-11.8	Pk	-31.8	-20.0	-11.8	Pk
3404.50000	63.7	77.4	-13.7	Pk	-33.7	-20.0	-13.7	Pk
5106.50000	60.6	77.4	-16.8	Pk	-36.8	-20.0	-16.8	Pk

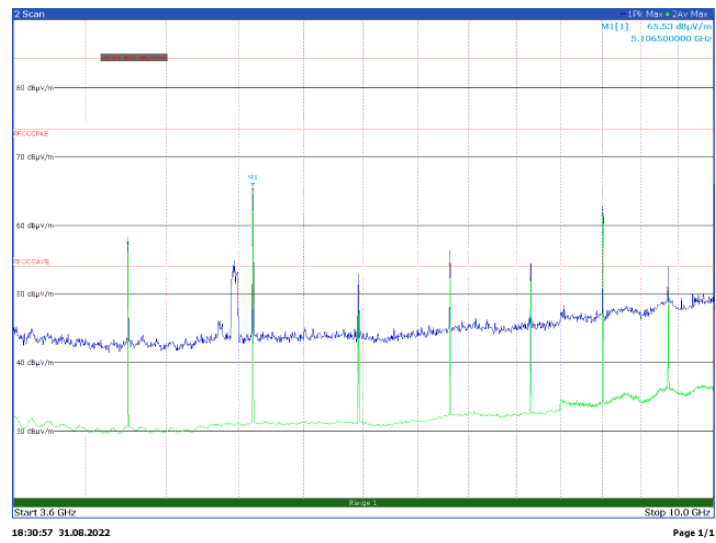
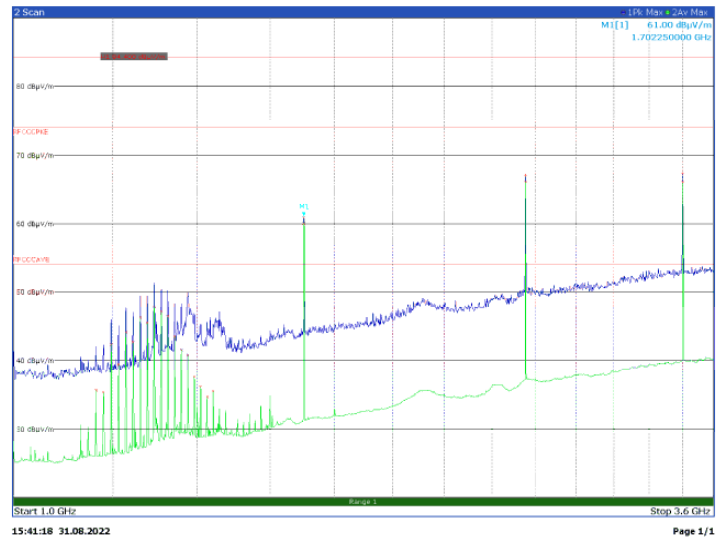
Radiated spurious emissions with modulation P25 C4FM at 851.1MHz – Frequency range 1 GHz to 10 GHz with antenna in vertical polarization



Date: 30.AUG.2022 19:36:12

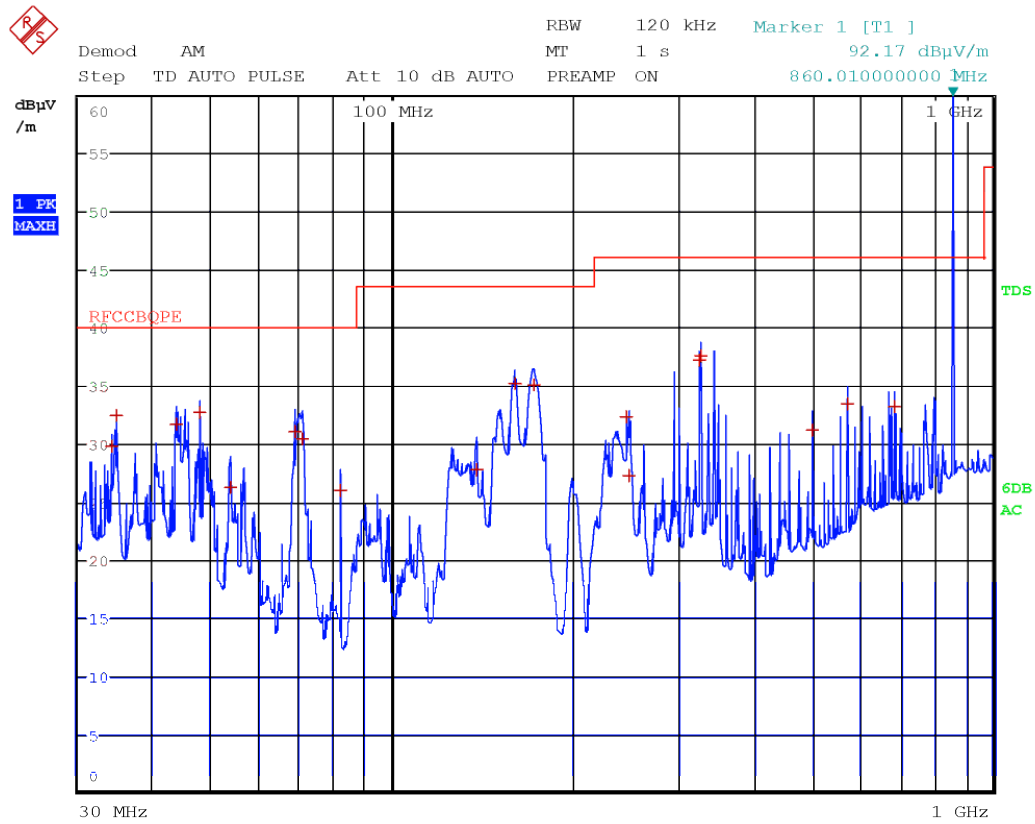
Limit -20 dBm erp = 77.4 dBμV/m at 3 m, limit exceeded by carrier

Radiated spurious emissions with modulation P25 C4FM at 851.1MHz – Frequency range 30 MHz to 1 GHz with antenna in horizontal polarization



Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
1702.25000	61.0	77.4	-16.4	Pk	-36.4	-20.0	-16.4	Pk
2553.25000	67.2	77.4	-10.2	Pk	-30.2	-20.0	-10.2	Pk
3404.50000	67.5	77.4	-9.9	Pk	-29.9	-20.0	-9.9	Pk
5106.50000	65.5	77.4	-11.9	Pk	-31.9	-20.0	-11.9	Pk

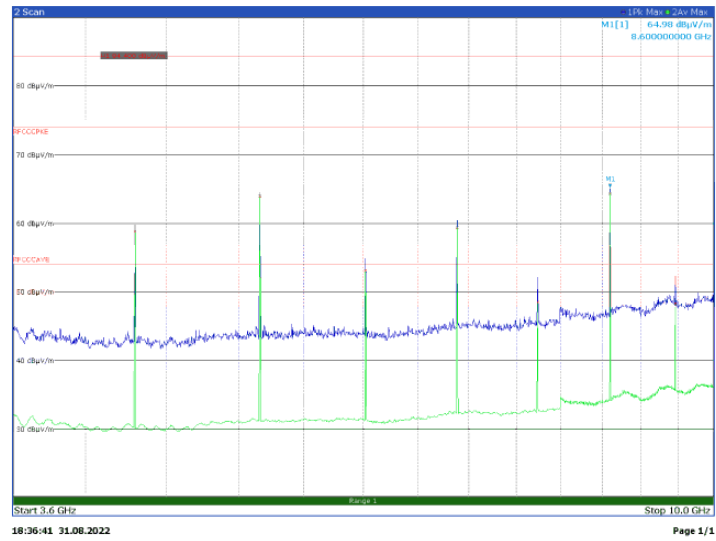
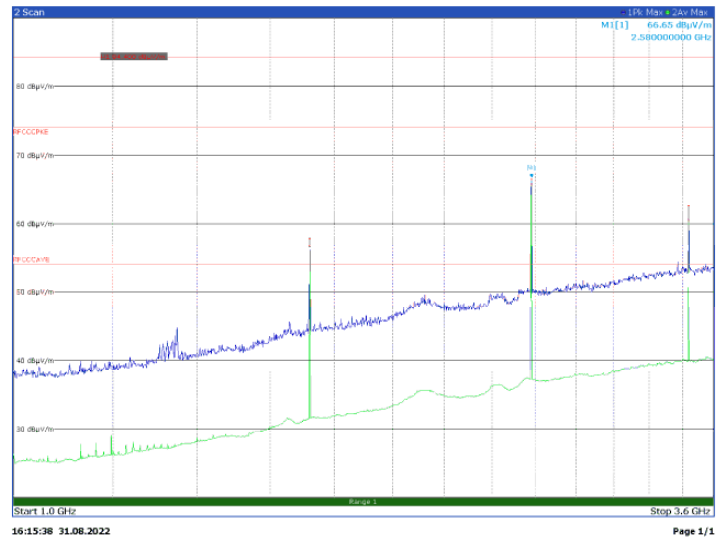
Radiated spurious emissions with modulation P25 C4FM at 851.1MHz – Frequency range 1 GHz to 10 GHz with antenna in horizontal polarization



Date: 30.AUG.2022 20:18:27

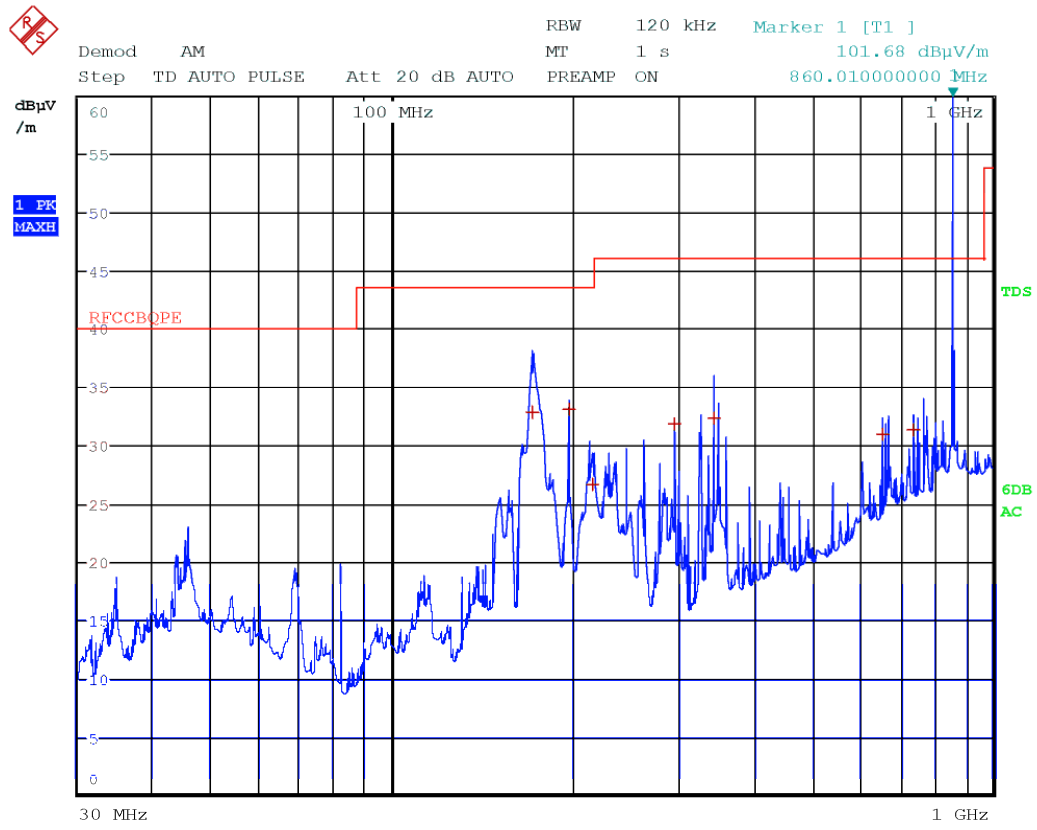
Limit -20 dBm erp = 77.4 dBμV/m at 3 m, limit exceeded by carrier

Radiated spurious emissions with modulation P25 C4FM at 860 MHz – Frequency range 30 MHz to 1 GHz with antenna in vertical polarization



Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
1720.00000	57.9	77.4	-19.5	Pk	-39.5	-20.0	-19.5	Pk
2580.00000	66.7	77.4	-10.7	Pk	-30.7	-20.0	-10.7	Pk
3440.00000	62.7	77.4	-14.7	Pk	-34.7	-20.0	-14.7	Pk
8600.00000	65.0	77.4	-12.4	Pk	-32.4	-20.0	-12.4	Pk

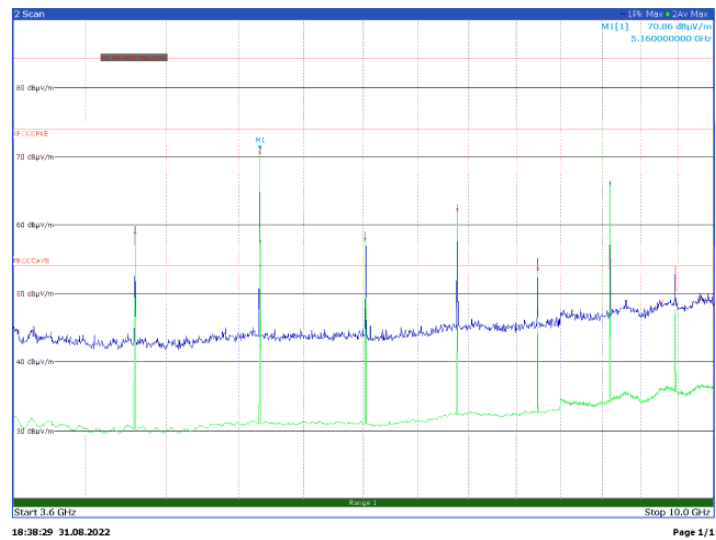
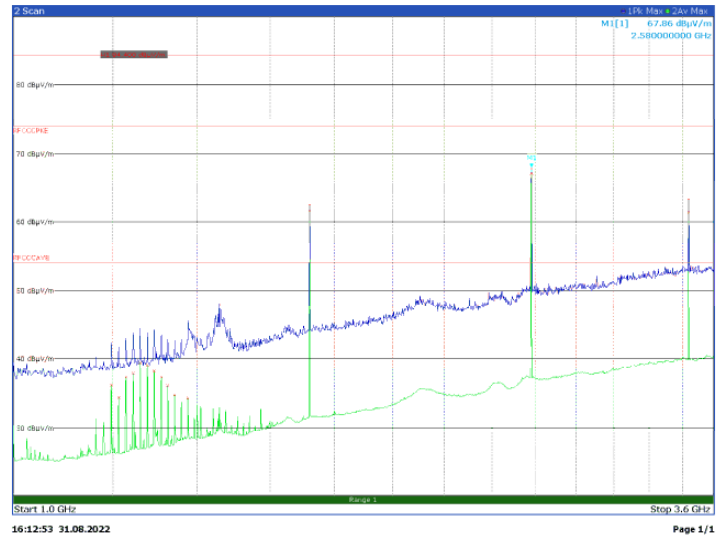
Radiated spurious emissions with modulation P25 C4FM at 860 MHz – Frequency range 1 GHz to 10 GHz with antenna in vertical polarization



Date: 30.AUG.2022 20:16:41

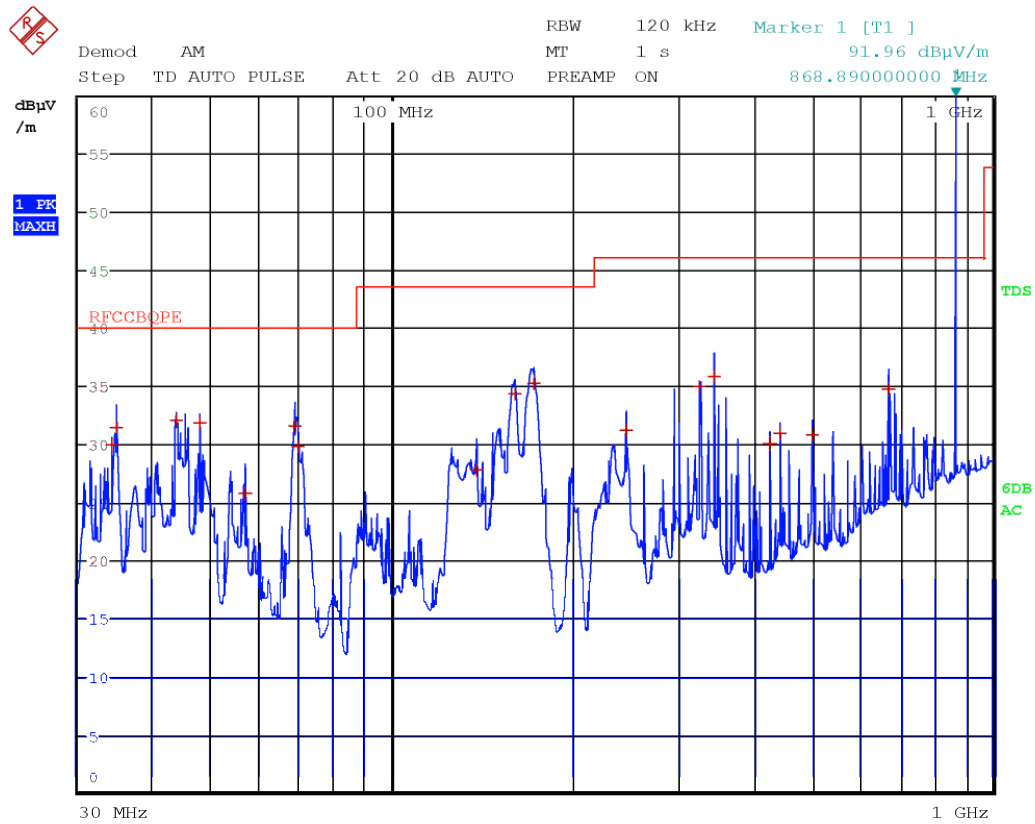
Limit -20 dBm erp = 77.4 dBμV/m at 3 m, limit exceeded by carrier

Radiated spurious emissions with modulation P25 C4FM at 860 MHz – Frequency range 30 MHz to 1 GHz with antenna in horizontal polarization



Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
1720.00000	62.5	77.4	-14.9	Pk	-34.9	-20.0	-14.9	Pk
2580.00000	67.9	77.4	-9.5	Pk	-29.5	-20.0	-9.5	Pk
3440.00000	63.3	77.4	-14.1	Pk	-34.1	-20.0	-14.1	Pk
5160.00000	70.9	77.4	-6.5	Pk	-26.5	-20.0	-6.5	Pk

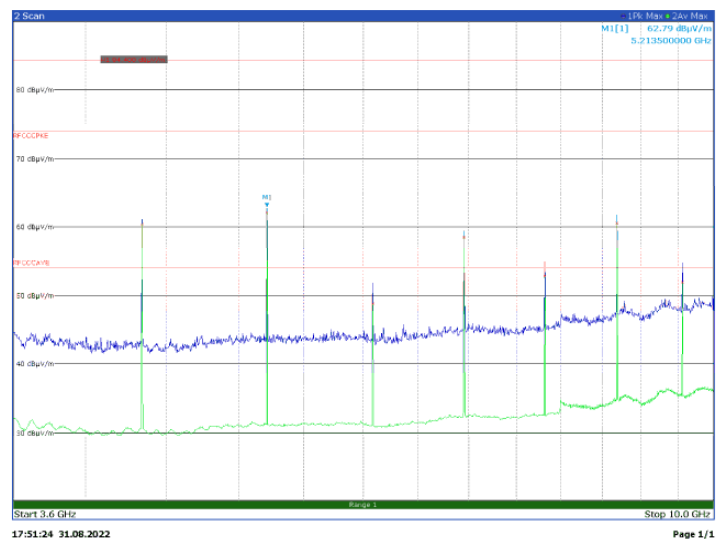
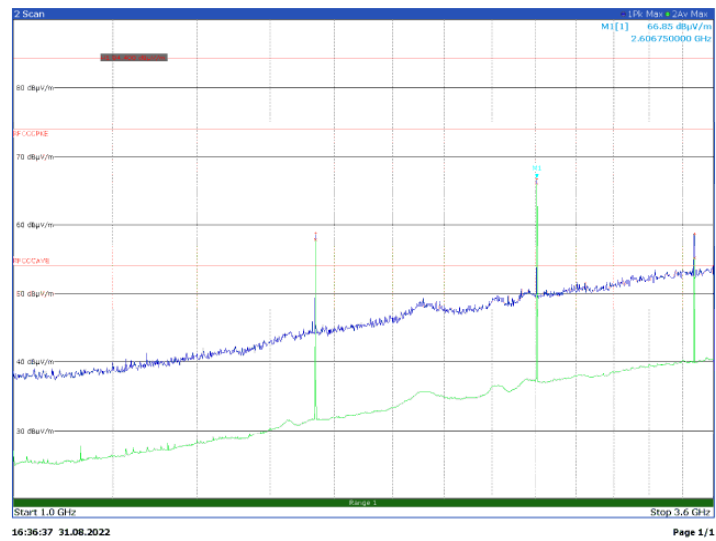
Radiated spurious emissions with modulation P25 C4FM at 860 MHz – Frequency range 1 GHz to 10 GHz with antenna in horizontal polarization



Date: 30.AUG.2022 20:35:39

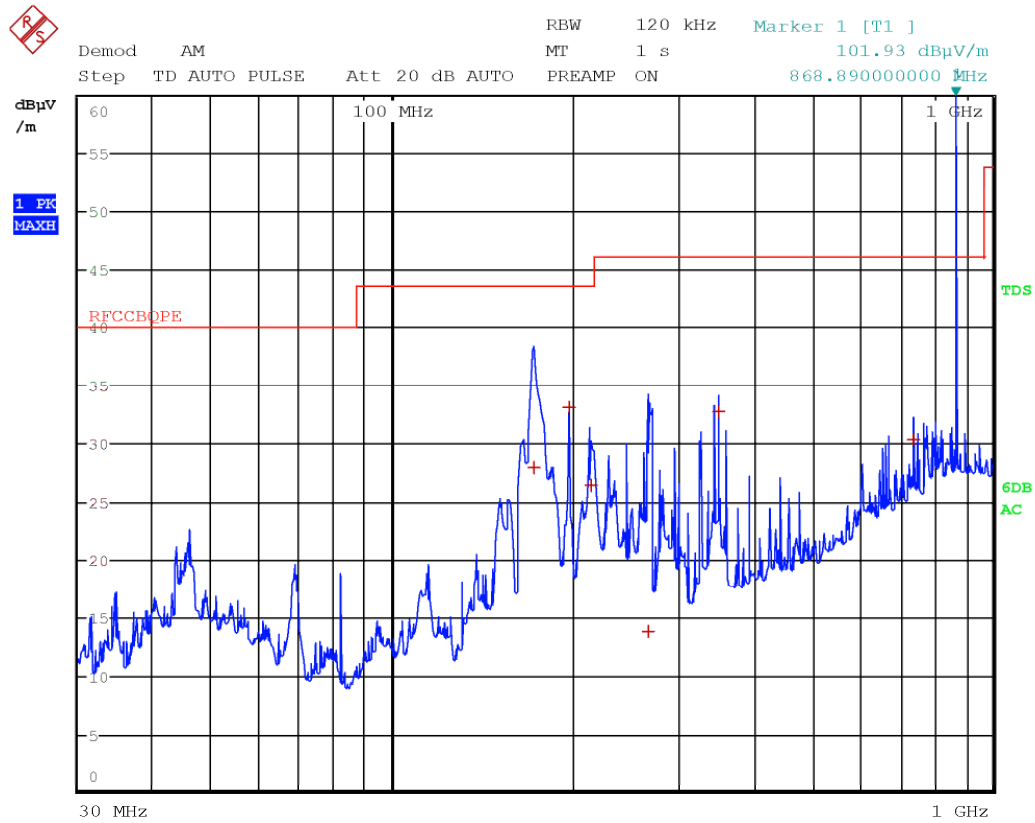
Limit -20 dBm erp = 77.4 dBμV/m at 3 m, limit exceeded by carrier

Radiated spurious emissions with modulation P25 C4FM at 868.9 MHz – Frequency range 30 MHz to 1 GHz with antenna in vertical polarization



Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
1737.75000	58.9	77.4	-18.5	Pk	-38.5	-20.0	-18.5	Pk
2606.75000	66.9	77.4	-10.5	Pk	-30.5	-20.0	-10.5	Pk
3475.50000	58.7	77.4	-18.7	Pk	-38.7	-20.0	-18.7	Pk
5213.50000	62.8	77.4	-14.6	Pk	-34.6	-20.0	-14.6	Pk

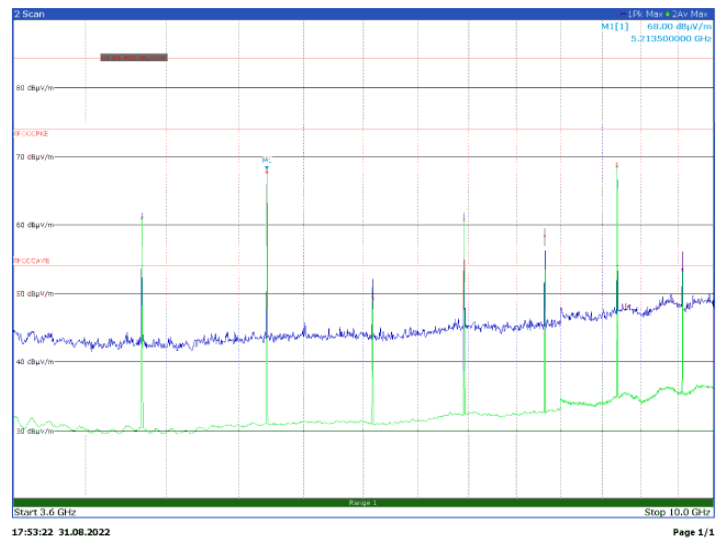
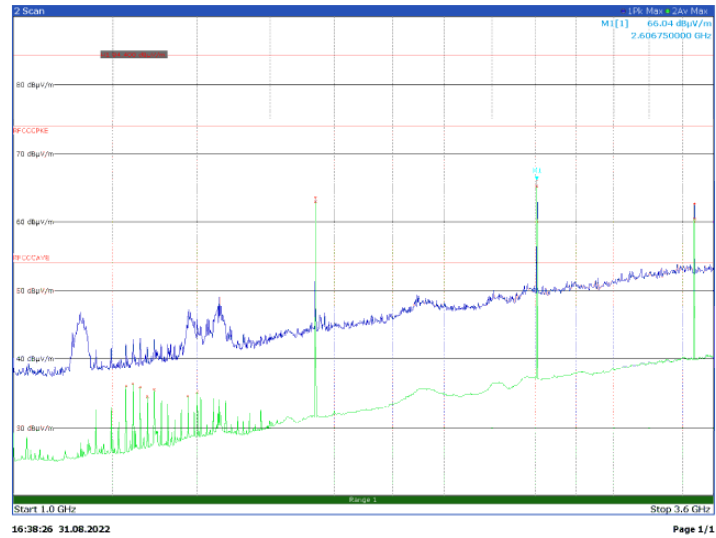
Radiated spurious emissions with modulation P25 C4FM at 868.9 MHz – Frequency range 1 GHz to 10 GHz with antenna in vertical polarization



Date: 30.AUG.2022 20:44:43

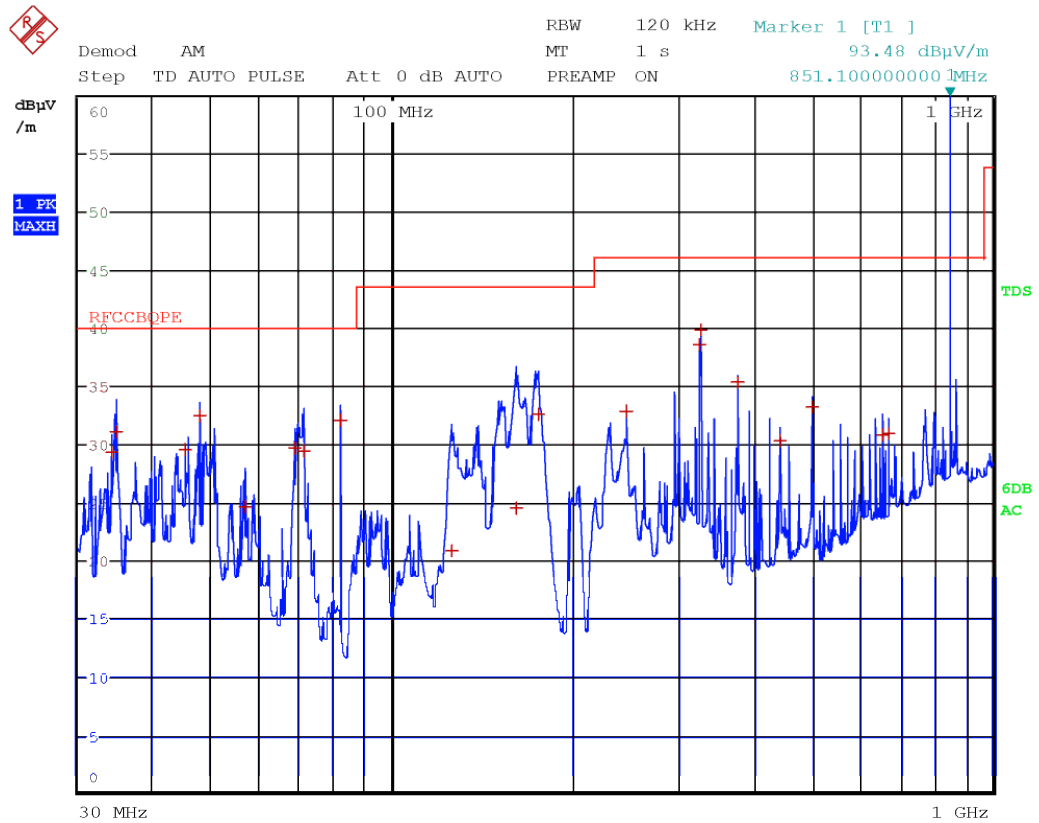
Limit -20 dBm erp = 77.4 dBμV/m at 3 m, limit exceeded by carrier

Radiated spurious emissions with modulation P25 C4FM at 868.9 MHz – Frequency range 30 MHz to 1 GHz with antenna in horizontal polarization



Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
1737.75000	63.6	77.4	-18.5	Pk	-33.8	-20.0	-18.5	Pk
2606.75000	66.1	77.4	-10.5	Pk	-31.3	-20.0	-10.5	Pk
3475.50000	62.6	77.4	-18.7	Pk	-34.8	-20.0	-18.7	Pk
5213.50000	68.0	77.4	-14.6	Pk	-29.4	-20.0	-14.6	Pk
8689.00000	69.0	77.4	-18.5	Pk	-28.4	-20.0	-18.5	Pk

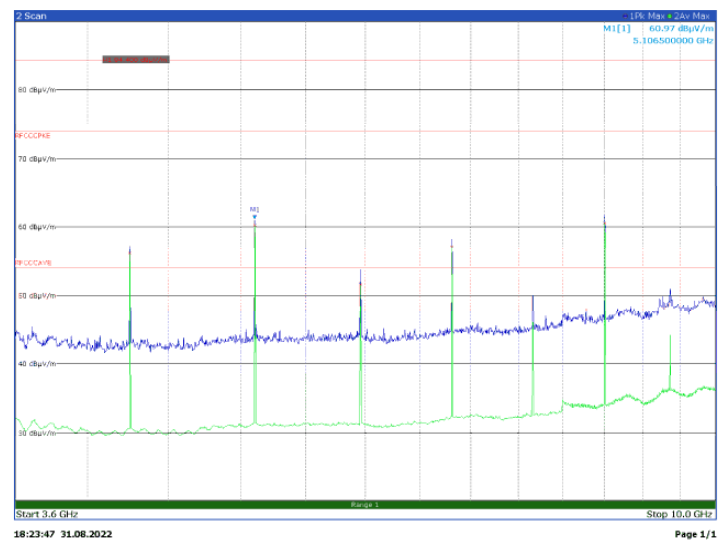
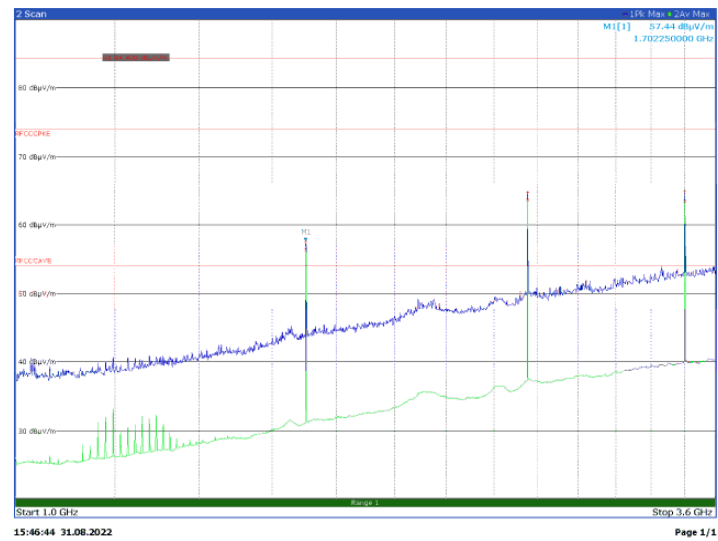
Radiated spurious emissions with modulation P25 C4FM at 868.9 MHz – Frequency range 1 GHz to 10 GHz with antenna in horizontal polarization



Date: 30.AUG.2022 20:04:08

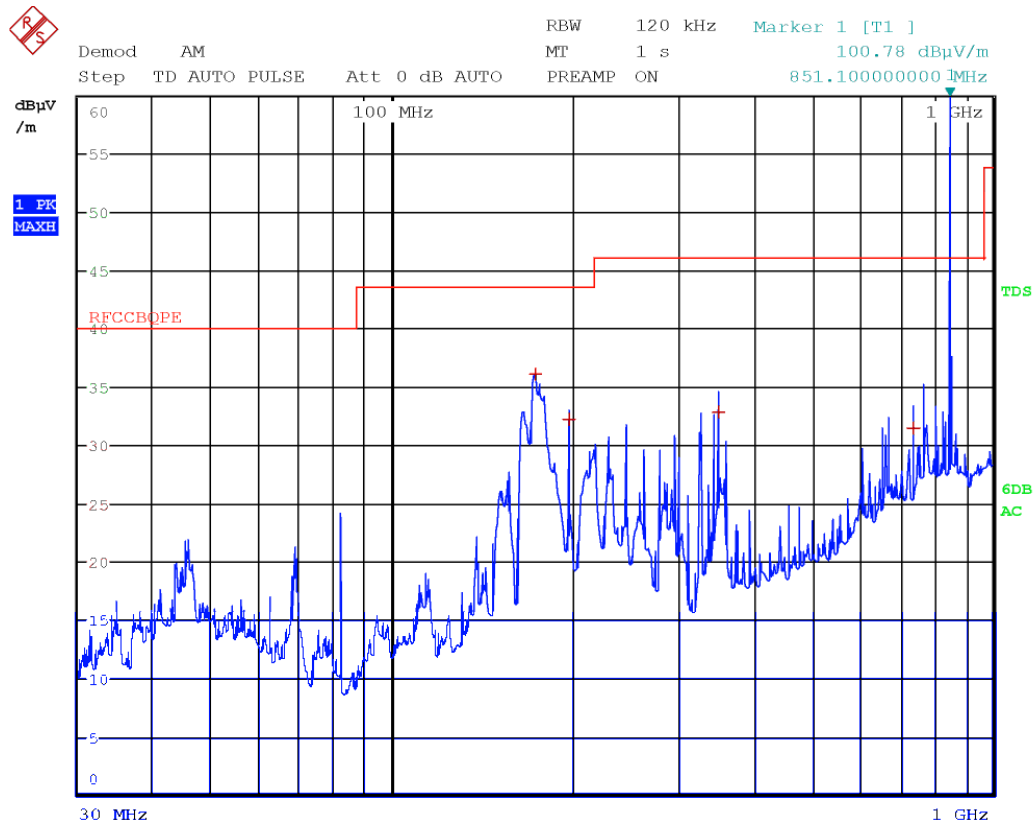
Limit -20 dBm erp = 77.4 dBμV/m at 3 m, limit exceeded by carrier

Radiated spurious emissions with modulation FM 12kHz 851.1 MHz – Frequency range 30 MHz to 1 GHz with antenna in vertical polarization



Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
1702.25000	57.5	77.4	-19.9	Pk	-39.9	-20.0	-19.9	Pk
2553.25000	64.7	77.4	-12.7	Pk	-32.7	-20.0	-12.7	Pk
3404.50000	64.9	77.4	-12.5	Pk	-32.5	-20.0	-12.5	Pk
5106.50000	61.0	77.4	-16.4	Pk	-36.4	-20.0	-16.4	Pk

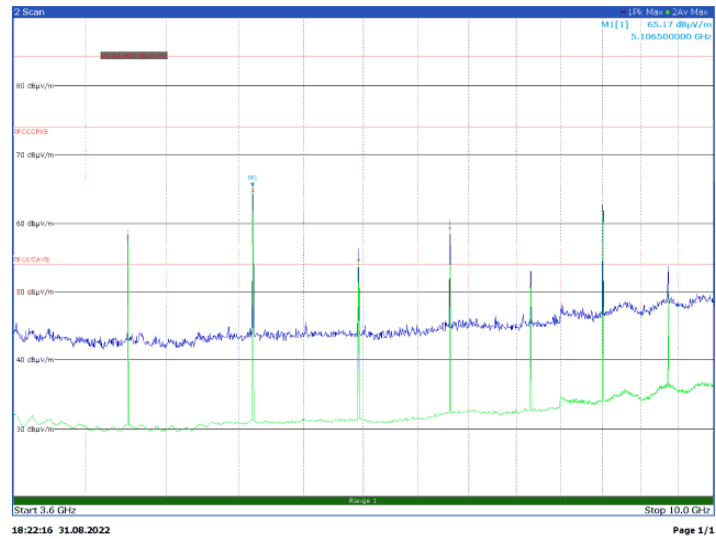
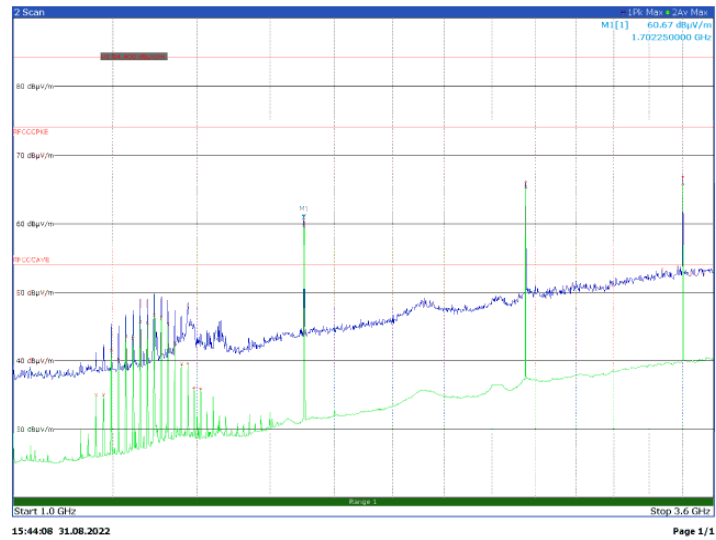
Radiated spurious emissions with modulation FM 12kHz 851.1 MHz – Frequency range 1 GHz to 10 GHz with antenna in vertical polarization



Date: 30.AUG.2022 20:01:43

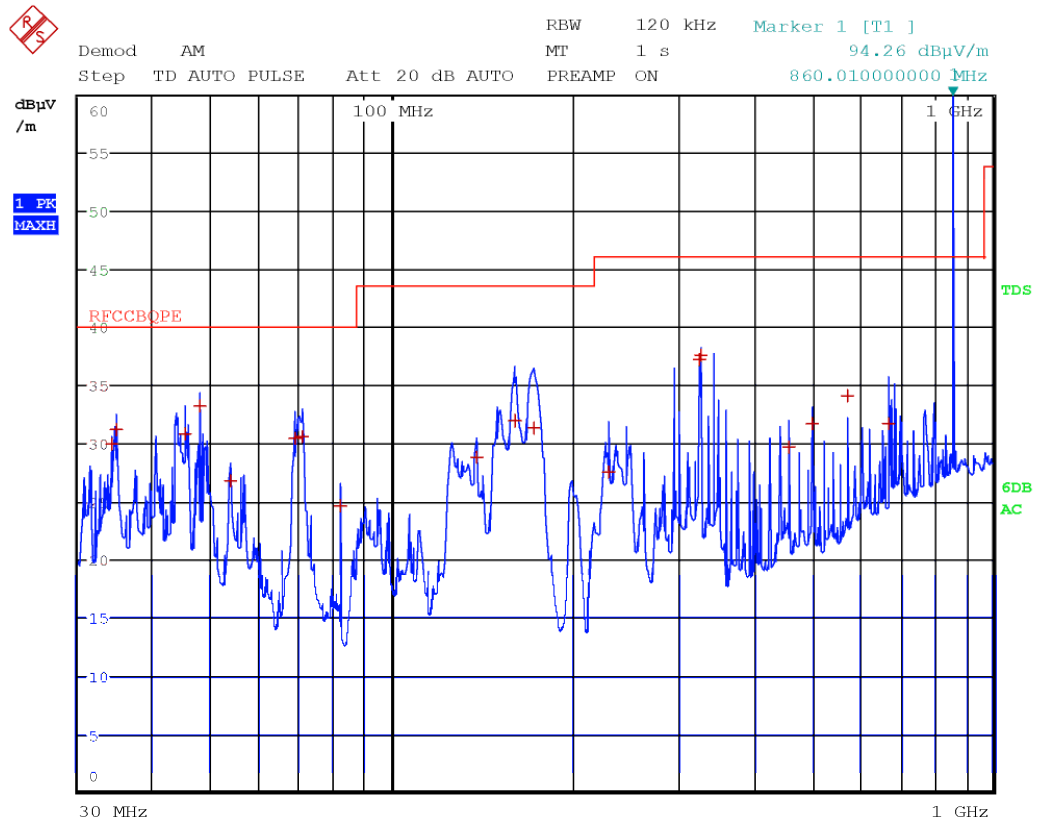
Limit -20 dBm erp = 77.4 dBμV/m at 3 m, limit exceeded by carrier

adiated spurious emissions with modulation FM 12kHz 851.1 MHz – Frequency range 30 MHz to 1 GHz with antenna in horizontal polarization



Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
1702.25000	60.7	77.4	-16.7	Pk	-36.7	-20.0	-16.7	Pk
2553.25000	66.2	77.4	-11.2	Pk	-31.2	-20.0	-11.2	Pk
3404.50000	67.0	77.4	-10.4	Pk	-30.4	-20.0	-10.4	Pk
5106.50000	65.2	77.4	-12.2	Pk	-32.2	-20.0	-12.2	Pk

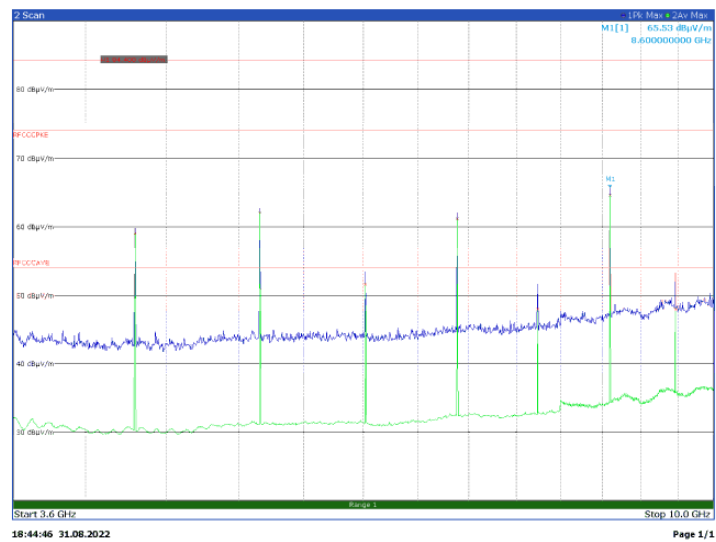
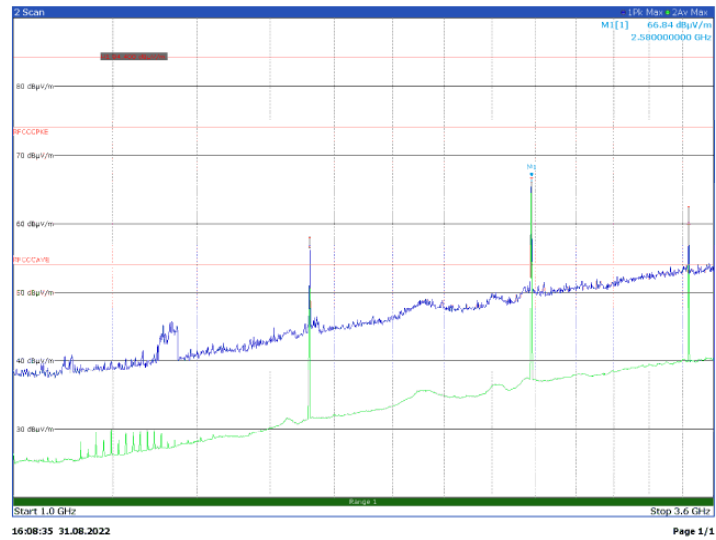
adiated spurious emissions with modulation FM 12kHz 851.1 MHz – Frequency range 1 GHz to 10 GHz with antenna in horizontal polarization



Date: 30.AUG.2022 20:23:20

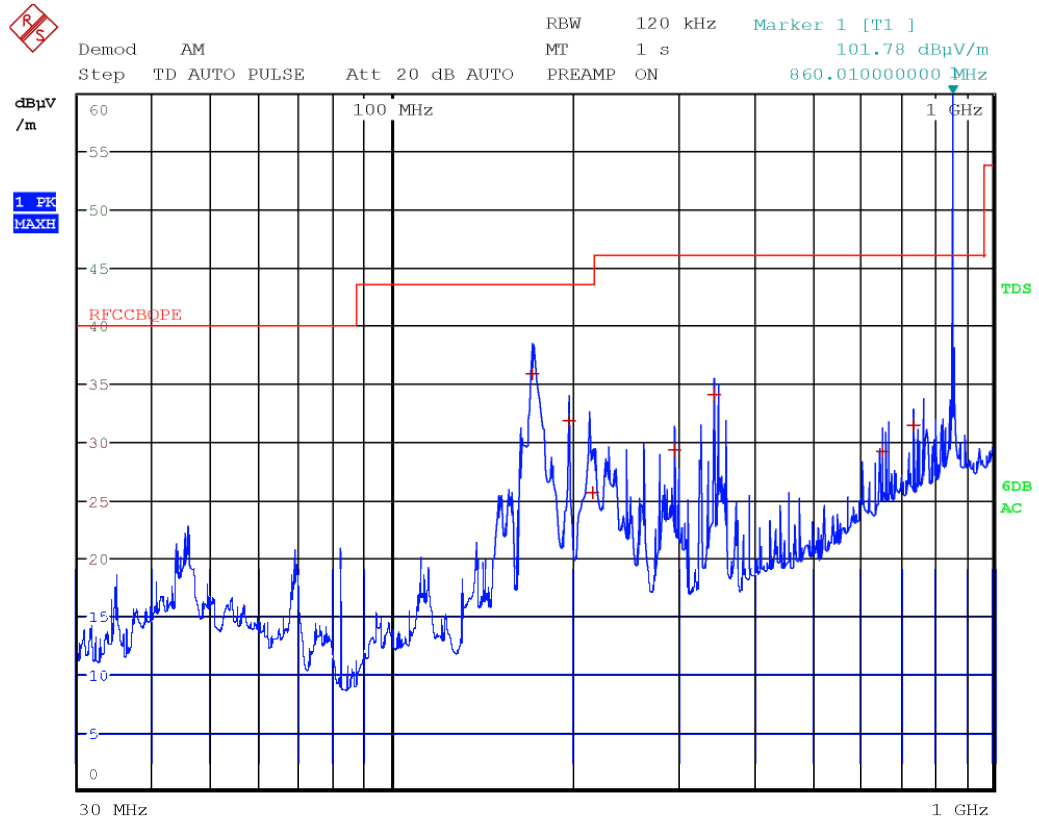
Limit -20 dBm erp = 77.4 dBμV/m at 3 m, limit exceeded by carrier

Radiated spurious emissions with modulation FM 12kHz 860 MHz – Frequency range 30 MHz to 1 GHz with antenna in vertical polarization



Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
1720.00000	58.0	77.4	-19.4	Pk	-39.4	-20.0	-19.4	Pk
2580.00000	66.9	77.4	-10.5	Pk	-30.5	-20.0	-10.5	Pk
3440.00000	62.5	77.4	-14.9	Pk	-34.9	-20.0	-14.9	Pk
8600.00000	65.6	77.4	-11.8	Pk	-31.8	-20.0	-11.8	Pk

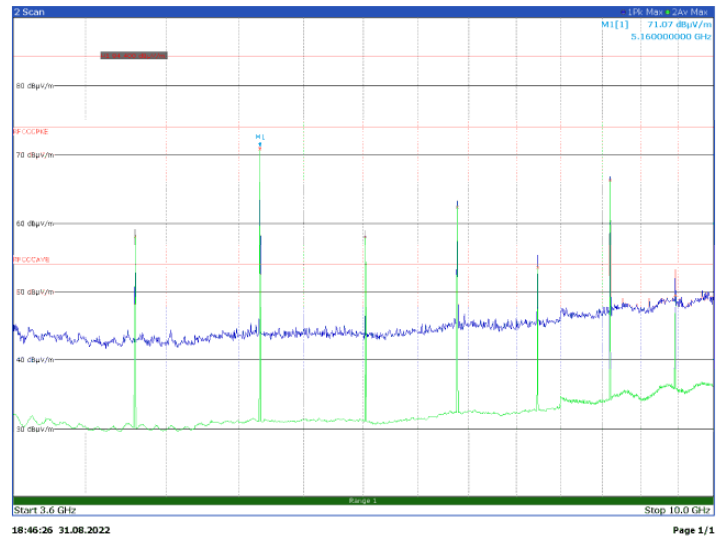
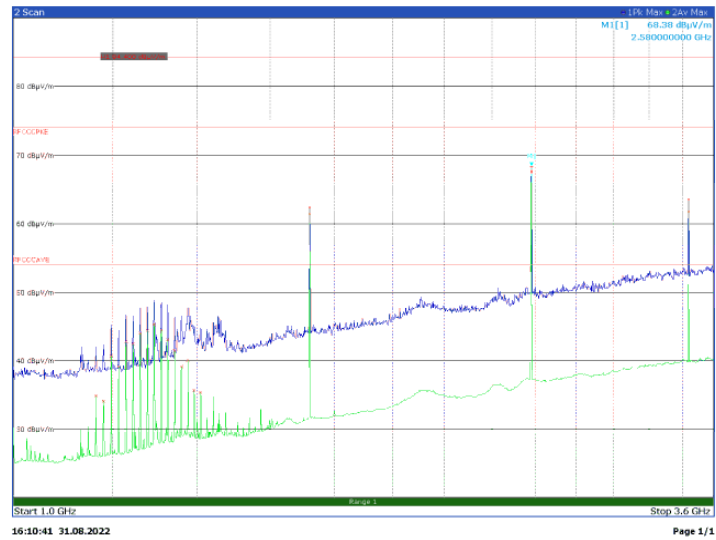
Radiated spurious emissions with modulation FM 12kHz 860 MHz – Frequency range 1 GHz to 10 GHz with antenna in vertical polarization



Date: 30.AUG.2022 20:12:40

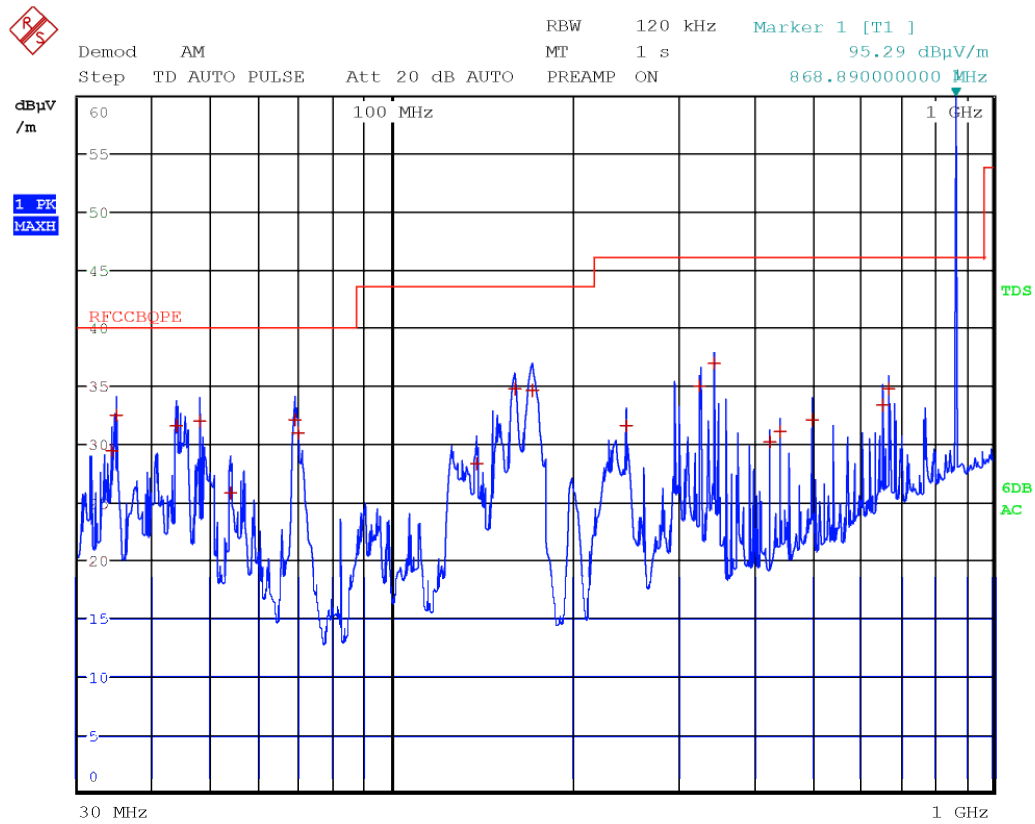
Limit -20 dBm erp = 77.4 dBμV/m at 3 m, limit exceeded by carrier

Radiated spurious emissions with modulation FM 12kHz 860 MHz – Frequency range 30 MHz to 1 GHz with antenna in horizontal polarization



Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
1720.00000	62.4	77.4	-15.0	Pk	-35.0	-20.0	-15.0	Pk
2580.00000	68.4	77.4	-9.0	Pk	-29.0	-20.0	-9.0	Pk
3440.00000	63.6	77.4	-13.8	Pk	-33.8	-20.0	-13.8	Pk
5160.00000	71.1	77.4	-6.3	Pk	-26.3	-20.0	-6.3	Pk

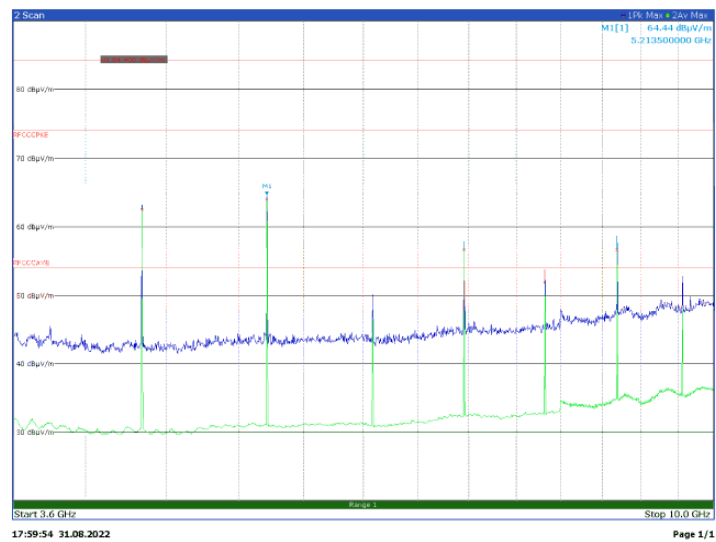
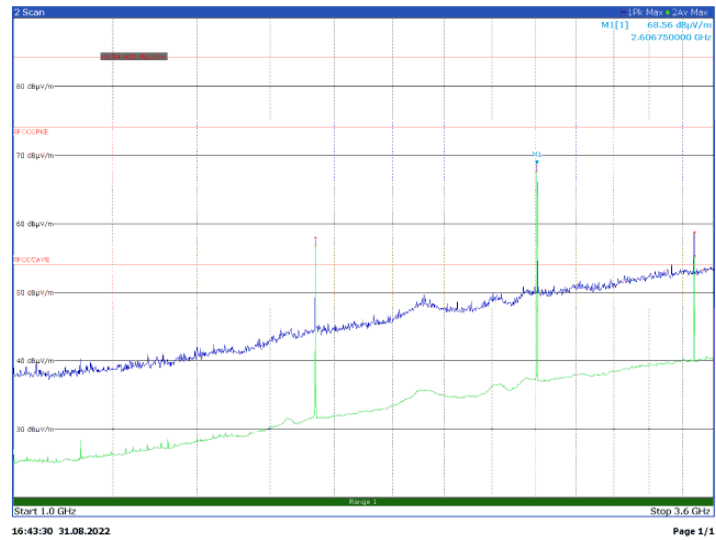
Radiated spurious emissions with modulation FM 12kHz 860 MHz – Frequency range 1 GHz to 10 GHz with antenna in horizontal polarization



Date: 30.AUG.2022 20:32:02

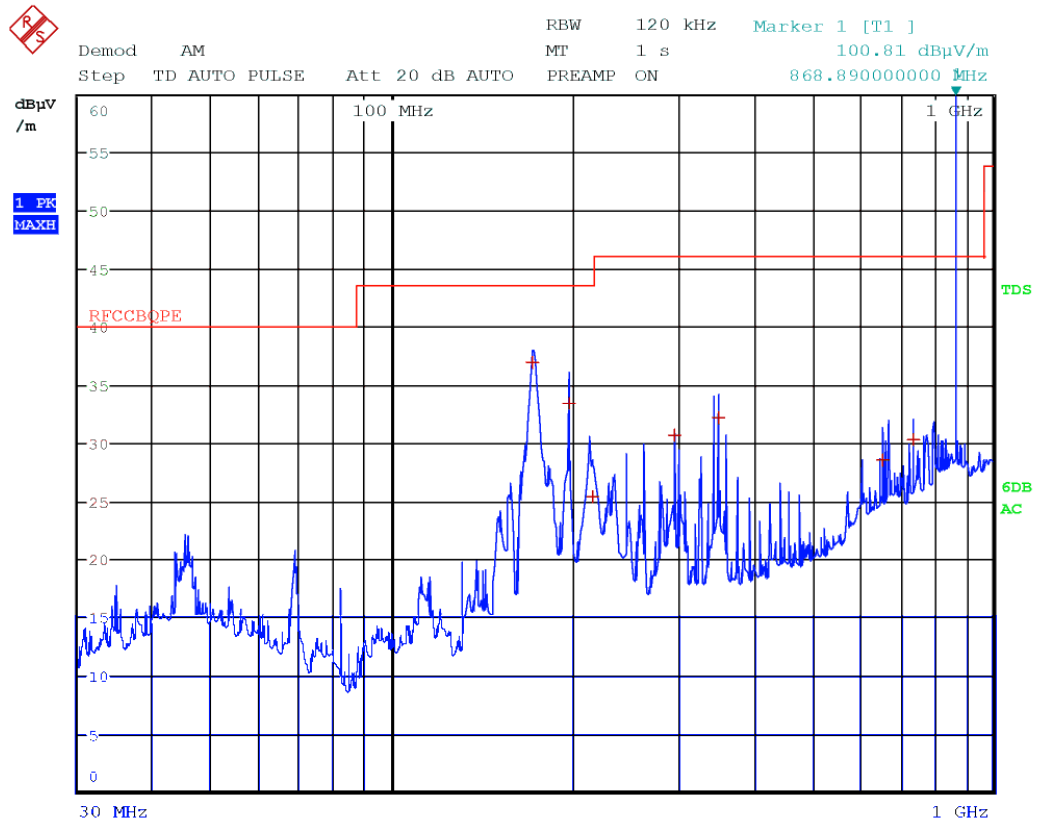
Limit -20 dBm erp = 77.4 dBμV/m at 3 m, limit exceeded by carrier

Radiated spurious emissions with modulation FM 12kHz 868.9 MHz – Frequency range 30 MHz to 1 GHz with antenna in vertical polarization



Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
1737.75000	58.0	77.4	-19.4	Pk	-39.4	-20.0	-19.4	Pk
2606.75000	68.6	77.4	-8.8	Pk	-28.8	-20.0	-8.8	Pk
3475.50000	58.8	77.4	-18.6	Pk	-38.6	-20.0	-18.6	Pk
5213.50000	64.4	77.4	-13.0	Pk	-33.0	-20.0	-13.0	Pk

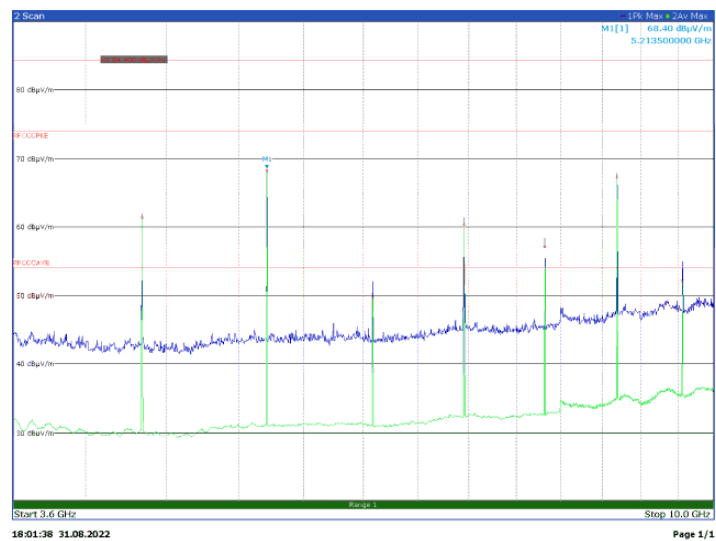
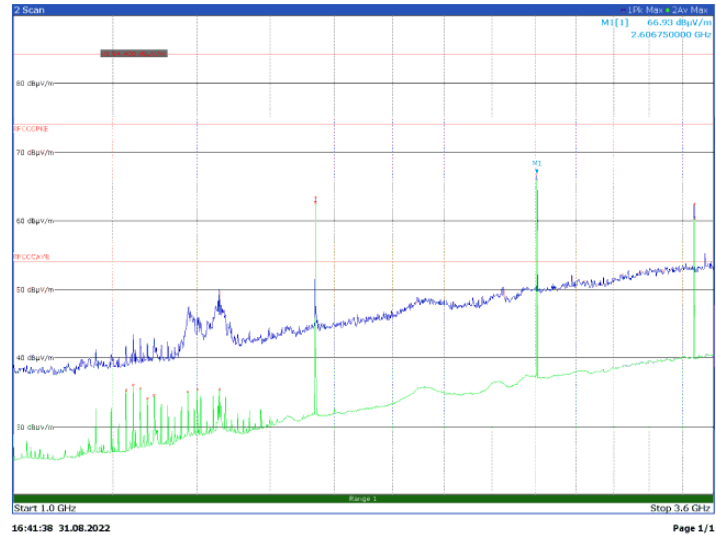
Radiated spurious emissions with modulation FM 12kHz 868.9 MHz – Frequency range 31 GHz to 10 GHz with antenna in vertical polarization



Date: 30.AUG.2022 20:47:22

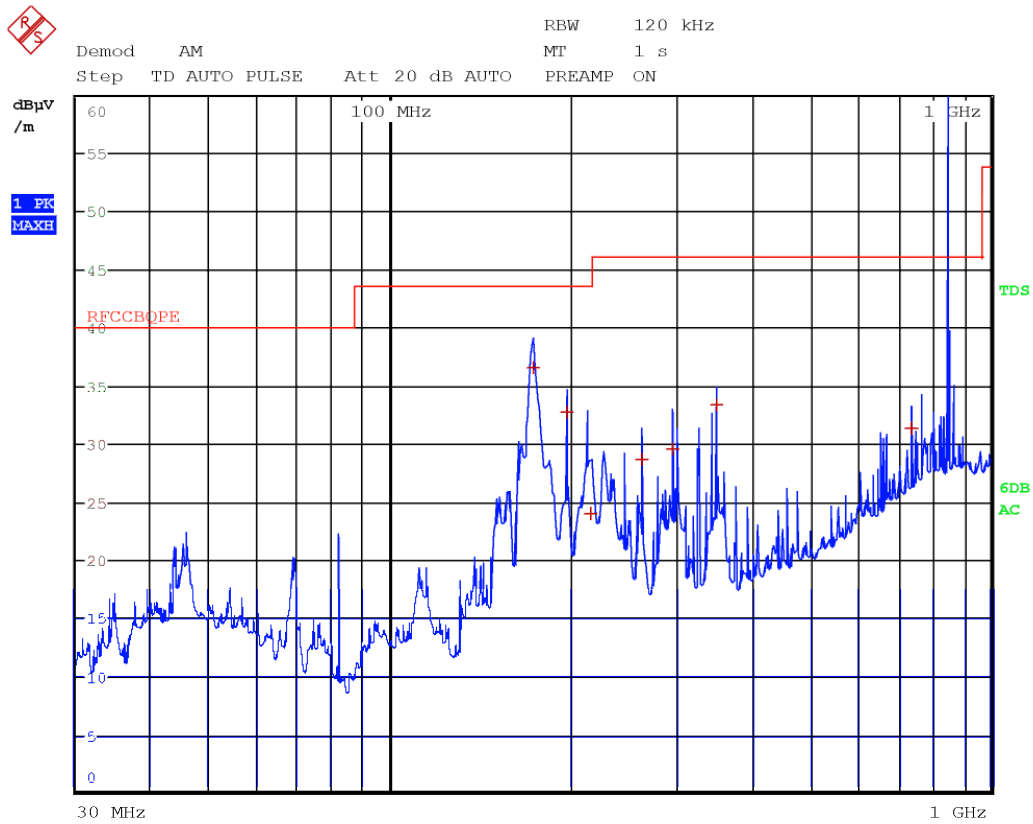
Limit -20 dBm erp = 77.4 dBμV/m at 3 m, limit exceeded by carrier

Radiated spurious emissions with modulation FM 12KHz 868.9 MHz – Frequency range 30 MHz to 1 GHz with antenna in horizontal polarization



Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
1737.75000	63.4	77.4	-14.0	Pk	-34.0	-20.0	-14.0	Pk
2606.75000	67.0	77.4	-10.4	Pk	-30.4	-20.0	-10.4	Pk
3475.50000	62.5	77.4	-14.9	Pk	-34.9	-20.0	-14.9	Pk
5213.50000	68.4	77.4	-9.0	Pk	-29.0	-20.0	-9.0	Pk

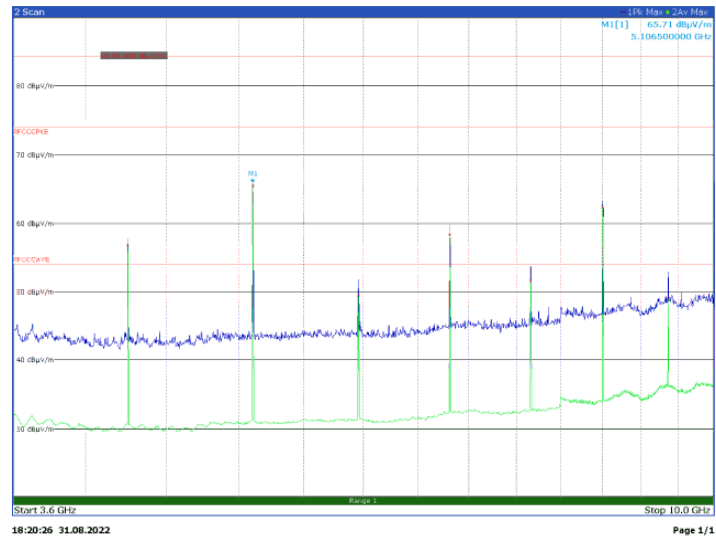
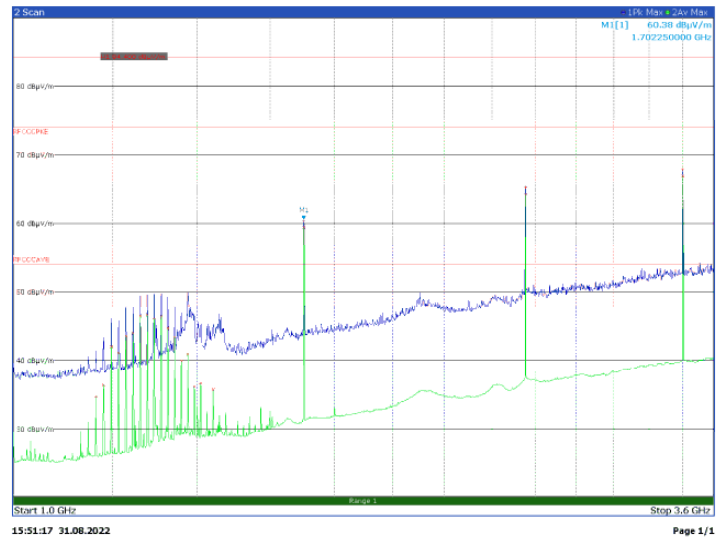
Radiated spurious emissions with modulation FM 12KHz 868.9 MHz – Frequency range 31 GHz to 10 GHz with antenna in horizontal polarization



Date: 30.AUG.2022 20:08:18

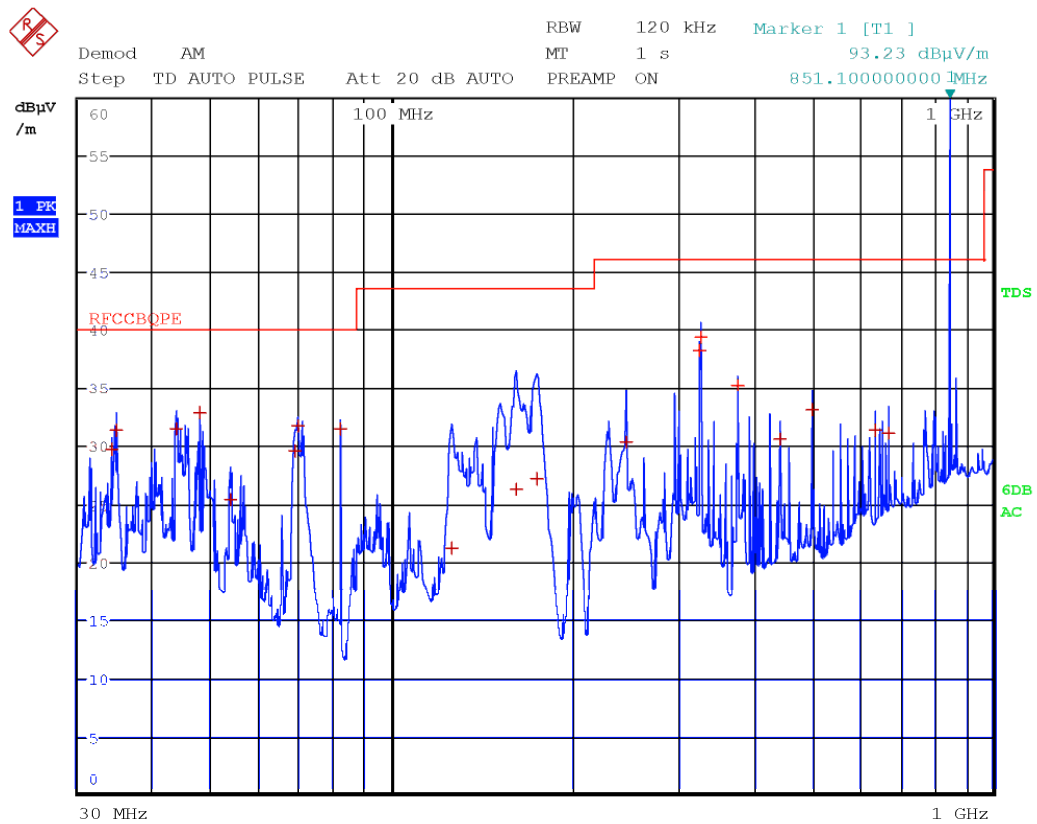
Limit -13 dBm erp = 84.4 dBμV/m at 3 m, limit exceeded by carrier

Radiated spurious emissions with modulation FM 25 kHz 851.1 MHz – Frequency range 30 MHz to 1 GHz with antenna in horizontal polarization



Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
1702.25000	60.4	84.4	-24.0	Pk	-37.0	-13.0	-24.0	Pk
2553.25000	65.2	84.4	-19.2	Pk	-32.2	-13.0	-19.2	Pk
3404.50000	67.9	84.4	-16.5	Pk	-29.5	-13.0	-16.5	Pk
5106.50000	65.7	84.4	-18.7	Pk	-31.7	-13.0	-18.7	Pk

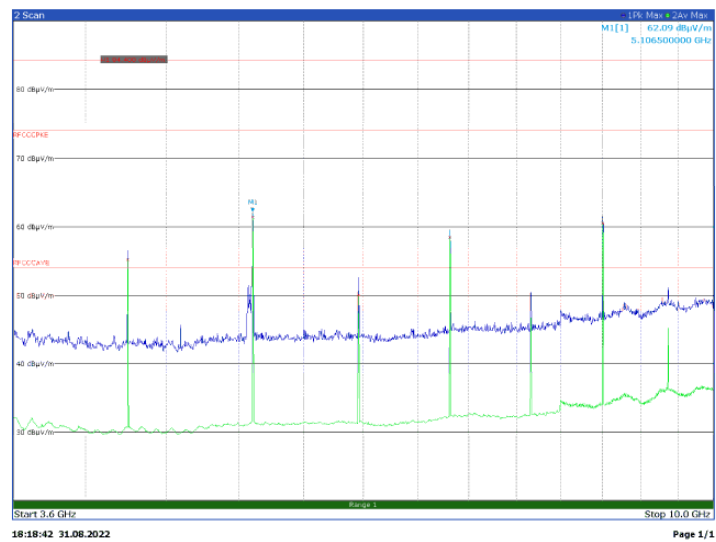
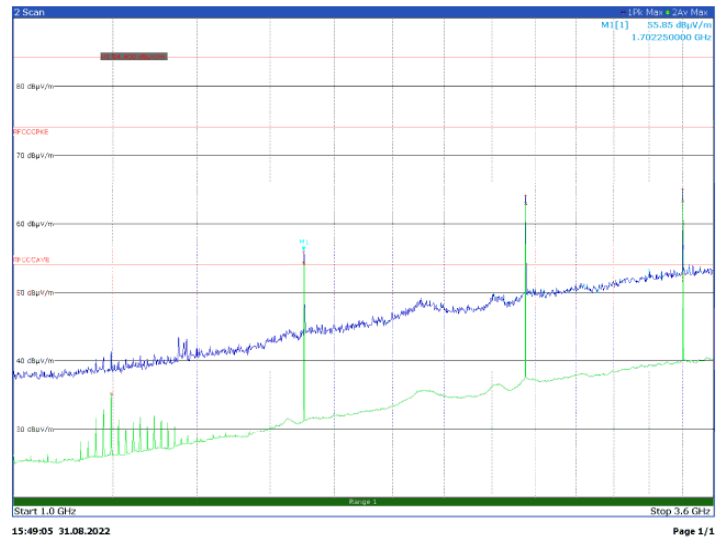
Radiated spurious emissions with modulation FM 25 kHz 851.1 MHz – Frequency range 1 GHz to 10 GHz with antenna in horizontal polarization



Date: 30.AUG.2022 20:06:01

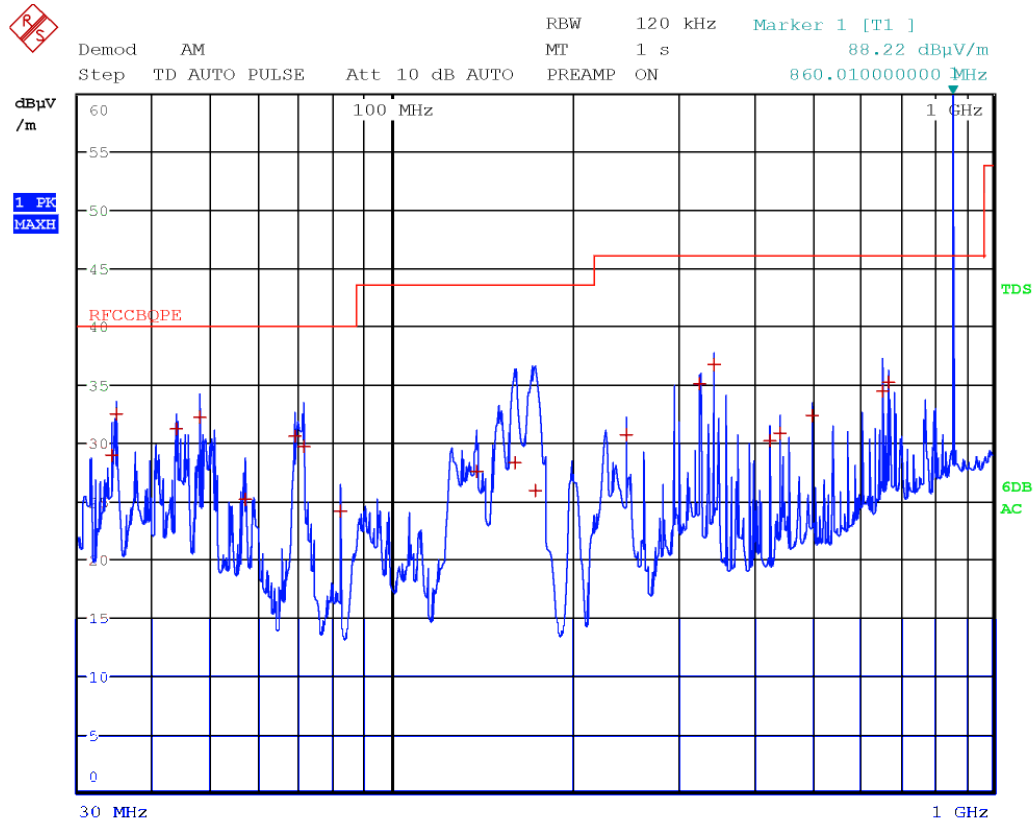
Limit -13 dBm erp = 84.4 dBμV/m at 3 m, limit exceeded by carrier

Radiated spurious emissions with modulation FM 25 kHz 851.1 MHz – Frequency range 30 MHz to 1 GHz with antenna in vertical polarization



Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
1702.25000	55.9	84.4	-28.5	Pk	-41.5	-13.0	-28.5	Pk
2553.25000	64.1	84.4	-20.3	Pk	-33.3	-13.0	-20.3	Pk
3404.50000	65.0	84.4	-19.4	Pk	-32.4	-13.0	-19.4	Pk
5106.50000	62.1	84.4	-22.3	Pk	-35.3	-13.0	-22.3	Pk

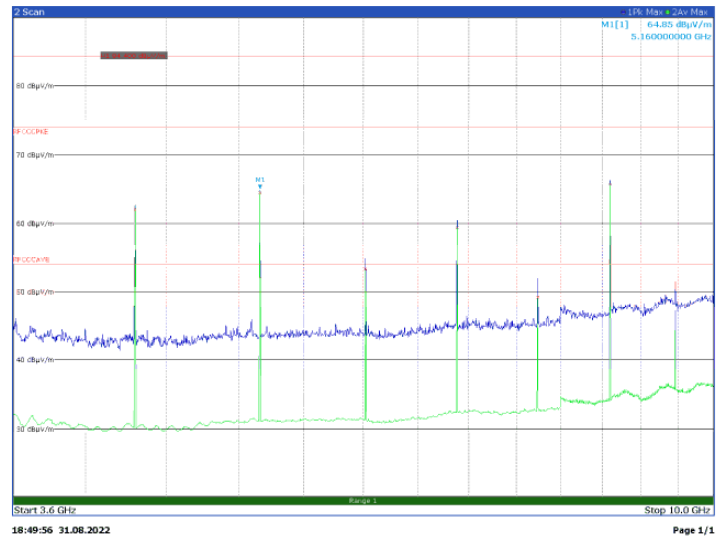
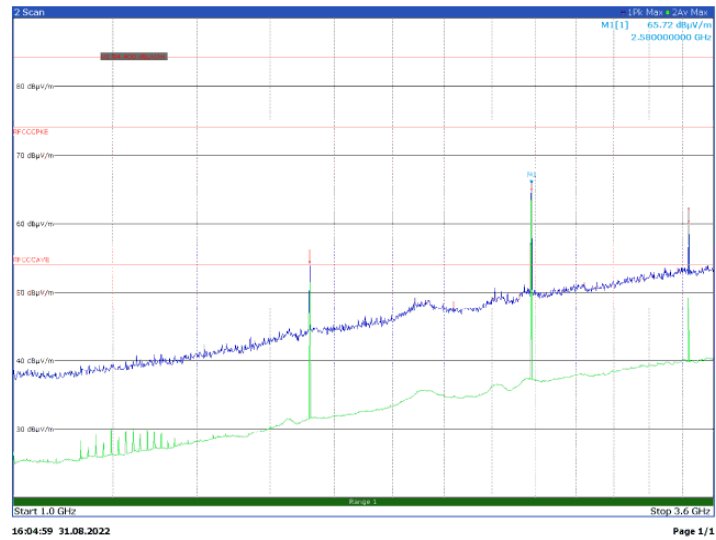
Radiated spurious emissions with modulation FM 25 kHz 851.1 MHz – Frequency range 1 GHz to 10 GHz with antenna in vertical polarization



Date: 30.AUG.2022 20:25:38

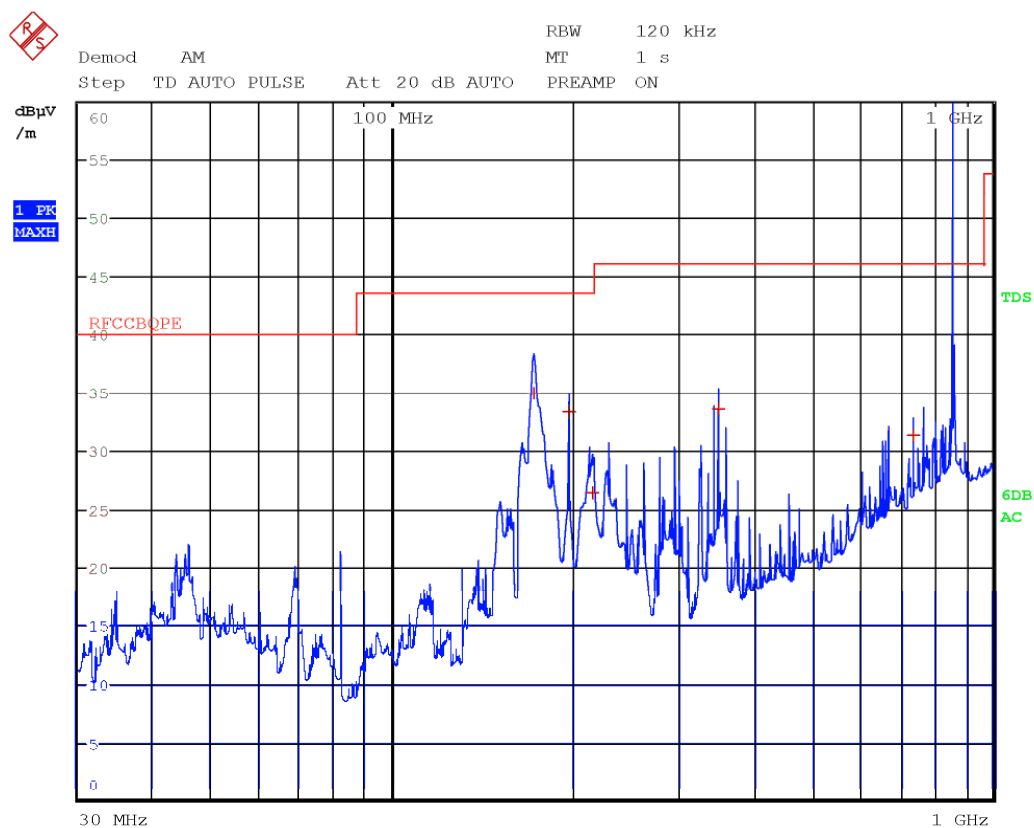
Limit -13 dBm erp = 84.4 dBμV/m at 3 m, limit exceeded by carrier

Radiated spurious emissions with modulation FM 25 kHz 860 MHz – Frequency range 30 MHz to 1 GHz with antenna in vertical polarization



Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
1720.00000	56.1	84.4	-28.3	Pk	-41.3	-13.0	-28.3	Pk
2580.00000	65.8	84.4	-18.6	Pk	-31.6	-13.0	-18.6	Pk
3440.00000	62.2	84.4	-22.2	Pk	-35.2	-13.0	-22.2	Pk
5160.00000	64.9	84.4	-19.6	Pk	-32.6	-13.0	-19.6	Pk

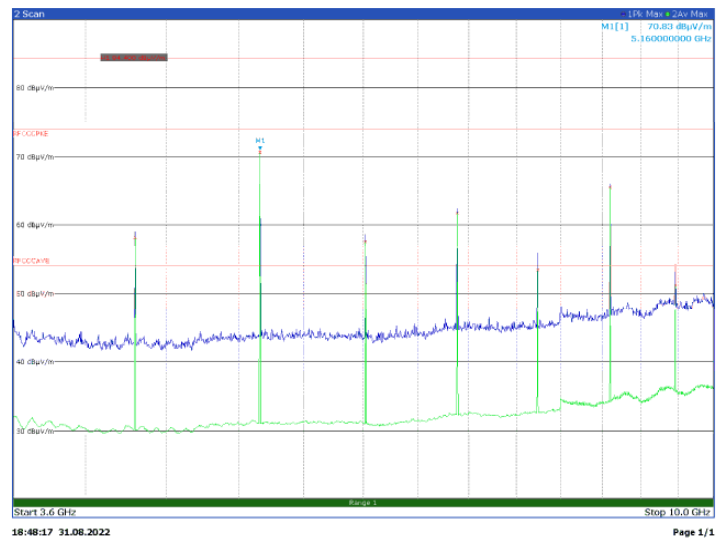
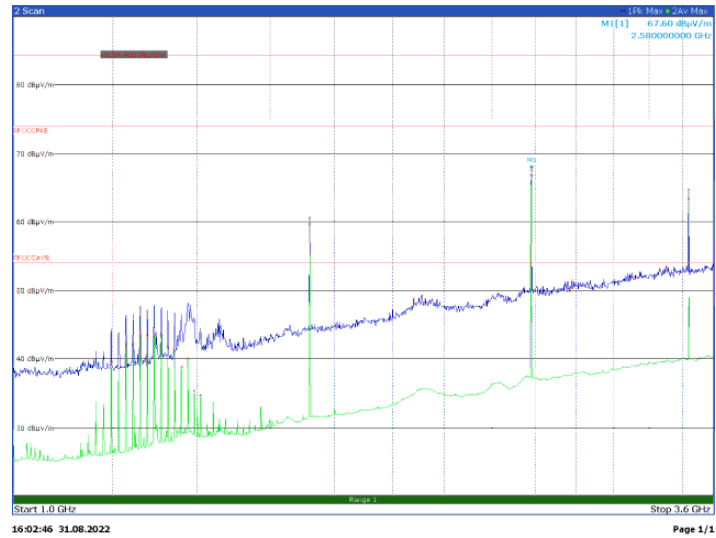
Radiated spurious emissions with modulation FM 25 kHz 860 MHz – Frequency range 1 GHz to 10 GHz with antenna in vertical polarization



Date: 30.AUG.2022 20:10:33

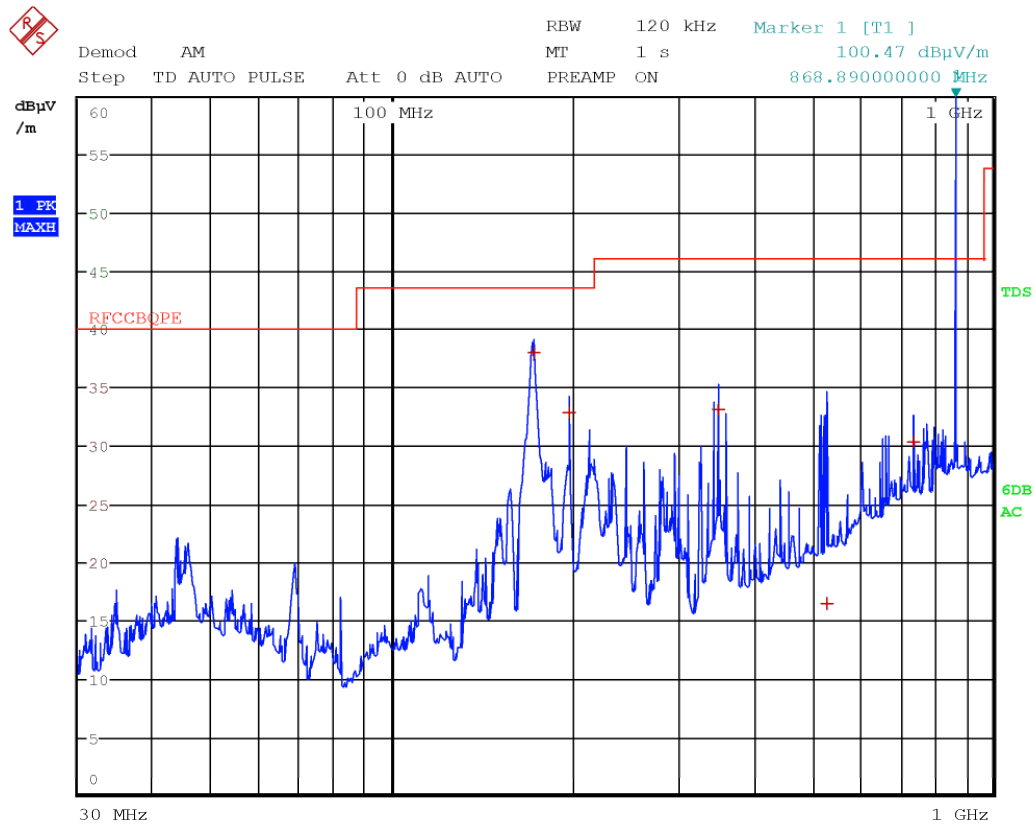
Limit -13 dBm erp = 84.4 dBμV/m at 3 m, limit exceeded by carrier

Radiated spurious emissions with modulation FM 25 kHz 860 MHz – Frequency range 30 MHz to 1 GHz with antenna in horizontal polarization



Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
1720.00000	60.7	84.4	-23.7	Pk	-36.7	-13.0	-23.7	Pk
2580.00000	67.6	84.4	-16.8	Pk	-29.8	-13.0	-16.8	Pk
3440.00000	64.7	84.4	-19.7	Pk	-32.7	-13.0	-19.7	Pk
5160.00000	70.9	84.4	-13.5	Pk	-26.5	-13.0	-13.5	Pk

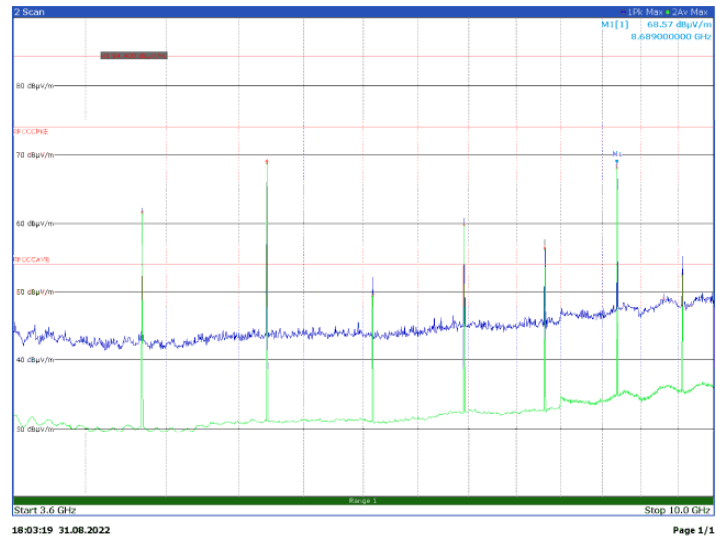
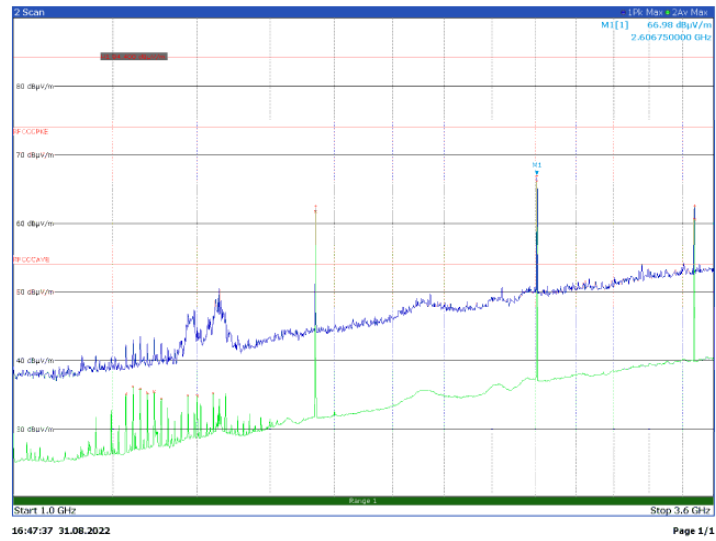
Radiated spurious emissions with modulation FM 25 kHz 860 MHz – Frequency range 1 GHz 10 GHz with antenna in horizontal polarization



Date: 30.AUG.2022 20:48:51

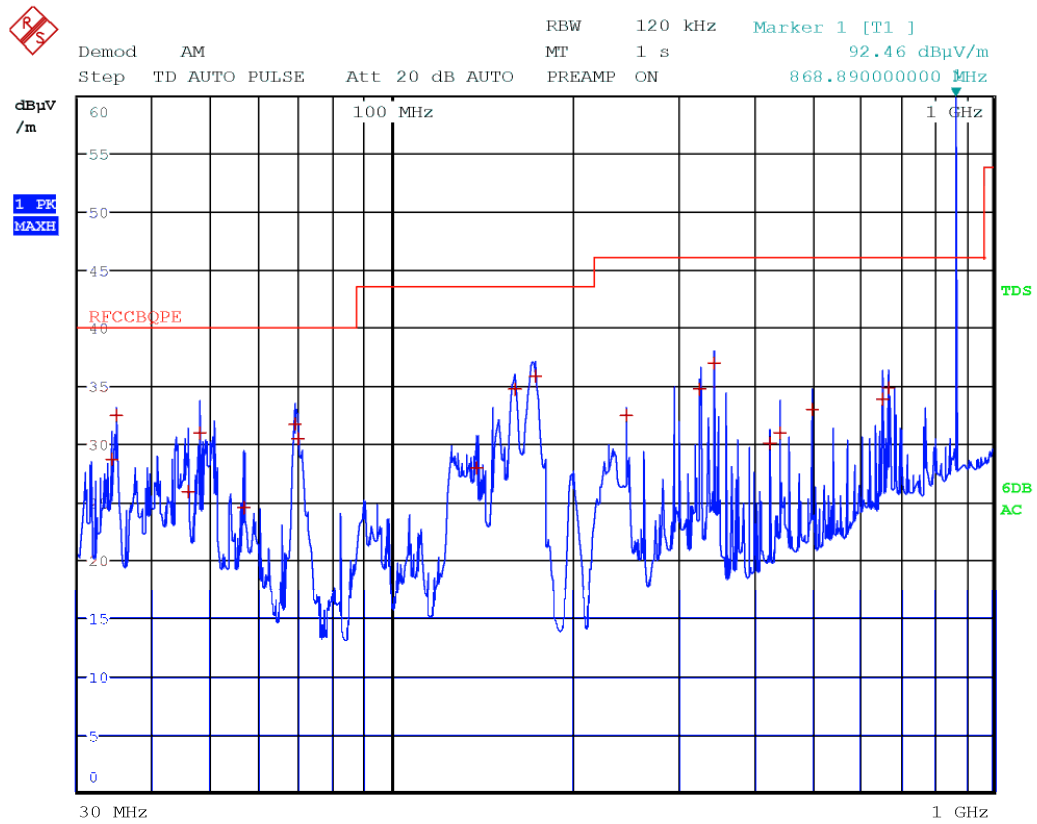
Limit -13 dBm erp = 84.4 dBμV/m at 3 m, limit exceeded by carrier

Radiated spurious emissions with modulation FM 25 kHz 868.9 MHz – Frequency range 30 MHz to 1 GHz with antenna in horizontal polarization



Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
1737.75000	62.5	84.4	-21.9	Pk	-34.9	-13.0	-21.9	Pk
2606.75000	67.0	84.4	-17.4	Pk	-30.4	-13.0	-17.4	Pk
3475.75000	62.6	84.4	-21.8	Pk	-34.8	-13.0	-21.8	Pk
5213.50000	69.2	84.4	-15.2	Pk	-28.2	-13.0	-15.2	Pk
8689.00000	68.6	84.4	-15.8	Pk	-28.8	-13.0	-15.8	Pk

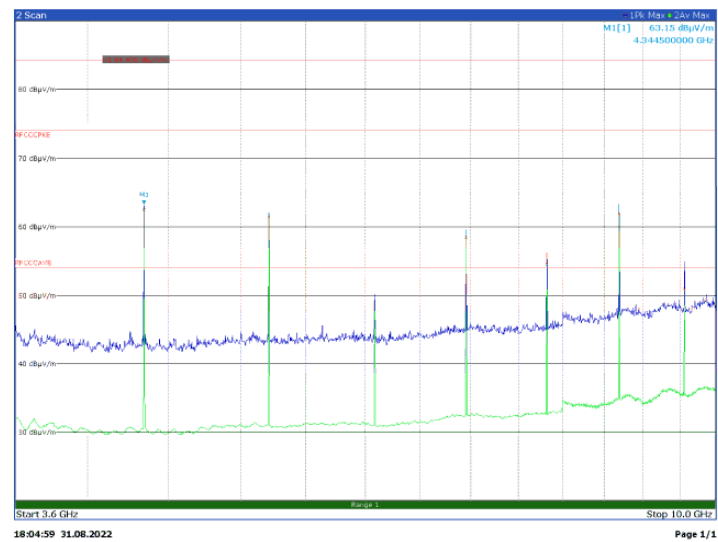
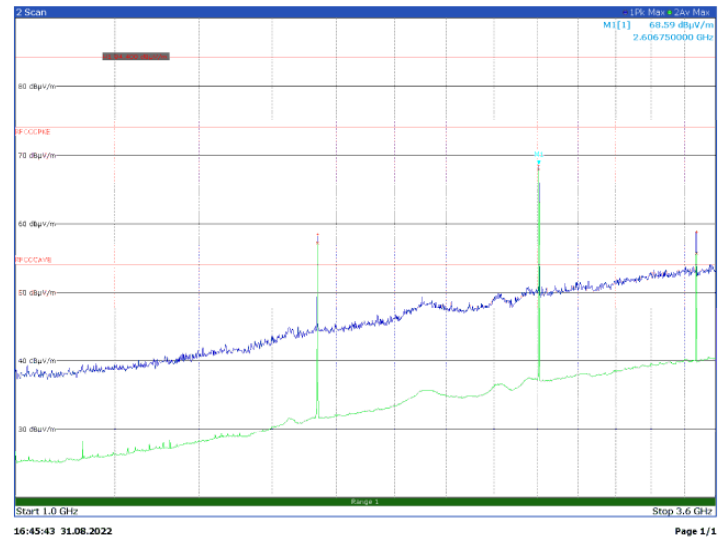
Radiated spurious emissions with modulation FM 25 kHz 868.9 MHz – Frequency range 1 GHz to 10 GHz with antenna in horizontal polarization



Date: 30.AUG.2022 20:30:00

Limit -13 dBm erp = 84.4 dBμV/m at 3 m, limit exceeded by carrier

Radiated spurious emissions with modulation FM 25 kHz 868.9 MHz – Frequency range 30 MHz to 1 GHz with antenna in vertical polarization



Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
1737.75000	58.5	84.4	-25.9	Pk	-38.9	-13.0	-25.9	Pk
2606.75000	68.6	84.4	-15.8	Pk	-28.8	-13.0	-15.8	Pk
3475.50000	58.9	84.4	-25.5	Pk	-38.5	-13.0	-25.5	Pk
4344.50000	63.2	84.4	-21.3	Pk	-34.3	-13.0	-21.3	Pk

Radiated spurious emissions with modulation FM 25 kHz 868.9 MHz – Frequency range 30 MHz to 1 GHz with antenna in vertical polarization

7.6 FCC 90.214 Transient frequency behavior

7.6.1 References, definitions and limits

Transmitters designed to operate in the 421–512 MHz frequency band must maintain transient frequencies within the maximum frequency difference limits during the time intervals indicated

Table 7.6-1: Transient frequency behavior

Channel Bandwidth, kHz	Time intervals ^{1,2}	Maximum frequency difference	Transient duration limit
25	t ₁	±25.0 kHz	10.0 ms
	t ₂	±12.5 kHz	25.0 ms
	t ₃	±25.0 kHz	10.0 ms
12.5	t ₁	±12.5 kHz	10.0 ms
	t ₂	±6.25 kHz	25.0 ms
	t ₃	±12.5 kHz	10.0 ms
6.25	t ₁	±6.25 kHz	10.0 ms
	t ₂	±3.125 kHz	25.0 ms
	t ₃	±6.25 kHz	10.0 ms

Notes:

¹t_{on}: the instant when a 1 kHz test signal is completely suppressed, including any capture time due to phasing.

t₁: the time period immediately following t_{on}.

t₂: the time period immediately following t₁.

t₃: the time period from the instant when the transmitter is turned off until t_{off}.

t_{off}: the instant when the 1 kHz test signal starts to rise.

²If the transmitter carrier output power rating is 6 W or less, the frequency difference during the time periods t₁ and t₃ may exceed the maximum frequency difference for these time periods. The corresponding plot of frequency versus time during t₁ and t₃ shall be recorded in the test report.

7.6.2 Test summary

Verdict N/A

7.6.3 Observations, settings and special notes

Alternative Method (Using a Test Receiver) of TIA Standard 603 applied.

7.6.4 Test equipment list

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
EMI receiver	Rohde & Schwarz	ESW44	101620	2021-09	2022-09
Shielded room	Siemens	10m control room	1947	NCR	NCR
Radio communication tester	Rohde & Schwarz	CMT	883 152/001	2021-01	2024-01
Oscilloscope	Yokogawa	DL1540	25WY1600L	2021-03	2022-03

Note: NCR - no calibration required, VOU - verify on use

7.6.5 Test data

7.7 FCC 90.213(a) Transmitter frequency stability

7.7.1 References, definitions and limits

FCC

Unless noted elsewhere, transmitters used in the services governed by this part must have a minimum frequency stability as specified in the following table.

Table 7.7-1: Transmitter frequency stability

Frequency range (MHz)	Channel bandwidth (kHz)	Frequency stability for Base/Fixed stations ($\pm$ ppm)	Frequency stability for mobile stations with output power >2 W ($\pm$ ppm)	Frequency stability for mobile stations with output power $\leq$ 2 W ($\pm$ ppm)
851-854	--	1	1.5	1.5
854-869	--	1.5	1.5	2.5

7.7.2 Test summary

Verdict

Pass

Tested by

P. Barbieri

Test date

August 25, 2022

7.7.3 Observations, settings and special notes

Test was performed on supply voltage variations as per client rated, no frequency deviation was observed.

7.7.4 Test equipment list

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
EMI receiver	Rohde & Schwarz	ESU8	100202	2021-09	2022-09
Climatic chamber	Espec	ARS-1100	4100000067	2022-01	2023-01

Note: NCR - no calibration required, VOU - verify on use

7.7.5 Test data

Table 7.7-2: Transmitter frequency stability results

Conditions	Frequency (MHz)	Offset (ppm)
+60 °C, Nominal power	851.1001503	0.117847485
+50 °C, Nominal power	851.1001501	0.117612494
+40 °C, Nominal power	851.1000573	0.008577135
+30 °C, Nominal power	851.1000521	0.002467395
+20 °C, Nominal power	851.10005	0
+20 °C, 115 % power	851.10005	0
+20 °C, 85 % power	851.10005	0
+10 °C, Nominal power	851.1000521	0.002467395
0 °C, Nominal power	851.1000531	0.003642345
-10 °C, Nominal power	851.1000541	0.004817295
-20 °C, Nominal power	851.1000543	0.005052285
-30 °C, Nominal power	851.1000563	0.007402185