

Test Report



INTENTIONAL RADIATOR TESTS ACCORDING TO FCC PART 90 AND ISED CANADA REQUIREMENTS

Equipment Under Test: Radio Modem

Model: SATEL-EASy Pro+

Type: SATEL-TA44

Manufacturer: Satel Oy
Meriniitynkatu 17
FI-24100, Salo
Finland

Customer: Satel Oy
Meriniitynkatu 17
FI-24100, Salo
Finland

FCC Rule Part: 90
IC Rule Part: RSS-119, Issue 12, May 2015
KDB: 971168 D01 Power Meas License Digital Systems
v03r01
Measurement Guidance for Certification of
Licensed Digital Transmitters
(April 9, 2018)

Date: 7 December 2022

Issued by:

A blue ink signature of Pekka Kälviäinen.

Pekka Kälviäinen
Testing Engineer

Date: 7 December 2022

Checked by:

A blue ink signature of Rauno Repo.

Rauno Repo
Senior EMC Specialist

Table of Contents

GENERAL REMARKS	3
Disclaimer	3
RELEASE HISTORY	4
PRODUCT DESCRIPTION	5
Equipment Under Test	5
General Description	5
Ports and cables	5
Specifications	5
Mechanical Size of the EUT	5
Peripherals	5
SUMMARY OF TESTING	6
EUT Test Conditions	6
TEST RESULTS	8
Transmitter output power	8
Occupied bandwidth	16
Spurious emission mask	19
Spurious emissions (conducted) 9 kHz – 5 GHz	32
Spurious emissions (radiated) 9 kHz – 5 GHz	78
Frequency stability	88
Transient frequency behaviour	91
TEST EQUIPMENT	10
0	

GENERAL REMARKS

Disclaimer

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at <http://www.sgs.com/en/Terms-and-Conditions/Terms-e-Document.aspx>

Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 30 days only.

RELEASE HISTORY

Version	Changes	Issued
1.0	Initial release	26 August 2022
1.1	Some editorial fixes	28 November 2022
1.2	Spurious emissions (radiated) result table added	7 December 2022

PRODUCT DESCRIPTION

Equipment Under Test

Equipment Under Test: Radio Modem
Model: SATEL-EASy Pro+
Type: SATEL-TA44
Serial no: 2221000001
FCC ID: MRBSATEL-TA44
IC: 2422A-SATELTA44

General Description

The equipment under test is a radio modem using 403-473 MHz band.

Classification

Fixed device ☒
Mobile Device (Human body distance > 20cm) ☒
Portable Device (Human body distance < 20cm) ☐

Modifications Incorporated in the EUT

No modifications.

Ports and cables

Cable / Port	Description
Serial port RS232	Device configuration and data communication. Unshielded
DC input port	9.0 - 30.0 VDC (12.0 V used during testing)
Antenna port	50Ω TNC (female)

Specifications

Frequency: 406.1-430 MHz and 450-470 MHz
Channel width: 12.5 kHz, 25 kHz
Channel spacing: 12.5 kHz, 25 kHz
Modulation: 4FSK, 8FSK, 16FSK, GMSK
Carrier power: 1, 5, 10, 25, 35 W

Mechanical Size of the EUT

Height: 70 mm Width: 140 mm Length: 180 mm Weight: 1.40 kg

Peripherals

Peripheral	Description / Usage
Test PC	Device configuration and monitoring with programs supplied by customer.

SUMMARY OF TESTING

Test Specification	Description of Test	Result
§90.205 / RSS-119 5.4	Transmitter output power	PASS
§90.210 / RSS-119 5.5	Occupied bandwidth	PASS
§90.210 / RSS-119 5.5	Spectrum emission mask	PASS
§90.210 / RSS-119 5.8	Spurious emissions (conducted)	PASS
§90.210 / RSS-119 5.8	Spurious emissions (radiated)	PASS
§90.213 / RSS-119 5.3	Frequency stability	PASS
§90.214 / RSS-119 5.9	Transient frequency behaviour	PASS

The decision rule applied for the tests results stated in this test report is according to the requirements of section 1.3 of ANSI C63.26-2015.

EUT Test Conditions

The EUT was in continuous transmit mode during all the tests. The EUT was configured into the wanted channel using software provided by the manufacturer ("TypeApproval_Pro+_UI_V005_19052022.exe").

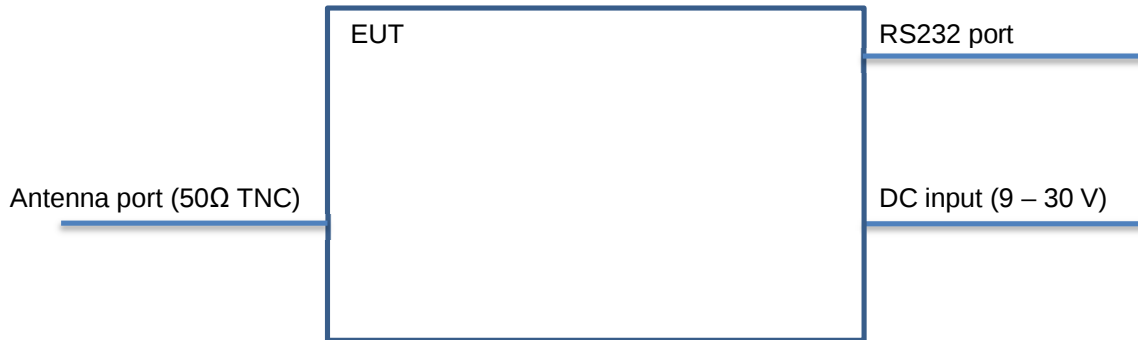


Figure 1: Test setup block diagram

Table 1: Test frequencies

Channel	Frequency (MHz)
Bottom	406.6
Middle 1	429.5
Middle 2	450.5
Top	469.5

Test Facility

Testing Laboratory / address: FCC designation number: FI0002 ISED CAB identifier: T004	SGS Fimko Ltd Takomotie 8 FI-00380, HELSINKI FINLAND
Test Site:	☐ K10LAB, ISED Canada registration number: 8708A-1 ☒ K5LAB, ISED Canada registration number: 8708A-2 ☐ T10LAB

TEST RESULTS

Transmitter output power

Standard:	ANSI C63.26-2015
Tested by:	PKA
Date:	21 - 22 July 2022, 7 December 2022
Temperature:	23 ± 3 °C
Humidity:	20 - 75 % RH
Barometric pressure	860 - 1060 hPa
Measurement uncertainty:	± 0.470 dB, level of confidence 95.45 % (k = 2)
Test result:	PASS

FCC Rule: §90.205
RSS-119 5.4

The output power shall be within ±1 dB of the manufacturer's rated power listed in the equipment specifications.

The test was performed with a spectrum analyser with following settings:

Span:	200 kHz
RBW:	30 kHz
VBW:	100 kHz
Sweep points:	32001
Sweep time:	Auto
Detector:	Positive Peak

Test results

Table 2. Rated output power 4FSK

Frequency [MHz]	TX power [mW]	Ch. Width [kHz]	Modulation	Meter reading [dBm]	Offset [dB]	Meas. Power [dBm]	Limit [±dB]	Result
406.6	1000	12.5	4FSK	-8.94	-39.47	30.53	1.00	PASS
429.5	1000	12.5	4FSK	-9.09	-39.62	30.53	1.00	PASS
450.5	1000	12.5	4FSK	-9.61	-39.64	30.03	1.00	PASS
469.5	1000	12.5	4FSK	-9.56	-39.79	30.23	1.00	PASS
406.6	5000	12.5	4FSK	-2.40	-39.47	37.07	1.00	PASS
429.5	5000	12.5	4FSK	-2.50	-39.62	37.12	1.00	PASS
450.5	5000	12.5	4FSK	-2.83	-39.64	36.81	1.00	PASS
469.5	5000	12.5	4FSK	-2.73	-39.79	37.06	1.00	PASS
406.6	10000	12.5	4FSK	0.43	-39.47	39.90	1.00	PASS
429.5	10000	12.5	4FSK	0.66	-39.62	40.28	1.00	PASS
450.5	10000	12.5	4FSK	0.19	-39.64	39.83	1.00	PASS
469.5	10000	12.5	4FSK	-0.12	-39.79	39.67	1.00	PASS
406.6	25000	12.5	4FSK	4.55	-39.47	44.02	1.00	PASS
429.5	25000	12.5	4FSK	4.56	-39.62	44.18	1.00	PASS
450.5	25000	12.5	4FSK	4.38	-39.64	44.02	1.00	PASS
469.5	25000	12.5	4FSK	4.11	-39.79	43.90	1.00	PASS
406.6	35000	12.5	4FSK	5.80	-39.47	45.27	1.00	PASS
429.5	35000	12.5	4FSK	6.11	-39.62	45.73	1.00	PASS
450.5	35000	12.5	4FSK	5.70	-39.64	45.34	1.00	PASS
469.5	35000	12.5	4FSK	5.74	-39.79	45.53	1.00	PASS
406.6	1000	25.0	4FSK	-9.27	-39.47	30.20	1.00	PASS
429.5	1000	25.0	4FSK	-9.51	-39.62	30.11	1.00	PASS
450.5	1000	25.0	4FSK	-9.42	-39.64	30.22	1.00	PASS
469.5	1000	25.0	4FSK	-9.84	-39.79	29.95	1.00	PASS
406.6	5000	25.0	4FSK	-2.46	-39.47	37.01	1.00	PASS
429.5	5000	25.0	4FSK	-2.52	-39.62	37.10	1.00	PASS
450.5	5000	25.0	4FSK	-2.73	-39.64	36.91	1.00	PASS
469.5	5000	25.0	4FSK	-2.75	-39.79	37.04	1.00	PASS
406.6	10000	25.0	4FSK	0.43	-39.47	39.90	1.00	PASS
429.5	10000	25.0	4FSK	0.63	-39.62	40.25	1.00	PASS
450.5	10000	25.0	4FSK	0.24	-39.64	39.88	1.00	PASS
469.5	10000	25.0	4FSK	-0.12	-39.79	39.67	1.00	PASS
406.6	25000	25.0	4FSK	4.44	-39.47	43.91	1.00	PASS
429.5	25000	25.0	4FSK	4.58	-39.62	44.20	1.00	PASS
450.5	25000	25.0	4FSK	4.47	-39.64	44.11	1.00	PASS
469.5	25000	25.0	4FSK	4.15	-39.79	43.94	1.00	PASS
406.6	35000	25.0	4FSK	5.83	-39.47	45.30	1.00	PASS
429.5	35000	25.0	4FSK	6.00	-39.62	45.62	1.00	PASS
450.5	35000	25.0	4FSK	5.89	-39.64	45.53	1.00	PASS
469.5	35000	25.0	4FSK	5.64	-39.79	45.43	1.00	PASS

Table 3. Rated output power 8FSK

Frequency [MHz]	TX power [mW]	Ch. Width [kHz]	Modulation	Meter reading [dBm]	Offset [dB]	Meas. Power [dBm]	Limit [±dB]	Result
406.6	1000	12.5	8FSK	-8.66	-39.47	30.81	1.00	PASS
429.5	1000	12.5	8FSK	-9.13	-39.62	30.49	1.00	PASS
450.5	1000	12.5	8FSK	-9.31	-39.64	30.33	1.00	PASS
469.5	1000	12.5	8FSK	-9.70	-39.79	30.09	1.00	PASS
406.6	5000	12.5	8FSK	-2.43	-39.47	37.04	1.00	PASS
429.5	5000	12.5	8FSK	-2.49	-39.62	37.13	1.00	PASS
450.5	5000	12.5	8FSK	-2.80	-39.64	36.84	1.00	PASS
469.5	5000	12.5	8FSK	-2.88	-39.79	36.91	1.00	PASS
406.6	10000	12.5	8FSK	0.46	-39.47	39.93	1.00	PASS
429.5	10000	12.5	8FSK	0.61	-39.62	40.23	1.00	PASS
450.5	10000	12.5	8FSK	0.20	-39.64	39.84	1.00	PASS
469.5	10000	12.5	8FSK	-0.04	-39.79	39.75	1.00	PASS
406.6	25000	12.5	8FSK	4.53	-39.47	44.00	1.00	PASS
429.5	25000	12.5	8FSK	4.66	-39.62	44.28	1.00	PASS
450.5	25000	12.5	8FSK	4.54	-39.64	44.18	1.00	PASS
469.5	25000	12.5	8FSK	4.26	-39.79	44.05	1.00	PASS
406.6	35000	12.5	8FSK	5.92	-39.47	45.39	1.00	PASS
429.5	35000	12.5	8FSK	6.23	-39.62	45.85	1.00	PASS
450.5	35000	12.5	8FSK	5.92	-39.64	45.56	1.00	PASS
469.5	35000	12.5	8FSK	5.83	-39.79	45.62	1.00	PASS
406.6	1000	25.0	8FSK	-9.09	-39.47	30.38	1.00	PASS
429.5	1000	25.0	8FSK	-9.36	-39.62	30.26	1.00	PASS
450.5	1000	25.0	8FSK	-9.62	-39.64	30.02	1.00	PASS
469.5	1000	25.0	8FSK	-9.73	-39.79	30.06	1.00	PASS
406.6	5000	25.0	8FSK	-2.40	-39.47	37.07	1.00	PASS
429.5	5000	25.0	8FSK	-2.47	-39.62	37.15	1.00	PASS
450.5	5000	25.0	8FSK	-2.71	-39.64	36.93	1.00	PASS
469.5	5000	25.0	8FSK	-2.9	-39.79	36.89	1.00	PASS
406.6	10000	25.0	8FSK	0.53	-39.47	40.00	1.00	PASS
429.5	10000	25.0	8FSK	0.76	-39.62	40.38	1.00	PASS
450.5	10000	25.0	8FSK	0.40	-39.64	40.04	1.00	PASS
469.5	10000	25.0	8FSK	-0.06	-39.79	39.73	1.00	PASS
406.6	25000	25.0	8FSK	4.59	-39.47	44.06	1.00	PASS
429.5	25000	25.0	8FSK	4.81	-39.62	44.43	1.00	PASS
450.5	25000	25.0	8FSK	4.54	-39.64	44.18	1.00	PASS
469.5	25000	25.0	8FSK	4.12	-39.79	43.91	1.00	PASS
406.6	35000	25.0	8FSK	5.92	-39.47	45.39	1.00	PASS
429.5	35000	25.0	8FSK	6.19	-39.62	45.81	1.00	PASS
450.5	35000	25.0	8FSK	6.19	-39.64	45.83	1.00	PASS
469.5	35000	25.0	8FSK	5.76	-39.79	45.55	1.00	PASS

Table 4. Rated output power 16FSK

Frequency [MHz]	TX power [mW]	Ch. Width [kHz]	Modulation	Meter reading [dBm]	Offset [dB]	Meas. Power [dBm]	Limit [±dB]	Result
406.6	1000	12.5	16FSK	-9.17	-39.47	30.30	1.00	PASS
429.5	1000	12.5	16FSK	-8.73	-39.62	30.89	1.00	PASS
450.5	1000	12.5	16FSK	-9.68	-39.64	29.96	1.00	PASS
469.5	1000	12.5	16FSK	-9.85	-39.79	29.94	1.00	PASS
406.6	5000	12.5	16FSK	-2.45	-39.47	37.02	1.00	PASS
429.5	5000	12.5	16FSK	-2.52	-39.62	37.10	1.00	PASS
450.5	5000	12.5	16FSK	-2.72	-39.64	36.92	1.00	PASS
469.5	5000	12.5	16FSK	-2.94	-39.79	36.85	1.00	PASS
406.6	10000	12.5	16FSK	0.43	-39.47	39.90	1.00	PASS
429.5	10000	12.5	16FSK	0.66	-39.62	40.28	1.00	PASS
450.5	10000	12.5	16FSK	0.30	-39.64	39.94	1.00	PASS
469.5	10000	12.5	16FSK	-0.08	-39.79	39.71	1.00	PASS
406.6	25000	12.5	16FSK	4.46	-39.47	43.93	1.00	PASS
429.5	25000	12.5	16FSK	4.65	-39.62	44.27	1.00	PASS
450.5	25000	12.5	16FSK	4.54	-39.64	44.18	1.00	PASS
469.5	25000	12.5	16FSK	4.26	-39.79	44.05	1.00	PASS
406.6	35000	12.5	16FSK	5.98	-39.47	45.45	1.00	PASS
429.5	35000	12.5	16FSK	6.19	-39.62	45.81	1.00	PASS
450.5	35000	12.5	16FSK	6.11	-39.64	45.75	1.00	PASS
469.5	35000	12.5	16FSK	5.77	-39.79	45.56	1.00	PASS
406.6	1000	25.0	16FSK	-9.20	-39.47	30.27	1.00	PASS
429.5	1000	25.0	16FSK	-8.83	-39.62	30.79	1.00	PASS
450.5	1000	25.0	16FSK	-9.72	-39.64	29.92	1.00	PASS
469.5	1000	25.0	16FSK	-9.55	-39.79	30.24	1.00	PASS
406.6	5000	25.0	16FSK	-2.44	-39.47	37.03	1.00	PASS
429.5	5000	25.0	16FSK	-2.43	-39.62	37.19	1.00	PASS
450.5	5000	25.0	16FSK	-2.68	-39.64	36.96	1.00	PASS
469.5	5000	25.0	16FSK	-2.89	-39.79	36.90	1.00	PASS
406.6	10000	25.0	16FSK	0.45	-39.47	39.92	1.00	PASS
429.5	10000	25.0	16FSK	0.72	-39.62	40.34	1.00	PASS
450.5	10000	25.0	16FSK	0.28	-39.64	39.92	1.00	PASS
469.5	10000	25.0	16FSK	-0.08	-39.79	39.71	1.00	PASS
406.6	25000	25.0	16FSK	4.53	-39.47	44.00	1.00	PASS
429.5	25000	25.0	16FSK	4.72	-39.62	44.34	1.00	PASS
450.5	25000	25.0	16FSK	4.58	-39.64	44.22	1.00	PASS
469.5	25000	25.0	16FSK	4.19	-39.79	43.98	1.00	PASS
406.6	35000	25.0	16FSK	5.92	-39.47	45.39	1.00	PASS
429.5	35000	25.0	16FSK	6.14	-39.62	45.76	1.00	PASS
450.5	35000	25.0	16FSK	5.88	-39.64	45.52	1.00	PASS
469.5	35000	25.0	16FSK	5.81	-39.79	45.60	1.00	PASS

Table 5. Rated output power GMSK 4800 bps

Frequency [MHz]	TX power [mW]	Ch. Width [kHz]	Modulation	Meter reading [dBm]	Offset [dB]	Meas. Power [dBm]	Limit [±dB]	Result
406.6	1000	12.5	GMSK 4800bps	-9.10	-39.47	30.37	1.00	PASS
429.5	1000	12.5	GMSK 4800bps	-9.41	-39.62	30.21	1.00	PASS
450.5	1000	12.5	GMSK 4800bps	-9.67	-39.64	29.97	1.00	PASS
469.5	1000	12.5	GMSK 4800bps	-9.69	-39.79	30.10	1.00	PASS
406.6	5000	12.5	GMSK 4800bps	-2.47	-39.47	37.00	1.00	PASS
429.5	5000	12.5	GMSK 4800bps	-2.53	-39.62	37.09	1.00	PASS
450.5	5000	12.5	GMSK 4800bps	-2.73	-39.64	36.91	1.00	PASS
469.5	5000	12.5	GMSK 4800bps	-2.85	-39.79	36.94	1.00	PASS
406.6	10000	12.5	GMSK 4800bps	0.44	-39.47	39.91	1.00	PASS
429.5	10000	12.5	GMSK 4800bps	0.62	-39.62	40.24	1.00	PASS
450.5	10000	12.5	GMSK 4800bps	0.26	-39.64	39.90	1.00	PASS
469.5	10000	12.5	GMSK 4800bps	-0.05	-39.79	39.74	1.00	PASS
406.6	25000	12.5	GMSK 4800bps	4.49	-39.47	43.96	1.00	PASS
429.5	25000	12.5	GMSK 4800bps	4.62	-39.62	44.24	1.00	PASS
450.5	25000	12.5	GMSK 4800bps	4.57	-39.64	44.21	1.00	PASS
469.5	25000	12.5	GMSK 4800bps	4.24	-39.79	44.03	1.00	PASS
406.6	35000	12.5	GMSK 4800bps	5.90	-39.47	45.37	1.00	PASS
429.5	35000	12.5	GMSK 4800bps	6.19	-39.62	45.81	1.00	PASS
450.5	35000	12.5	GMSK 4800bps	6.01	-39.64	45.65	1.00	PASS
469.5	35000	12.5	GMSK 4800bps	5.78	-39.79	45.57	1.00	PASS
406.6	1000	25.0	GMSK 4800bps	-9.10	-39.47	30.37	1.00	PASS
429.5	1000	25.0	GMSK 4800bps	-9.36	-39.62	30.26	1.00	PASS
450.5	1000	25.0	GMSK 4800bps	-9.65	-39.64	29.99	1.00	PASS
469.5	1000	25.0	GMSK 4800bps	-9.79	-39.79	30.00	1.00	PASS
406.6	5000	25.0	GMSK 4800bps	-2.38	-39.47	37.09	1.00	PASS
429.5	5000	25.0	GMSK 4800bps	-2.43	-39.62	37.19	1.00	PASS
450.5	5000	25.0	GMSK 4800bps	-2.78	-39.64	36.86	1.00	PASS
469.5	5000	25.0	GMSK 4800bps	-2.80	-39.79	36.99	1.00	PASS
406.6	10000	25.0	GMSK 4800bps	0.52	-39.47	39.99	1.00	PASS
429.5	10000	25.0	GMSK 4800bps	0.59	-39.62	40.21	1.00	PASS
450.5	10000	25.0	GMSK 4800bps	0.31	-39.64	39.95	1.00	PASS
469.5	10000	25.0	GMSK 4800bps	-0.05	-39.79	39.74	1.00	PASS
406.6	25000	25.0	GMSK 4800bps	4.53	-39.47	44.00	1.00	PASS
429.5	25000	25.0	GMSK 4800bps	4.68	-39.62	44.30	1.00	PASS
450.5	25000	25.0	GMSK 4800bps	4.66	-39.64	44.30	1.00	PASS
469.5	25000	25.0	GMSK 4800bps	4.27	-39.79	44.06	1.00	PASS
406.6	35000	25.0	GMSK 4800bps	5.95	-39.47	45.42	1.00	PASS
429.5	35000	25.0	GMSK 4800bps	6.22	-39.62	45.84	1.00	PASS
450.5	35000	25.0	GMSK 4800bps	6.15	-39.64	45.79	1.00	PASS
469.5	35000	25.0	GMSK 4800bps	6.00	-39.79	45.79	1.00	PASS

Table 6. Rated output power GMSK 8000 bps and GMSK 9600 bps

Frequency [MHz]	TX power [mW]	Ch. Width [kHz]	Modulation	Meter reading [dBm]	Offset [dB]	Meas. Power [dBm]	Limit [±dB]	Result
406.6	1000	12.5	GMSK 8000bps	-8.65	-39.47	30.82	1.00	PASS
429.5	1000	12.5	GMSK 8000bps	-8.88	-39.62	30.74	1.00	PASS
450.5	1000	12.5	GMSK 8000bps	-9.37	-39.64	30.27	1.00	PASS
469.5	1000	12.5	GMSK 8000bps	-9.41	-39.79	30.38	1.00	PASS
406.6	5000	12.5	GMSK 8000bps	-2.27	-39.47	37.20	1.00	PASS
429.5	5000	12.5	GMSK 8000bps	-2.32	-39.62	37.30	1.00	PASS
450.5	5000	12.5	GMSK 8000bps	-2.55	-39.64	37.09	1.00	PASS
469.5	5000	12.5	GMSK 8000bps	-2.71	-39.79	37.08	1.00	PASS
406.6	10000	12.5	GMSK 8000bps	0.52	-39.47	39.99	1.00	PASS
429.5	10000	12.5	GMSK 8000bps	0.71	-39.62	40.33	1.00	PASS
450.5	10000	12.5	GMSK 8000bps	0.42	-39.64	40.06	1.00	PASS
469.5	10000	12.5	GMSK 8000bps	0.08	-39.79	39.87	1.00	PASS
406.6	25000	12.5	GMSK 8000bps	4.63	-39.47	44.10	1.00	PASS
429.5	25000	12.5	GMSK 8000bps	4.83	-39.62	44.45	1.00	PASS
450.5	25000	12.5	GMSK 8000bps	4.50	-39.64	44.14	1.00	PASS
469.5	25000	12.5	GMSK 8000bps	4.29	-39.79	44.08	1.00	PASS
406.6	35000	12.5	GMSK 8000bps	5.89	-39.47	45.36	1.00	PASS
429.5	35000	12.5	GMSK 8000bps	6.19	-39.62	45.81	1.00	PASS
450.5	35000	12.5	GMSK 8000bps	6.14	-39.64	45.78	1.00	PASS
469.5	35000	12.5	GMSK 8000bps	5.85	-39.79	45.64	1.00	PASS
406.6	1000	25.0	GMSK 9600bps	-9.22	-39.47	30.25	1.00	PASS
429.5	1000	25.0	GMSK 9600bps	-9.10	-39.62	30.52	1.00	PASS
450.5	1000	25.0	GMSK 9600bps	-9.59	-39.64	30.05	1.00	PASS
469.5	1000	25.0	GMSK 9600bps	-9.71	-39.79	30.08	1.00	PASS
406.6	5000	25.0	GMSK 9600bps	-2.43	-39.47	37.04	1.00	PASS
429.5	5000	25.0	GMSK 9600bps	-2.46	-39.62	37.16	1.00	PASS
450.5	5000	25.0	GMSK 9600bps	-2.72	-39.64	36.92	1.00	PASS
469.5	5000	25.0	GMSK 9600bps	-2.86	-39.79	36.93	1.00	PASS
406.6	10000	25.0	GMSK 9600bps	0.48	-39.47	39.95	1.00	PASS
429.5	10000	25.0	GMSK 9600bps	0.71	-39.62	40.33	1.00	PASS
450.5	10000	25.0	GMSK 9600bps	0.28	-39.64	39.92	1.00	PASS
469.5	10000	25.0	GMSK 9600bps	-0.04	-39.79	39.75	1.00	PASS
406.6	25000	25.0	GMSK 9600bps	4.58	-39.47	44.05	1.00	PASS
429.5	25000	25.0	GMSK 9600bps	4.69	-39.62	44.31	1.00	PASS
450.5	25000	25.0	GMSK 9600bps	4.57	-39.64	44.21	1.00	PASS
469.5	25000	25.0	GMSK 9600bps	4.31	-39.79	44.10	1.00	PASS
406.6	35000	25.0	GMSK 9600bps	5.96	-39.47	45.43	1.00	PASS
429.5	35000	25.0	GMSK 9600bps	6.27	-39.62	45.89	1.00	PASS
450.5	35000	25.0	GMSK 9600bps	6.14	-39.64	45.78	1.00	PASS
469.5	35000	25.0	GMSK 9600bps	5.90	-39.79	45.69	1.00	PASS

Table 7. Rated output power GMSK 16000 bps

Frequency [MHz]	TX power [mW]	Ch. Width [kHz]	Modulation	Meter reading [dBm]	Offset [dB]	Meas. Power [dBm]	Limit [±dB]	Result
406.6	1000	25.0	GMSK 16000bps	-9.13	-39.47	30.34	1.00	PASS
429.5	1000	25.0	GMSK 16000bps	-9.21	-39.62	30.41	1.00	PASS
450.5	1000	25.0	GMSK 16000bps	-9.51	-39.64	30.13	1.00	PASS
469.5	1000	25.0	GMSK 16000bps	-9.71	-39.79	30.08	1.00	PASS
406.6	5000	25.0	GMSK 16000bps	-2.44	-39.47	37.03	1.00	PASS
429.5	5000	25.0	GMSK 16000bps	-2.48	-39.62	37.14	1.00	PASS
450.5	5000	25.0	GMSK 16000bps	-2.82	-39.64	36.82	1.00	PASS
469.5	5000	25.0	GMSK 16000bps	-2.95	-39.79	36.84	1.00	PASS
406.6	10000	25.0	GMSK 16000bps	0.44	-39.47	39.91	1.00	PASS
429.5	10000	25.0	GMSK 16000bps	0.64	-39.62	40.26	1.00	PASS
450.5	10000	25.0	GMSK 16000bps	0.12	-39.64	39.76	1.00	PASS
469.5	10000	25.0	GMSK 16000bps	-0.05	-39.79	39.74	1.00	PASS
406.6	25000	25.0	GMSK 16000bps	4.55	-39.47	44.02	1.00	PASS
429.5	25000	25.0	GMSK 16000bps	4.68	-39.62	44.30	1.00	PASS
450.5	25000	25.0	GMSK 16000bps	4.5	-39.64	44.14	1.00	PASS
469.5	25000	25.0	GMSK 16000bps	4.29	-39.79	44.08	1.00	PASS
406.6	35000	25.0	GMSK 16000bps	5.94	-39.47	45.41	1.00	PASS
429.5	35000	25.0	GMSK 16000bps	6.19	-39.62	45.81	1.00	PASS
450.5	35000	25.0	GMSK 16000bps	6.14	-39.64	45.78	1.00	PASS
469.5	35000	25.0	GMSK 16000bps	5.82	-39.79	45.61	1.00	PASS

Measurement figures 12.5 kHz and 25 kHz channel width

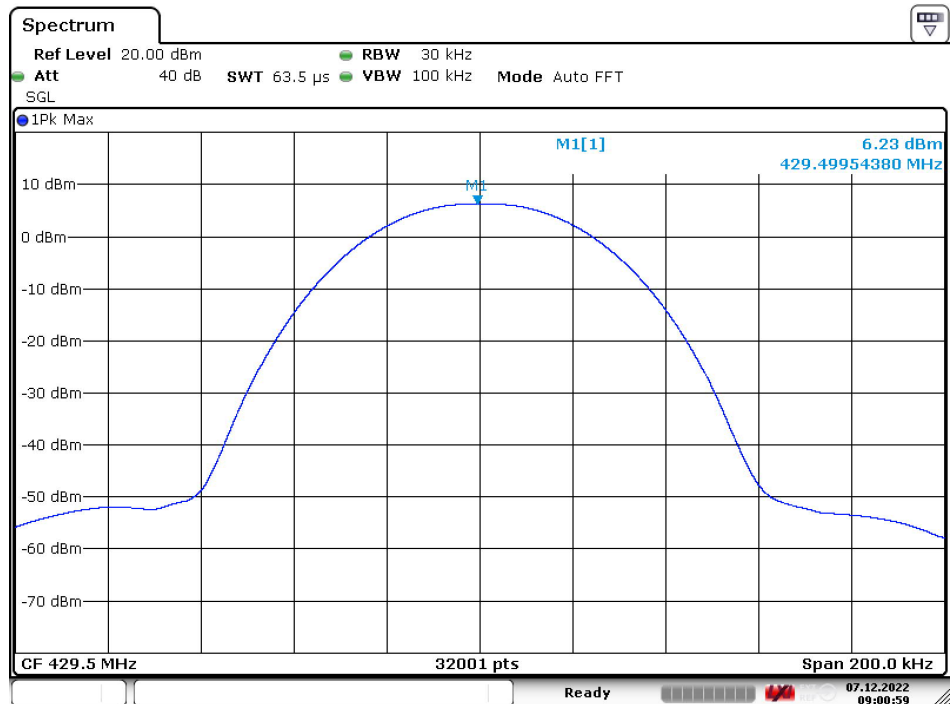


Figure 2: 429.5 MHz. 8FSK. 12.5 kHz. 35W

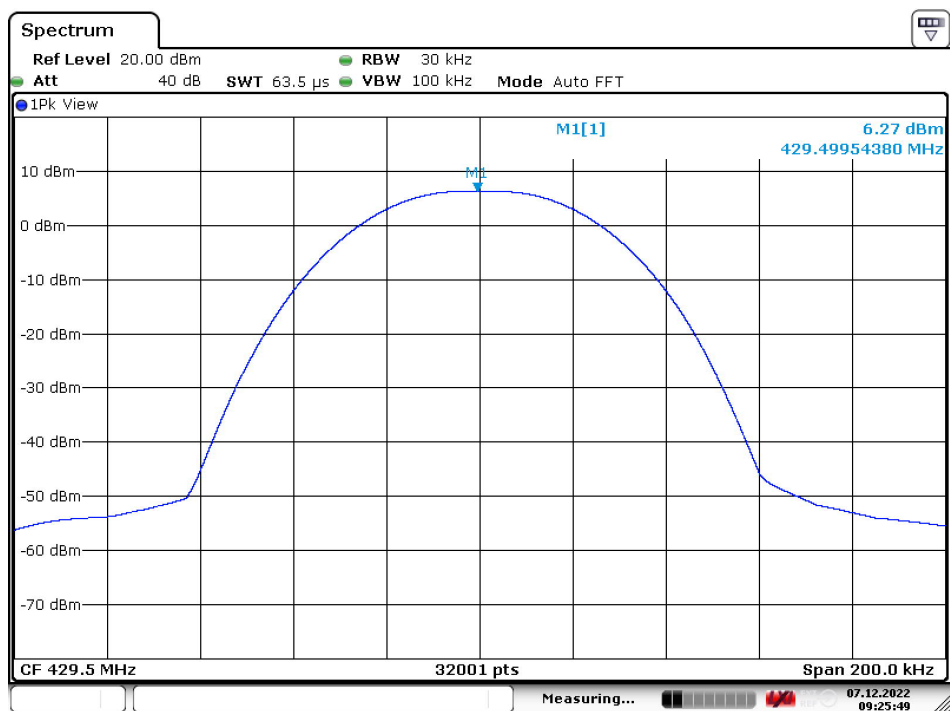


Figure 3: 429.5 MHz. GMSK9600bps. 25 kHz. 35W

Occupied bandwidth

Standard: ANSI C63.26-2015
Tested by: PKA
Date: 22 July 2022
Temperature: 23 ± 3 °C
Humidity: 20 - 75 % RH
Barometric pressure: 860 - 1060 hPa
Measurement uncertainty: ± 0.0005 %, level of confidence 95.45 % (k = 2)
Test result: **PASS**

FCC Rule: §90.210**RSS-119 5.5**

The occupied bandwidth is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained.

The maximum permissible occupied bandwidth shall not exceed the authorized bandwidth specified for the equipment's frequency band. The authorized bandwidth is defined as the maximum width of the band of frequencies used to derive spectrum masks and is not necessarily equivalent to the bandwidth found on radio and spectrum licenses.

Frequency Band (MHz)	Channel Bandwidth (kHz)	Authorized Bandwidth (kHz)
406.1-430 and 450-470	12.5	11.25
	25	20

Test results

Table 8: Occupied bandwidth test results

Frequency [MHz]	TX power [mW]	Ch. Width [kHz]	Modulation	OBW 99% [kHz]	Limit [kHz]	Result
406.6	35000	12.5	4FSK	8.078497547	11.25	PASS
429.5	35000	12.5	4FSK	8.220368113	11.25	PASS
450.5	35000	12.5	4FSK	8.237242586	11.25	PASS
469.5	35000	12.5	4FSK	8.210368426	11.25	PASS
406.6	35000	12.5	8FSK	7.428517859	11.25	PASS
429.5	35000	12.5	8FSK	7.437892566	11.25	PASS
450.5	35000	12.5	8FSK	7.441017468	11.25	PASS
469.5	35000	12.5	8FSK	7.433517703	11.25	PASS
406.6	35000	12.5	16FSK	8.162244930	11.25	PASS
429.5	35000	12.5	16FSK	8.145995438	11.25	PASS
450.5	35000	12.5	16FSK	8.157870067	11.25	PASS
469.5	35000	12.5	16FSK	8.159120027	11.25	PASS
406.6	35000	12.5	GMSK 4800	8.296615731	11.25	PASS
429.5	35000	12.5	GMSK 4800	8.299115653	11.25	PASS
450.5	35000	12.5	GMSK 4800	8.293490828	11.25	PASS
469.5	35000	12.5	GMSK 4800	8.294740789	11.25	PASS
406.6	35000	12.5	GMSK 8000	7.821630574	11.25	PASS
429.5	35000	12.5	GMSK 8000	7.849129715	11.25	PASS
450.5	35000	12.5	GMSK 8000	7.867254148	11.25	PASS
469.5	35000	12.5	GMSK 8000	7.848504734	11.25	PASS
406.6	35000	25.0	4FSK	16.044811100	20.00	PASS
429.5	35000	25.0	4FSK	16.199493766	20.00	PASS
450.5	35000	25.0	4FSK	16.174494547	20.00	PASS
469.5	35000	25.0	4FSK	16.186994156	20.00	PASS
406.6	35000	25.0	8FSK	17.174463298	20.00	PASS
429.5	35000	25.0	8FSK	17.182275554	20.00	PASS
450.5	35000	25.0	8FSK	17.211962126	20.00	PASS
469.5	35000	25.0	8FSK	17.238523796	20.00	PASS
406.6	35000	25.0	16FSK	18.194743914	20.00	PASS
429.5	35000	25.0	16FSK	18.179119403	20.00	PASS
450.5	35000	25.0	16FSK	18.236930096	20.00	PASS
469.5	35000	25.0	16FSK	18.225992938	20.00	PASS
406.6	35000	25.0	GMSK 4800	11.377769445	20.00	PASS
429.5	35000	25.0	GMSK 4800	11.366832286	20.00	PASS
450.5	35000	25.0	GMSK 4800	11.365269835	20.00	PASS
469.5	35000	25.0	GMSK 4800	11.374644542	20.00	PASS
406.6	35000	25.0	GMSK 9600	12.443361145	20.00	PASS
429.5	35000	25.0	GMSK 9600	12.199618762	20.00	PASS
450.5	35000	25.0	GMSK 9600	12.152745227	20.00	PASS
469.5	35000	25.0	GMSK 9600	12.282428674	20.00	PASS
406.6	35000	25.0	GMSK 16000	13.910502797	20.00	PASS
429.5	35000	25.0	GMSK 16000	13.938626918	20.00	PASS
450.5	35000	25.0	GMSK 16000	13.926127308	20.00	PASS
469.5	35000	25.0	GMSK 16000	13.932377113	20.00	PASS

Measurement figures 12.5 kHz and 25 kHz channel width

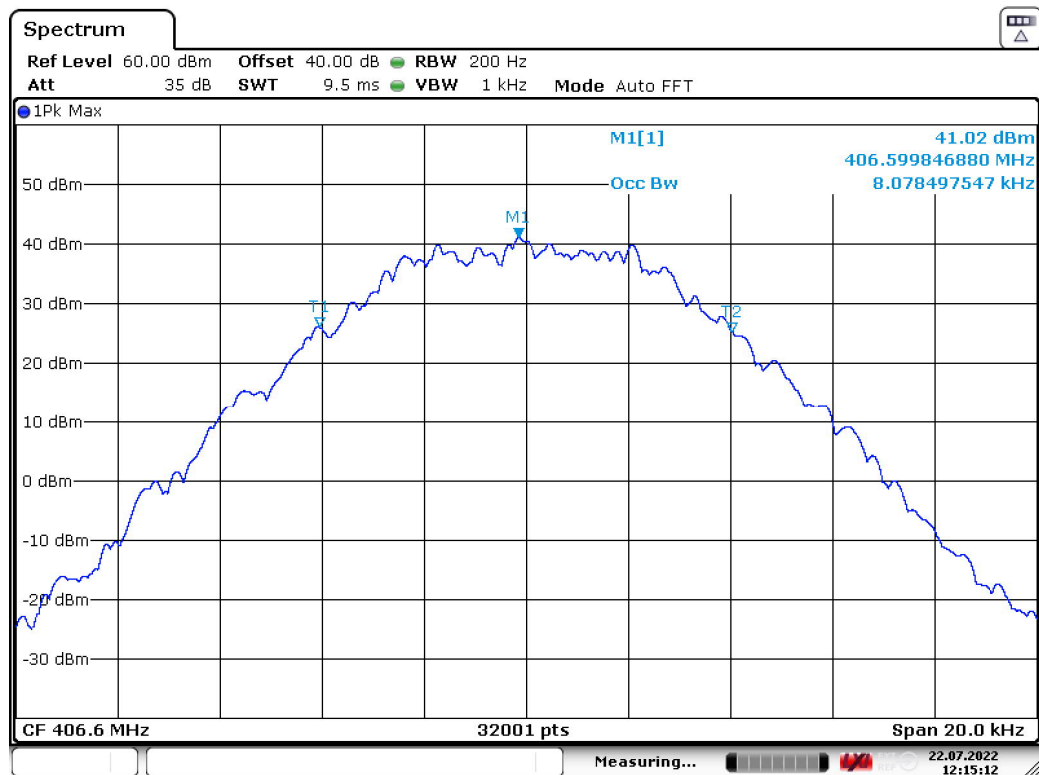


Figure 4: 406.6 MHz. 4FSK. 12.5 kHz. 35 W

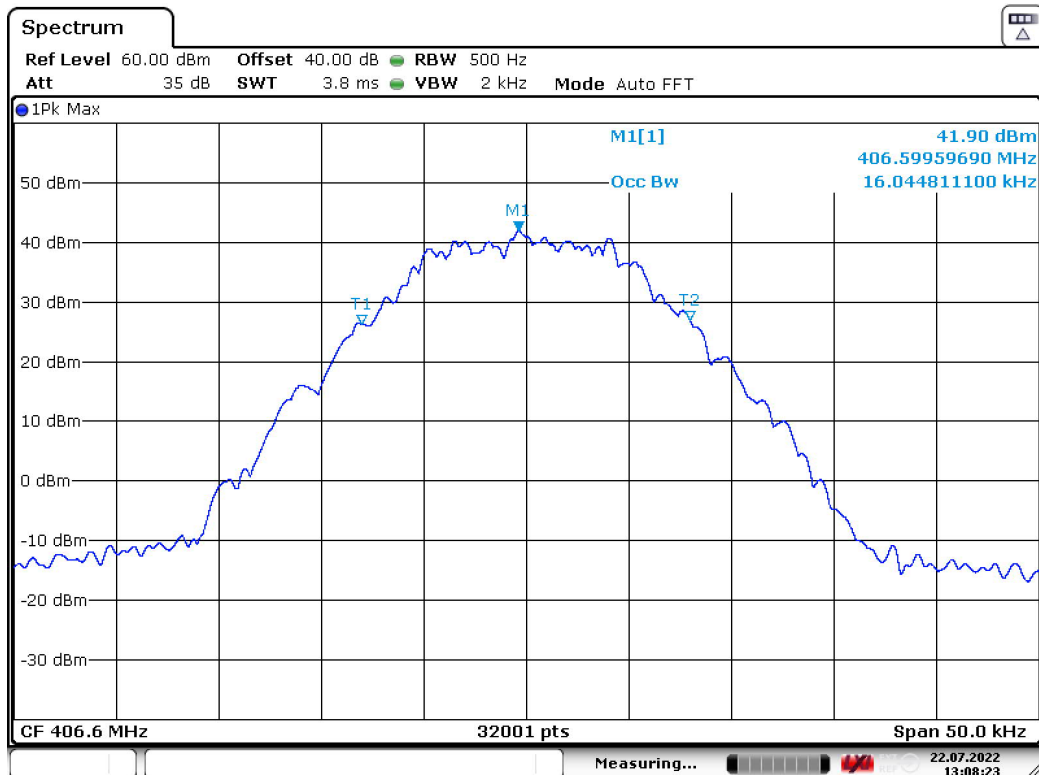


Figure 5: 406.6 MHz. 4FSK. 25 kHz. 35 W

Spurious emission mask

Standard: ANSI C63.26-2015
Tested by: PKA
Date: 27 July, 25 August 2022
Temperature: 23 ± 3 °C
Humidity: 20 - 75 % RH
Barometric pressure: 860 - 1060 hPa
Measurement uncertainty: ± 2.90 dB (level of confidence 95.45 % ($k = 2$))
Test result: **PASS**

FCC Rule: §90.210**RSS-119 5.5**

Emission Mask C. For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier output 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 5 kHz, but not more than 10 kHz: At least $83 \log(f_d/5)$ dB
- 2) 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 not more than 250 percent of the authorized bandwidth: At least $29 \log(f_d^2/11)$ dB or 50 dB, whichever is the lesser attenuation
- 3) 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

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 $50 + 10 \log(P)$ or 70 dB, whichever is the lesser attenuation

Test Results

Frequency [MHz]	TX power [mW]	Ch. Width [kHz]	Modulation	Mask	Result
406.6	35000	12.5	4FSK	D	PASS
429.5	35000	12.5	4FSK	D	PASS
450.5	35000	12.5	4FSK	D	PASS
469.5	35000	12.5	4FSK	D	PASS
406.6	35000	12.5	8FSK	D	PASS
429.5	35000	12.5	8FSK	D	PASS
450.5	35000	12.5	8FSK	D	PASS
469.5	35000	12.5	8FSK	D	PASS
406.6	35000	12.5	16FSK	D	PASS
429.5	35000	12.5	16FSK	D	PASS
450.5	35000	12.5	16FSK	D	PASS
469.5	35000	12.5	16FSK	D	PASS
406.6	35000	12.5	GMSK 4800	D	PASS
429.5	35000	12.5	GMSK 4800	D	PASS
450.5	35000	12.5	GMSK 4800	D	PASS
469.5	35000	12.5	GMSK 4800	D	PASS
406.6	35000	12.5	GMSK 8000	D	PASS
429.5	35000	12.5	GMSK 8000	D	PASS
450.5	35000	12.5	GMSK 8000	D	PASS
469.5	35000	12.5	GMSK 8000	D	PASS
406.6	35000	25.0	4FSK	C	PASS
429.5	35000	25.0	4FSK	C	PASS
450.5	35000	25.0	4FSK	C	PASS
469.5	35000	25.0	4FSK	C	PASS
406.6	35000	25.0	8FSK	C	PASS
429.5	35000	25.0	8FSK	C	PASS
450.5	35000	25.0	8FSK	C	PASS
469.5	35000	25.0	8FSK	C	PASS
406.6	35000	25.0	16FSK	C	PASS
429.5	35000	25.0	16FSK	C	PASS
450.5	35000	25.0	16FSK	C	PASS
469.5	35000	25.0	16FSK	C	PASS
406.6	35000	25.0	GMSK 4800	C	PASS
429.5	35000	25.0	GMSK 4800	C	PASS
450.5	35000	25.0	GMSK 4800	C	PASS
469.5	35000	25.0	GMSK 4800	C	PASS
406.6	35000	25.0	GMSK 9600	C	PASS
429.5	35000	25.0	GMSK 9600	C	PASS
450.5	35000	25.0	GMSK 9600	C	PASS
469.5	35000	25.0	GMSK 9600	C	PASS
406.6	35000	25.0	GMSK 16000	C	PASS
429.5	35000	25.0	GMSK 16000	C	PASS
450.5	35000	25.0	GMSK 16000	C	PASS
469.5	35000	25.0	GMSK 16000	C	PASS

Emission Mask D. 4FSK. Ch Width 12.5kHz

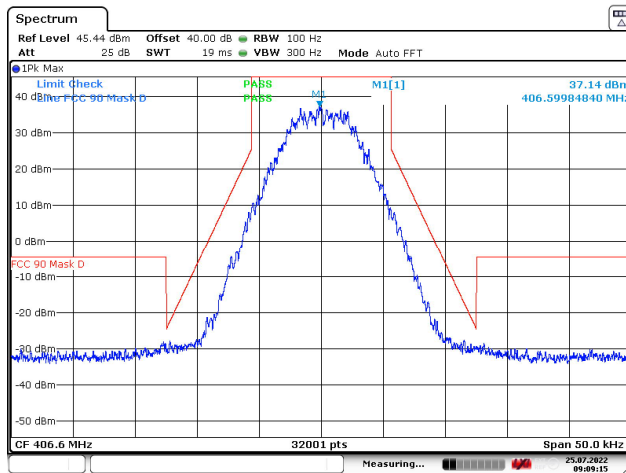


Figure 6: 406.6 MHz

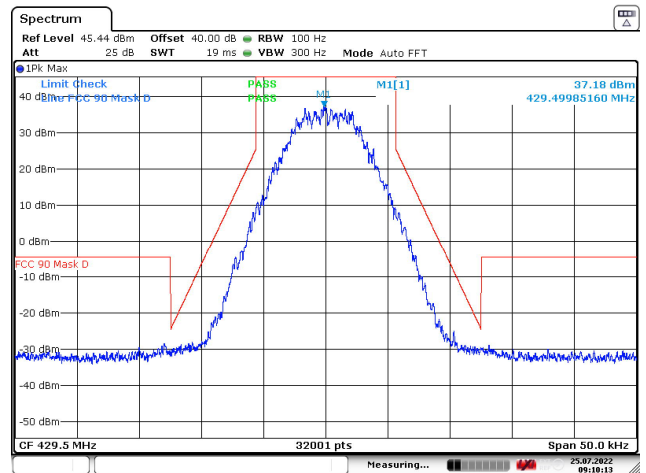


Figure 7: 429.5 MHz

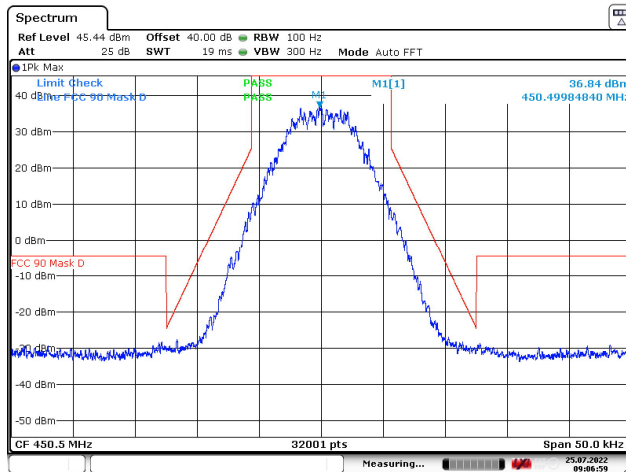


Figure 8: 450.5 MHz

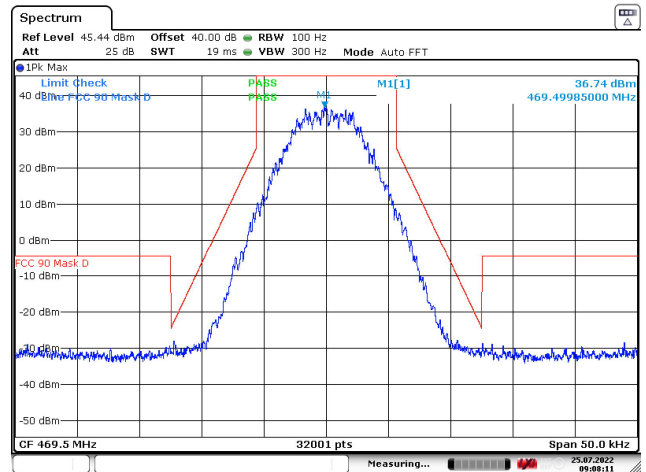


Figure 9: 469.5 MHz

Emission Mask D. 8FSK. Ch Width 12.5kHz

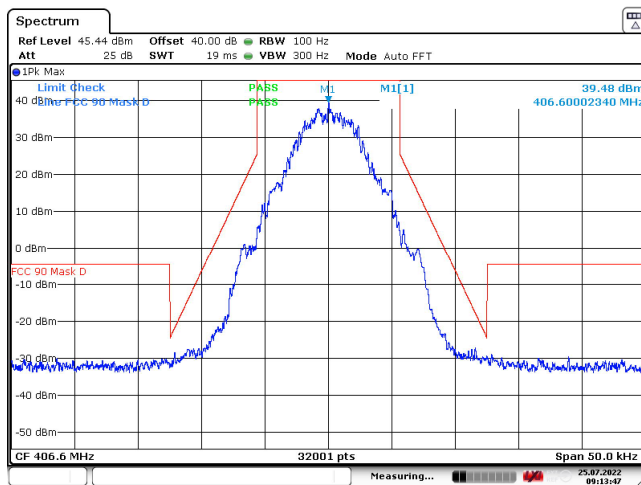


Figure 10: 406.6 MHz

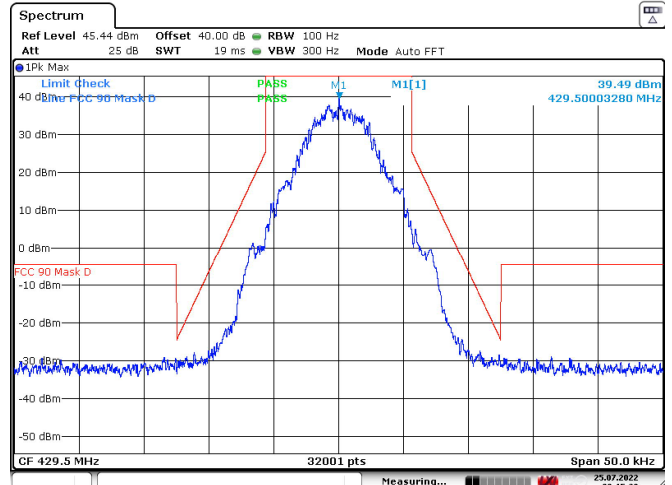


Figure 11: 429.5 MHz

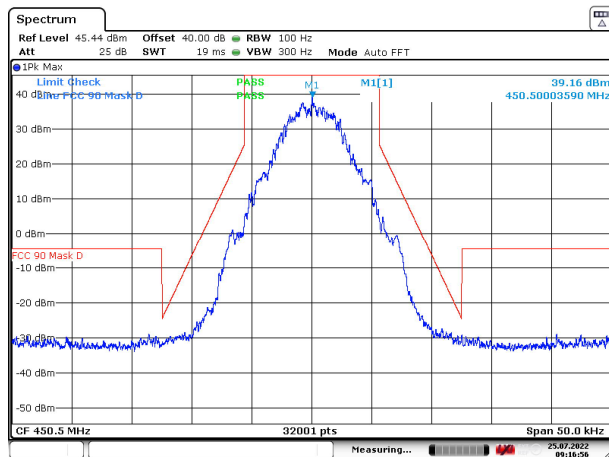


Figure 12: 450.5 MHz

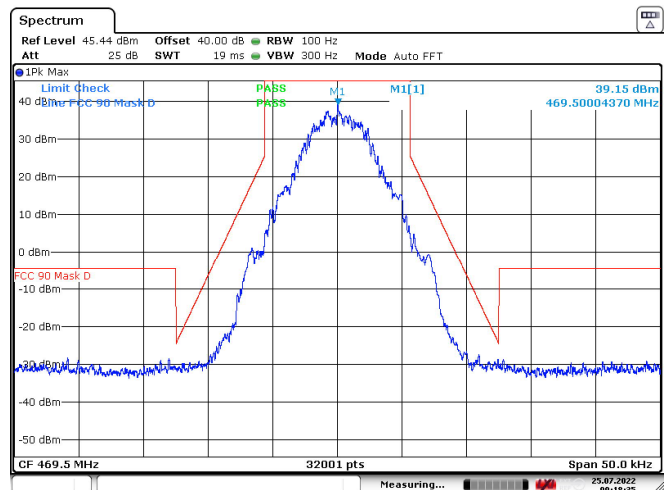


Figure 13: 469.5 MHz

Emission Mask D. 16FSK. Ch Width 12.5kHz

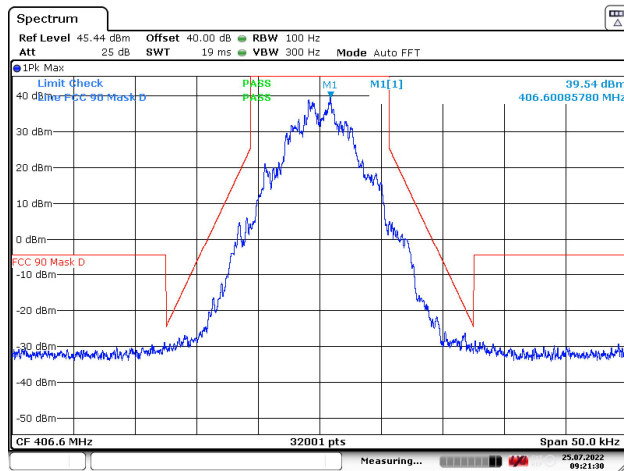


Figure 14: 406.6 MHz

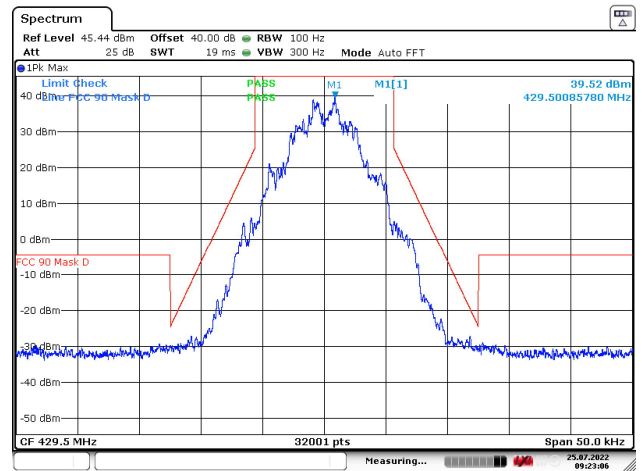


Figure 15: 429.5 MHz

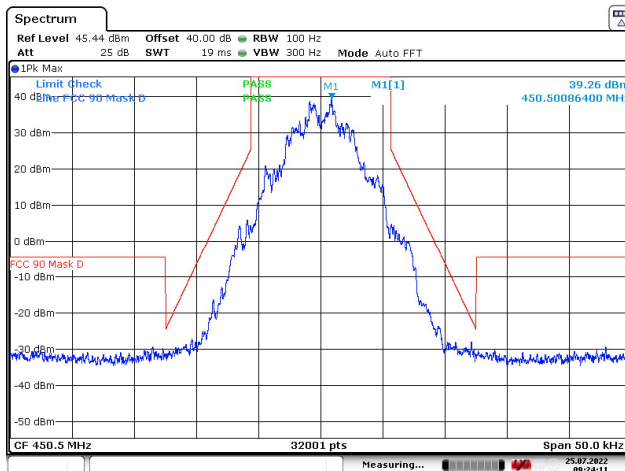


Figure 16: 450.5 MHz

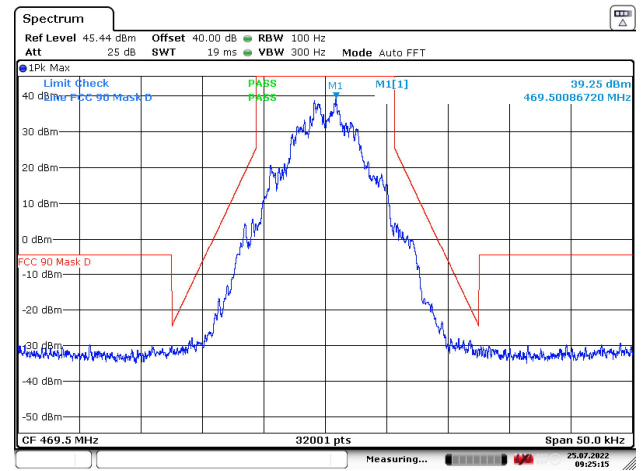


Figure 17: 469.5 MHz

Emission Mask D. GMSK 4800bps. Ch Width 12.5kHz

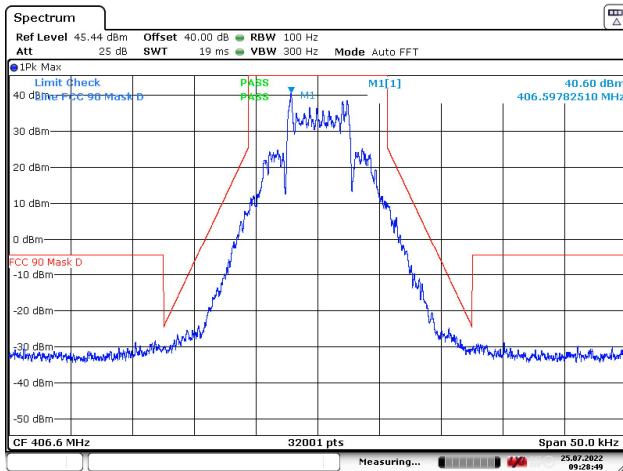


Figure 18: 406.6 MHz

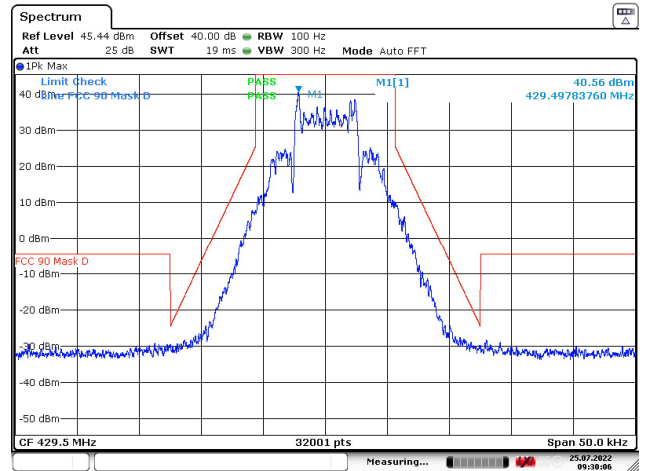


Figure 19: 429.5 MHz

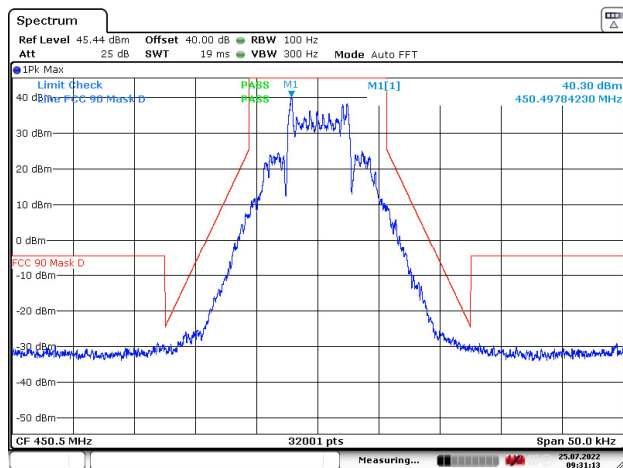


Figure 20: 450.5 MHz

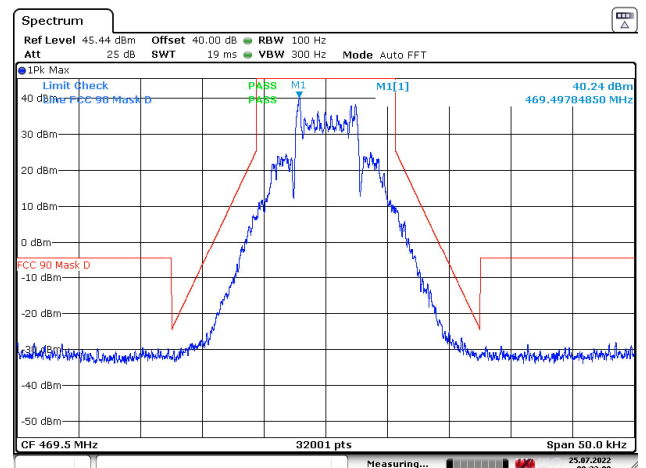


Figure 21: 469.5 MHz

Emission Mask D. GMSK 8000bps. Ch Width 12.5kHz

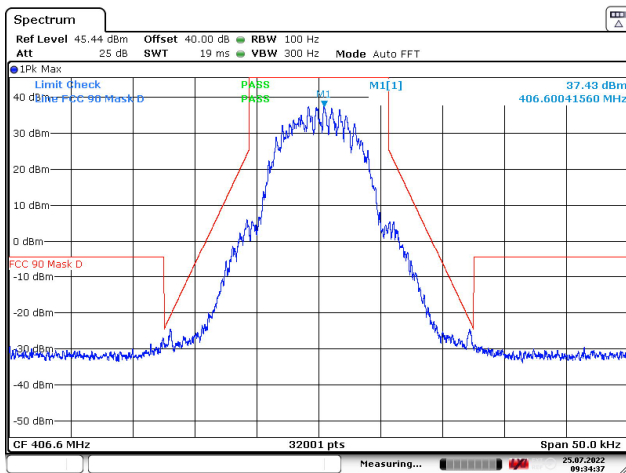


Figure 22: 406.6 MHz

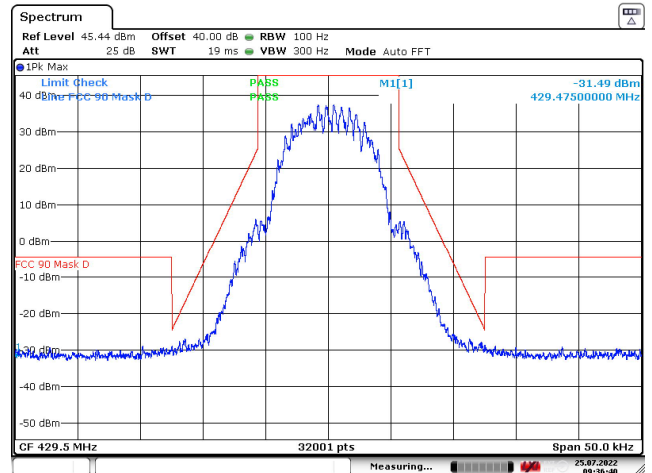


Figure 23: 429.5 MHz

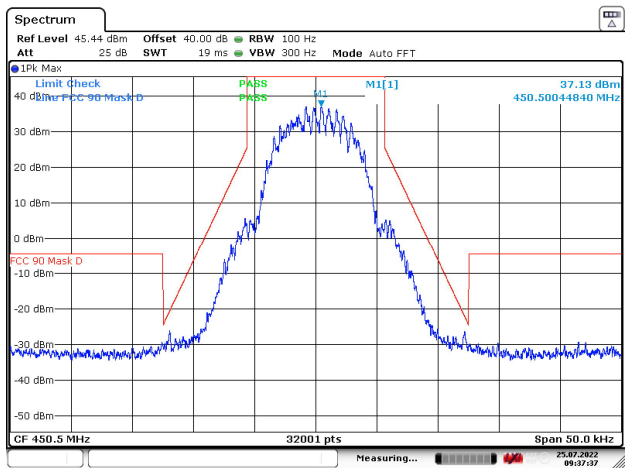


Figure 24: 450.5 MHz

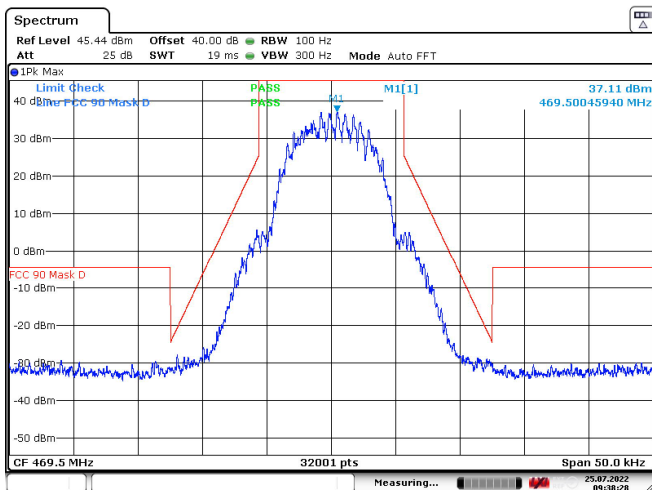


Figure 25: 469.5 MHz

Emission Mask C . 4FSK. Ch Width 25kHz

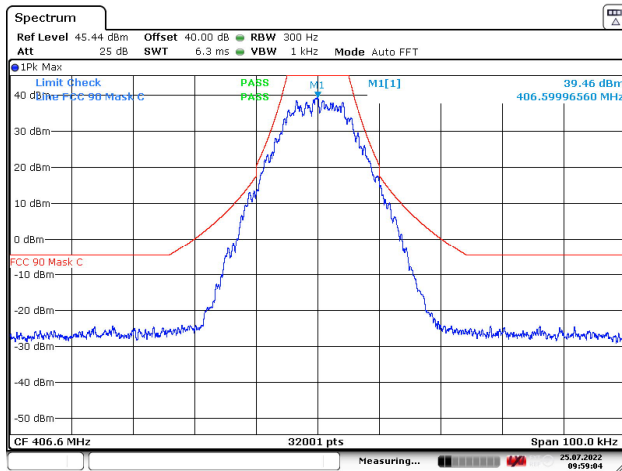


Figure 26: 406.6 MHz

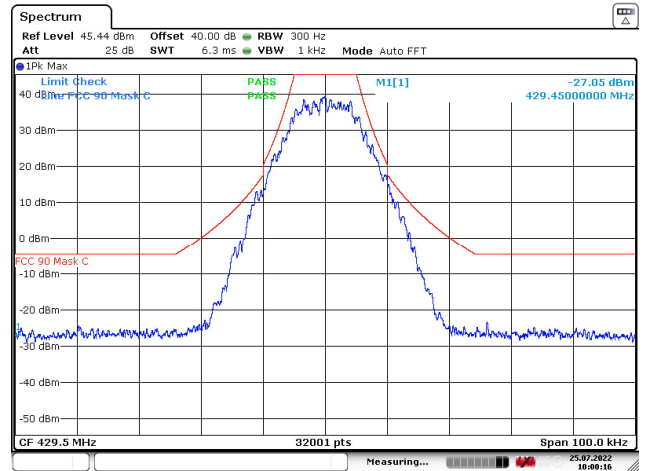


Figure 27: 429.5 MHz

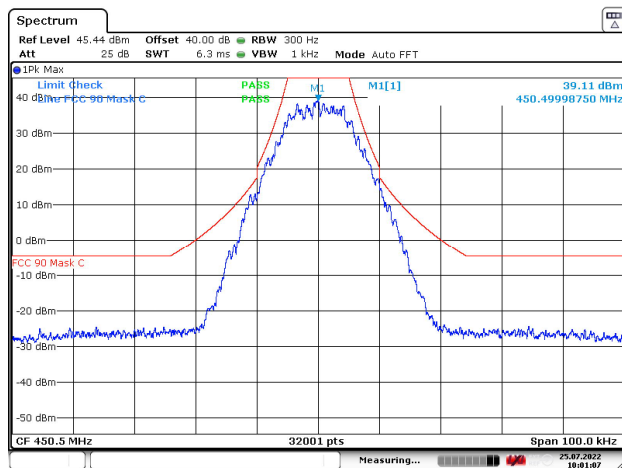


Figure 28: 450.5 MHz

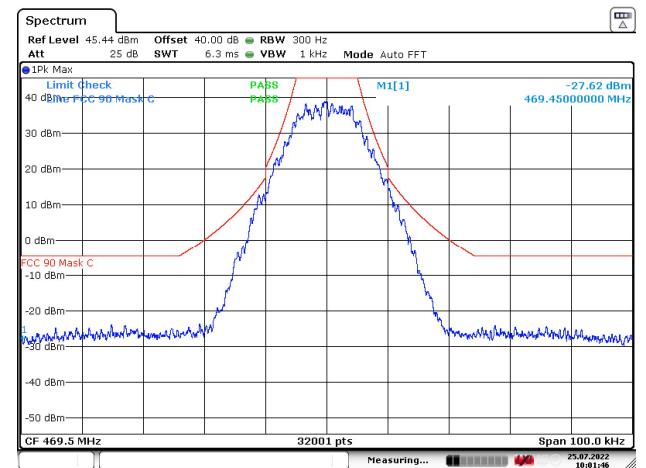


Figure 29: 469.5 MHz

Emission Mask C. 8FSK. Ch Width 25kHz

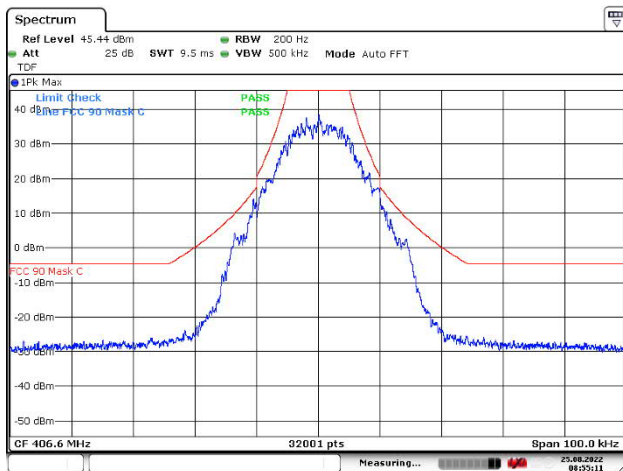


Figure 30: 406.6 MHz

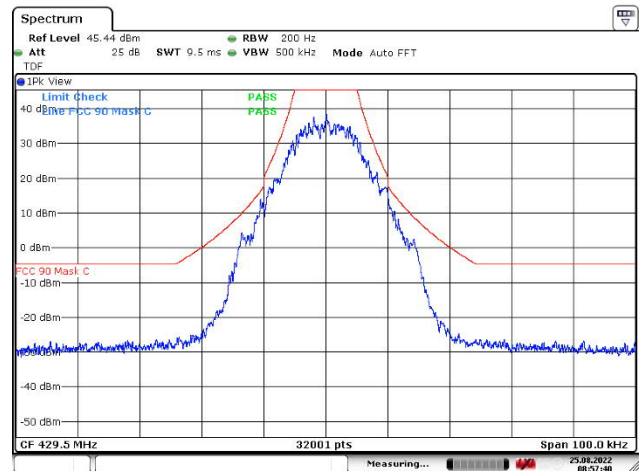


Figure 31: 429.5 MHz

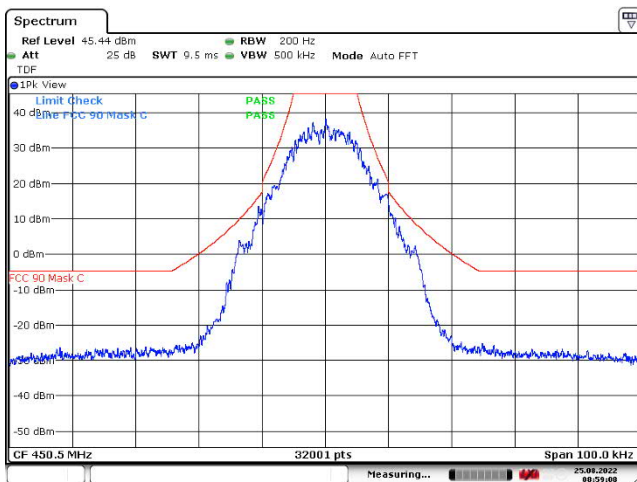


Figure 32: 450.5 MHz

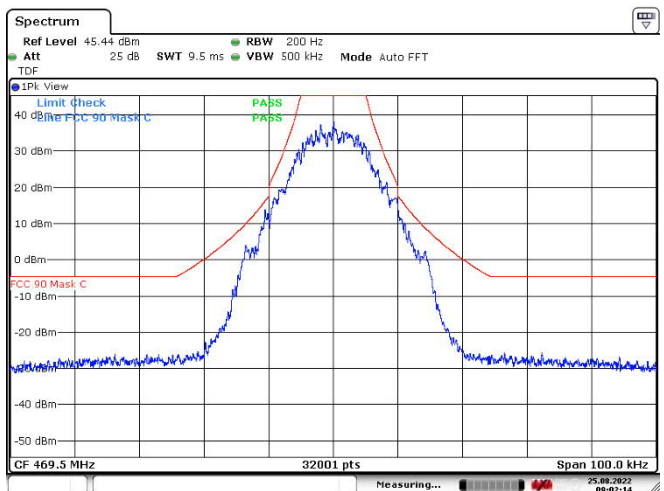


Figure 33: 469.5 MHz

Emission Mask C. 16FSK. Ch Width 25kHz

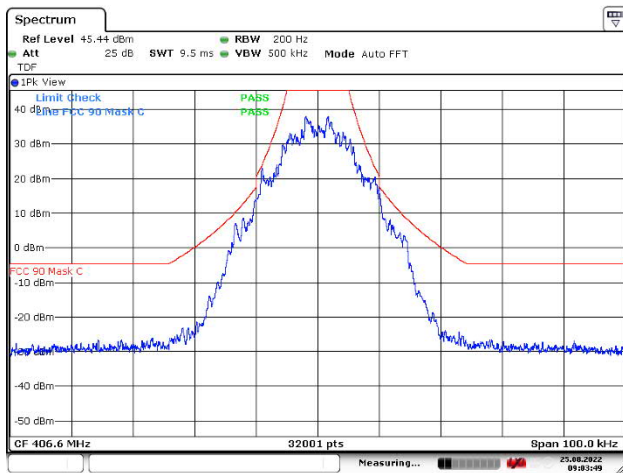


Figure 34: 406.6 MHz

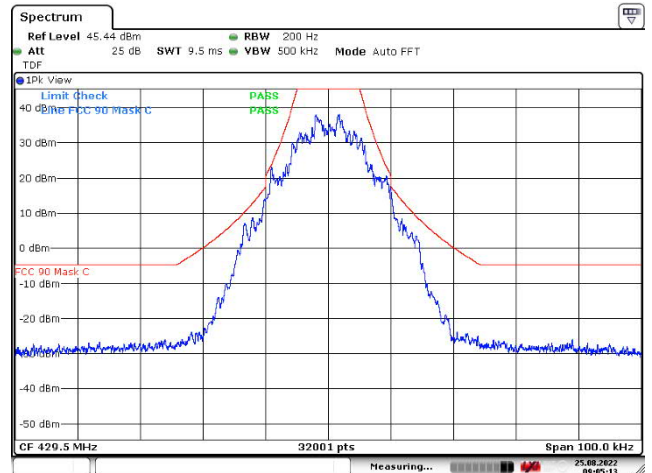


Figure 35: 429.5 MHz

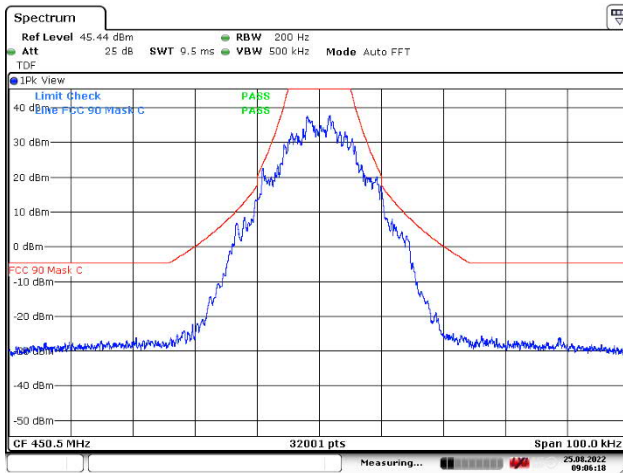


Figure 36: 450.5 MHz

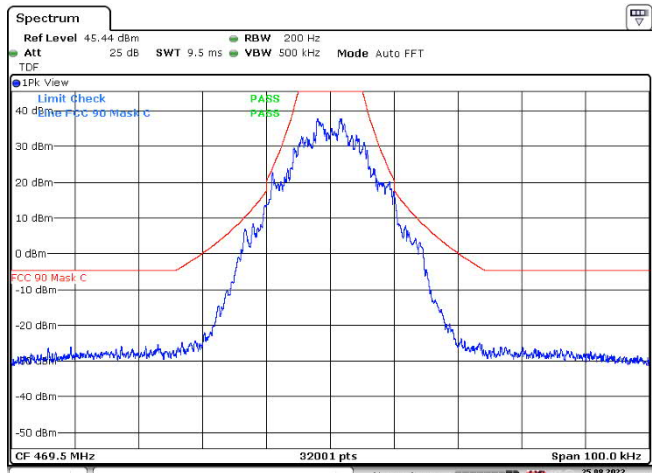


Figure 37: 469.5 MHz

Emission Mask C. GMSK 4800bps. Ch Width 25kHz

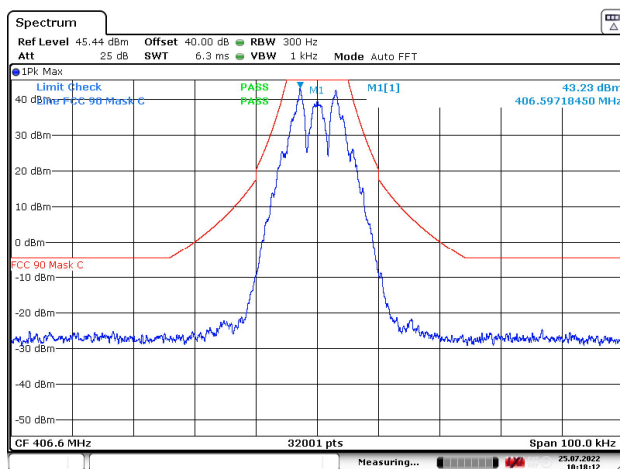


Figure 38: 406.6 MHz

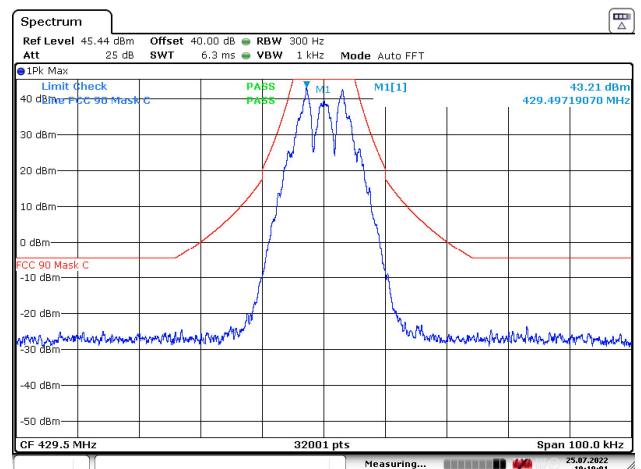


Figure 39: 429.5 MHz

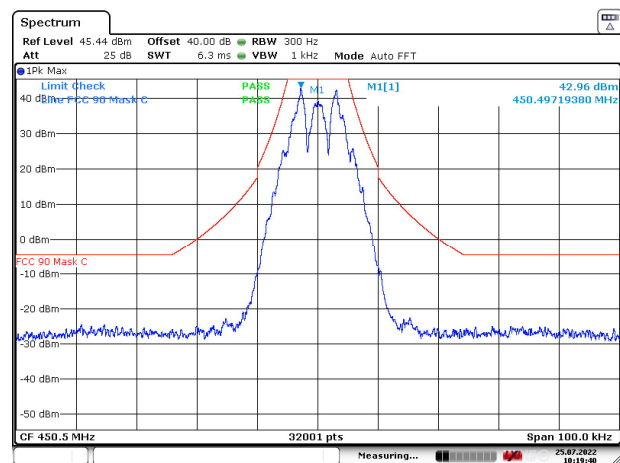


Figure 40: 450.5 MHz

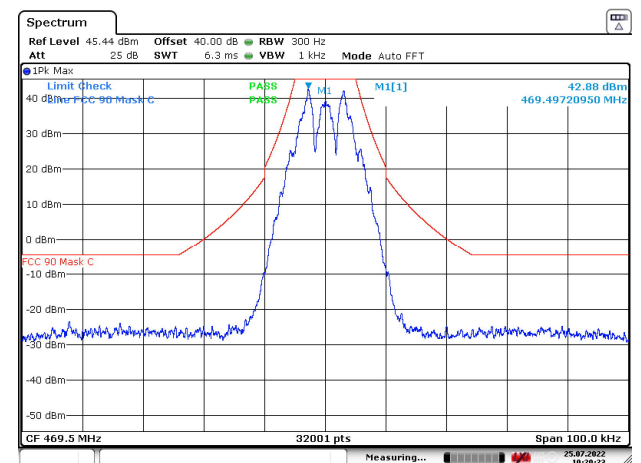


Figure 41: 469.5 MHz

Emission Mask C. GMSK 9600bps. Ch Width 25kHz

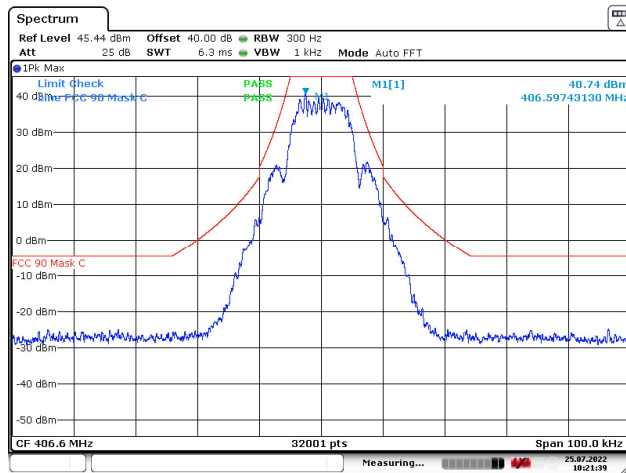


Figure 42: 406.6 MHz

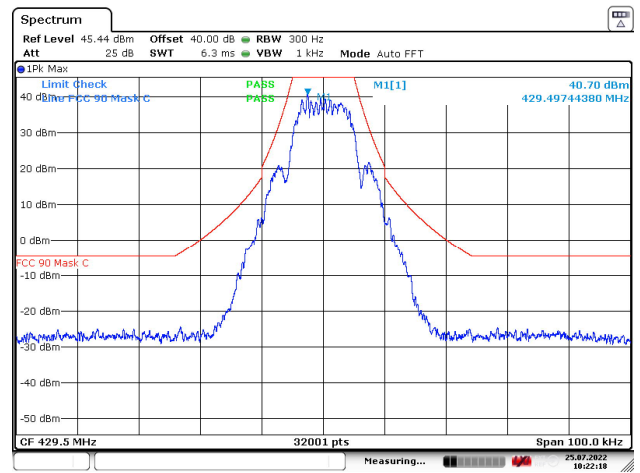


Figure 43: 429.5 MHz

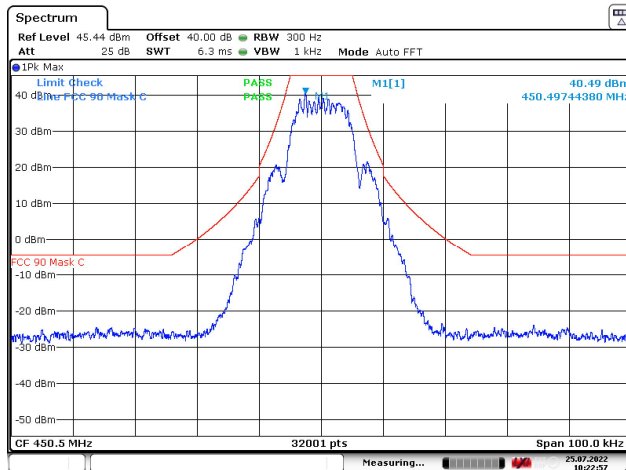


Figure 44: 450.5 MHz

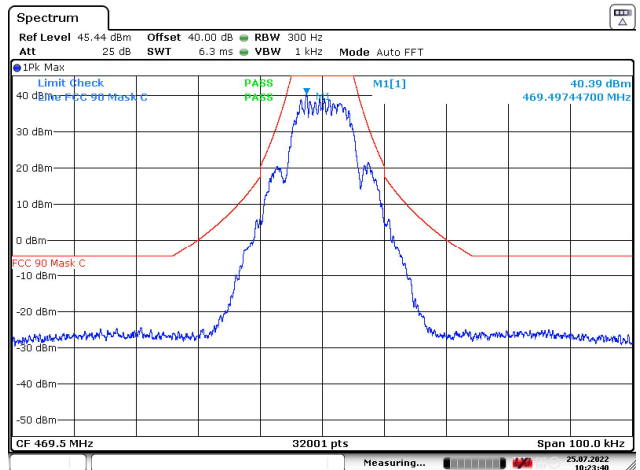


Figure 45: 469.5 MHz

Emission Mask C. GMSK 16000bps. Ch Width 25kHz

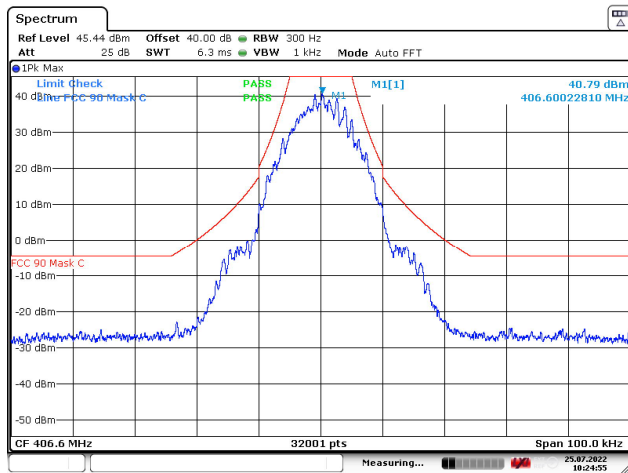


Figure 46: 406.6 MHz

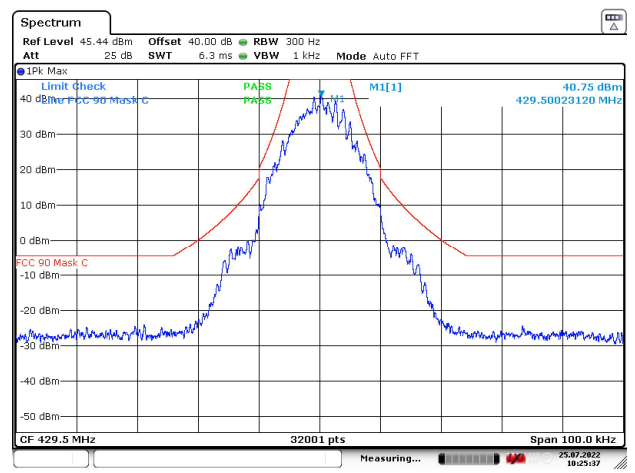


Figure 47: 429.5 MHz

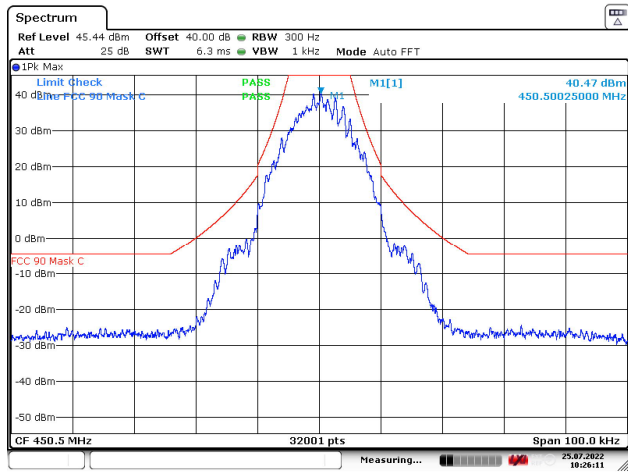


Figure 48: 450.5 MHz

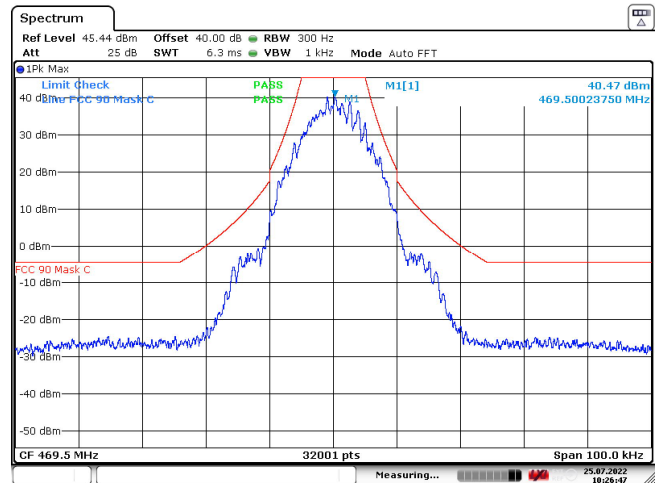


Figure 49: 469.5 MHz

Spurious emissions (conducted) 9 kHz – 5 GHz**Spurious emissions (conducted) 9 kHz – 5 GHz**

Standard: ANSI C63.26-2015
Tested by: PKA
Date: 27 - 28 July 2022
Temperature: 23 ± 3 °C
Humidity: 20 - 75 % RH
Barometric pressure: 860 - 1060 hPa
Measurement uncertainty: ± 2.90 dB. level of confidence 95.45 % (k = 2)
Test result: **PASS**

FCC Rule: §90.210**RSS-119 5.8**

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

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: 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 $50 + 10 \log (P)$ or 70 dB. whichever is the lesser attenuation.

Frequency Band (MHz)	Channel Bandwidth (kHz)	Authorized Bandwidth (kHz)	Limit (dBm)
406.1-430 and 450-470	12.5	11.25	-20
	25	20	-13

The test was performed at maximum power level.

Spurious emissions (conducted) 9 kHz – 5 GHz
Test Results

Frequency [MHz]	TX power [mW]	Ch. Width [kHz]	Modulation	Result
406.6	35000	12.5	4FSK	PASS
429.5	35000	12.5	4FSK	PASS
450.5	35000	12.5	4FSK	PASS
469.5	35000	12.5	4FSK	PASS
406.6	35000	12.5	8FSK	PASS
429.5	35000	12.5	8FSK	PASS
450.5	35000	12.5	8FSK	PASS
469.5	35000	12.5	8FSK	PASS
406.6	35000	12.5	16FSK	PASS
429.5	35000	12.5	16FSK	PASS
450.5	35000	12.5	16FSK	PASS
469.5	35000	12.5	16FSK	PASS
406.6	35000	12.5	GMSK 4800	PASS
429.5	35000	12.5	GMSK 4800	PASS
450.5	35000	12.5	GMSK 4800	PASS
469.5	35000	12.5	GMSK 4800	PASS
406.6	35000	12.5	GMSK 8000	PASS
429.5	35000	12.5	GMSK 8000	PASS
450.5	35000	12.5	GMSK 8000	PASS
469.5	35000	12.5	GMSK 8000	PASS
406.6	35000	25.0	4FSK	PASS
429.5	35000	25.0	4FSK	PASS
450.5	35000	25.0	4FSK	PASS
469.5	35000	25.0	4FSK	PASS
406.6	35000	25.0	8FSK	PASS
429.5	35000	25.0	8FSK	PASS
450.5	35000	25.0	8FSK	PASS
469.5	35000	25.0	8FSK	PASS
406.6	35000	25.0	16FSK	PASS
429.5	35000	25.0	16FSK	PASS
450.5	35000	25.0	16FSK	PASS
469.5	35000	25.0	16FSK	PASS
406.6	35000	25.0	GMSK 4800	PASS
429.5	35000	25.0	GMSK 4800	PASS
450.5	35000	25.0	GMSK 4800	PASS
469.5	35000	25.0	GMSK 4800	PASS
406.6	35000	25.0	GMSK 9600	PASS
429.5	35000	25.0	GMSK 9600	PASS
450.5	35000	25.0	GMSK 9600	PASS
469.5	35000	25.0	GMSK 9600	PASS
406.6	35000	25.0	GMSK 16000	PASS
429.5	35000	25.0	GMSK 16000	PASS
450.5	35000	25.0	GMSK 16000	PASS
469.5	35000	25.0	GMSK 16000	PASS

Spurious emissions (conducted) 9 kHz – 5 GHz

TX 406.6 MHz. 4FSK. Ch Width 12.5kHz

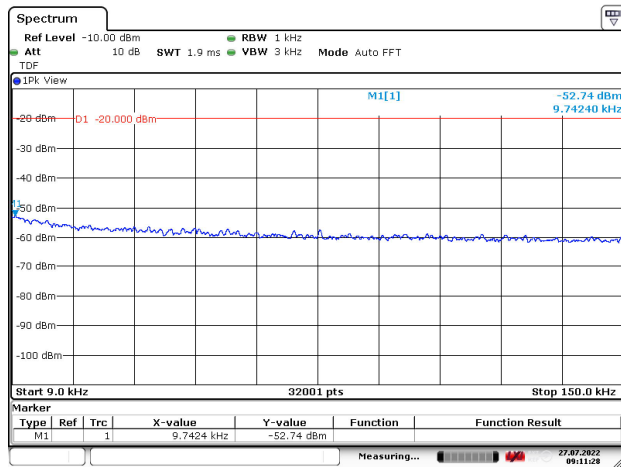


Figure 50: 9 – 150 kHz

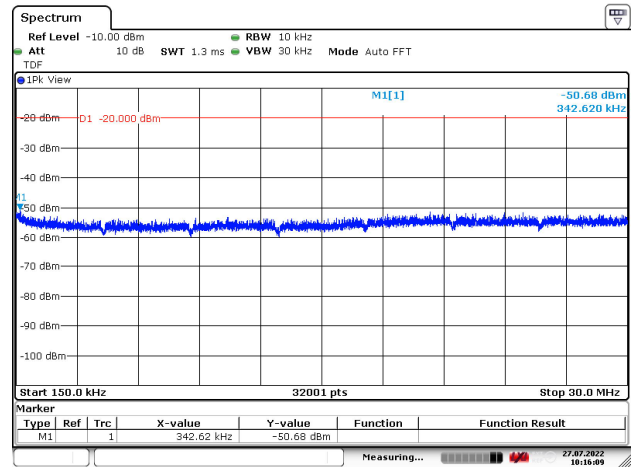


Figure 51: 150 kHz – 30 MHz

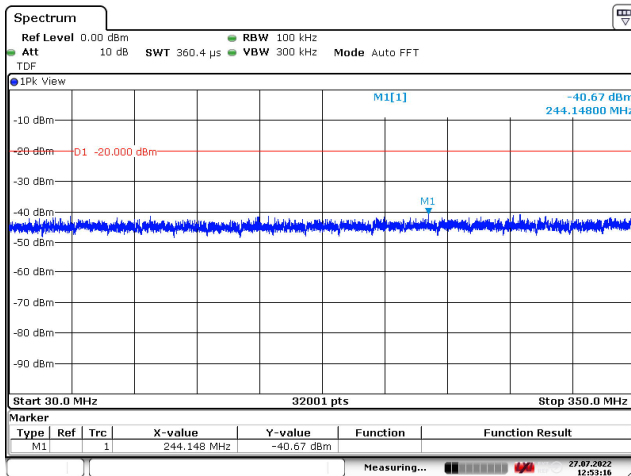


Figure 52: 30 – 350 MHz

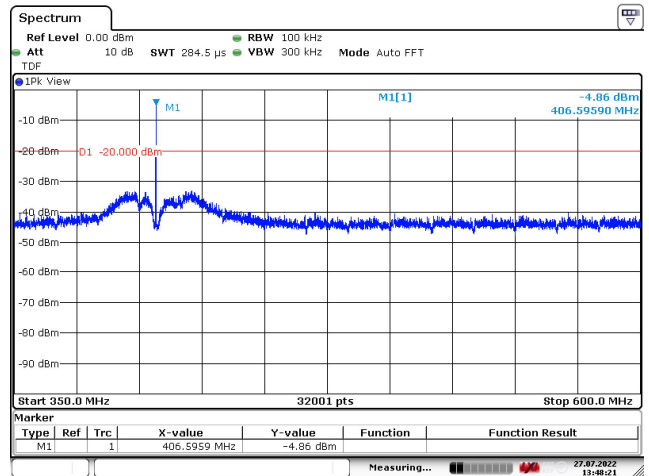


Figure 53: 350 – 600 MHz

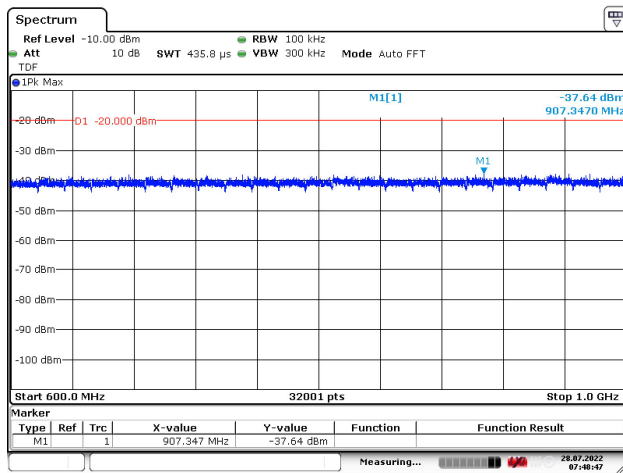


Figure 54: 600 – 1000 MHz

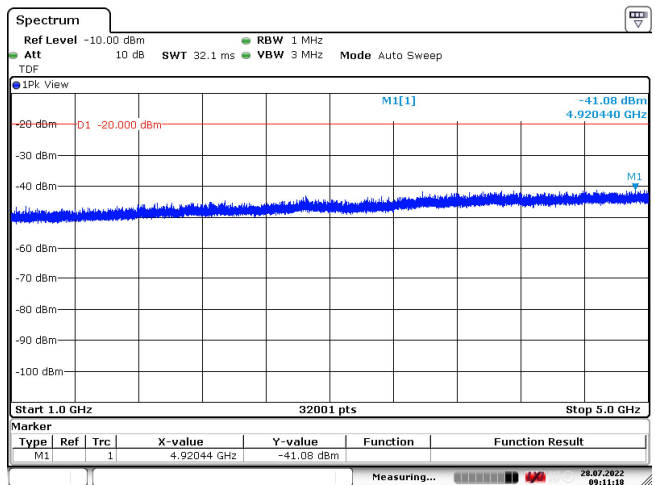


Figure 55: 1000 – 5000 MHz

Spurious emissions (conducted) 9 kHz – 5 GHz

TX 429.5 MHz. 4FSK. Ch Width 12.5kHz

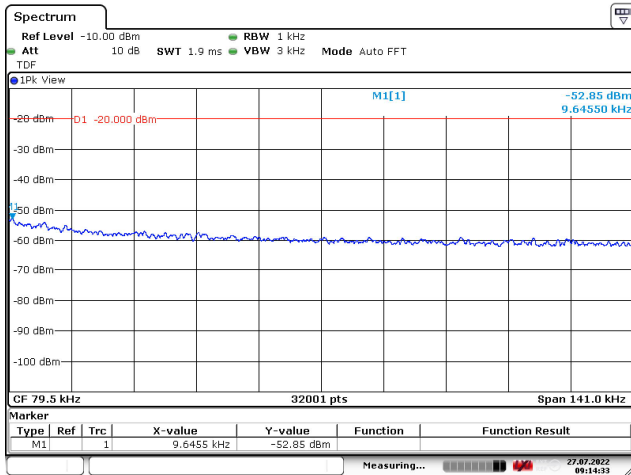


Figure 56: 9 – 150 kHz

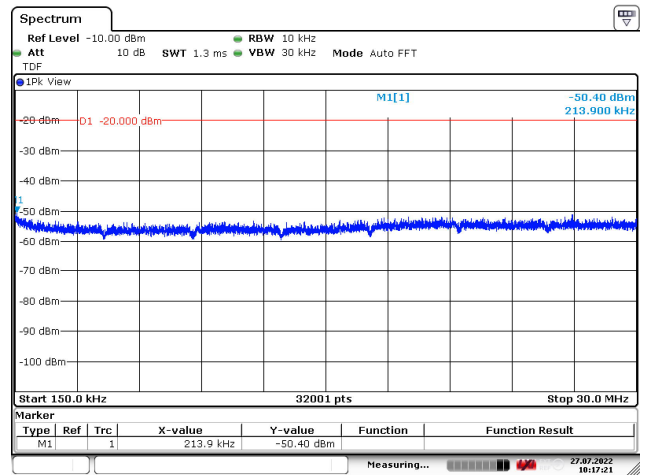


Figure 57: 150 kHz – 30 MHz

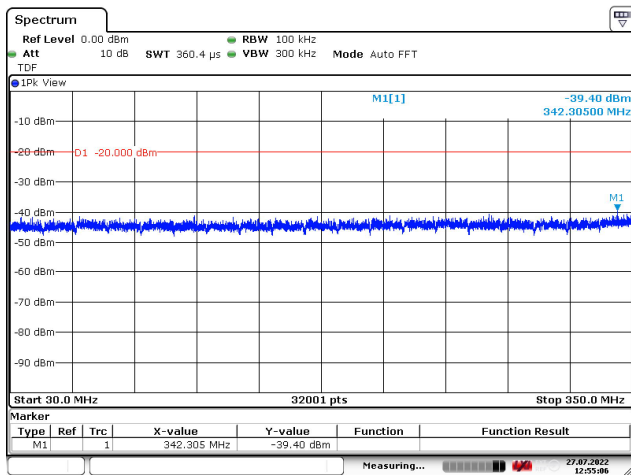


Figure 58: 30 – 350 MHz

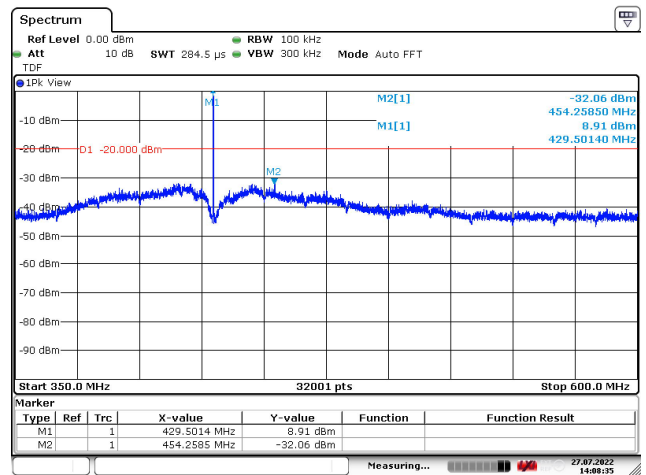


Figure 59: 350 – 600 MHz

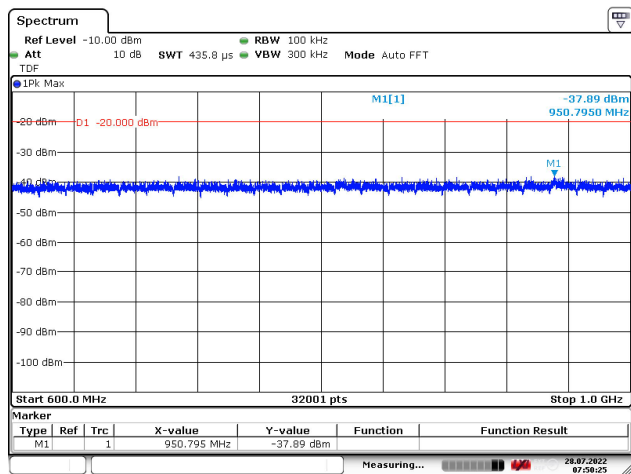


Figure 60: 600 – 1000 MHz

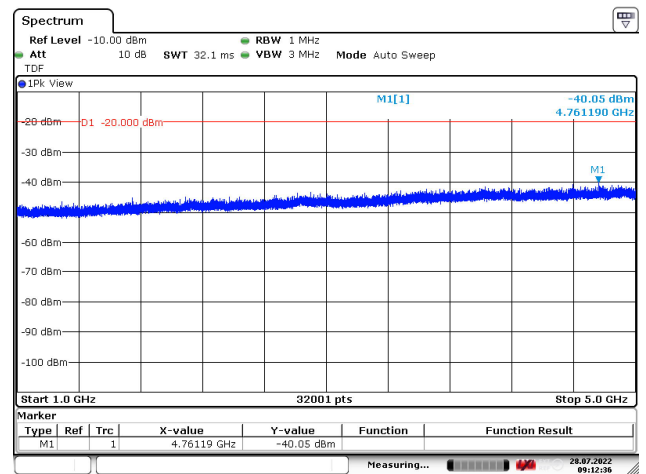


Figure 61: 1000 – 5000 MHz