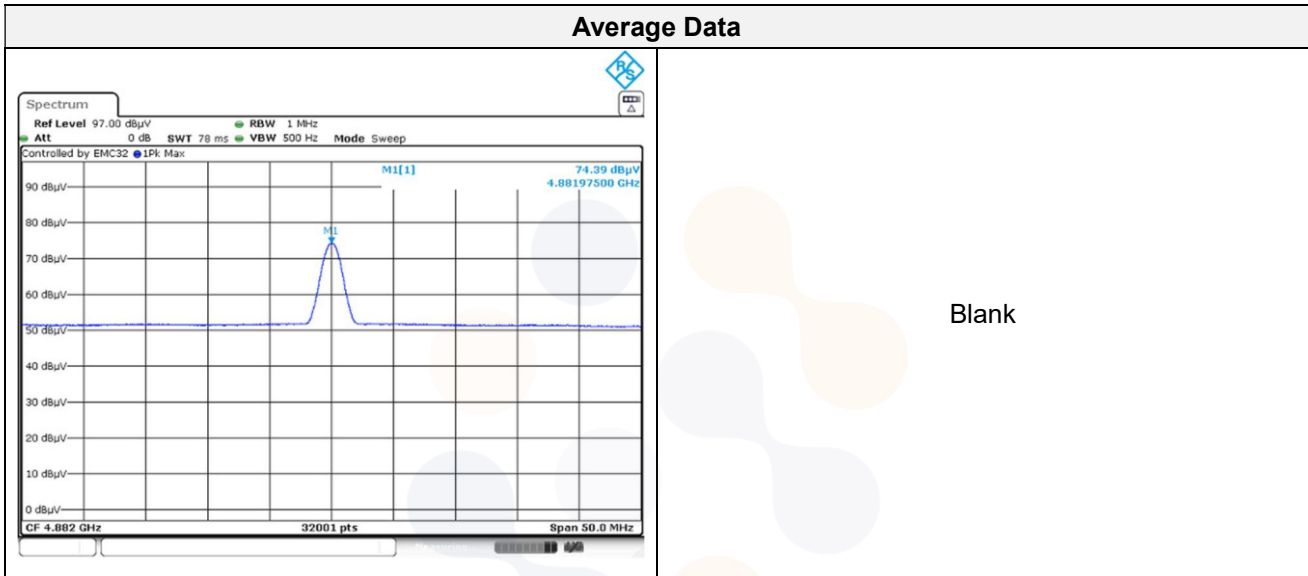
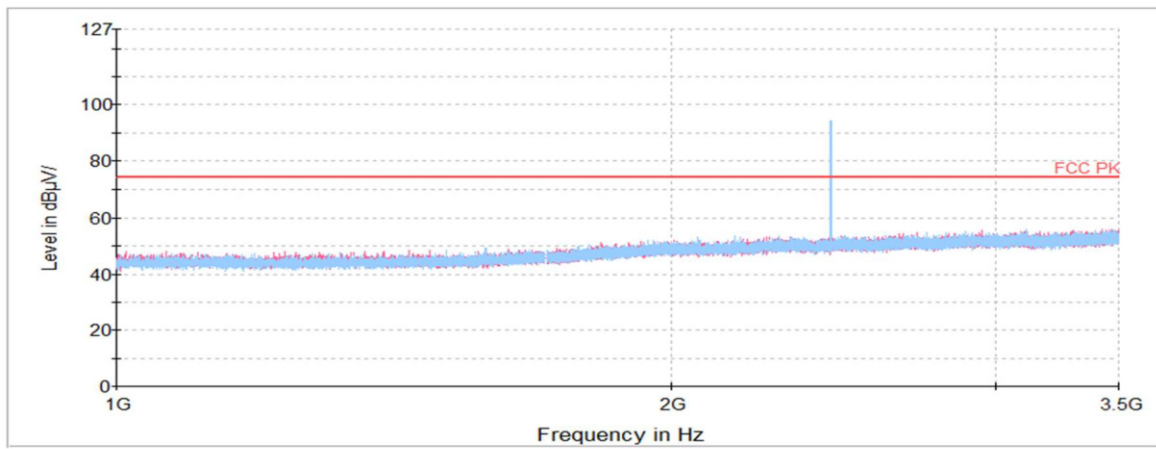


2 441 MHz

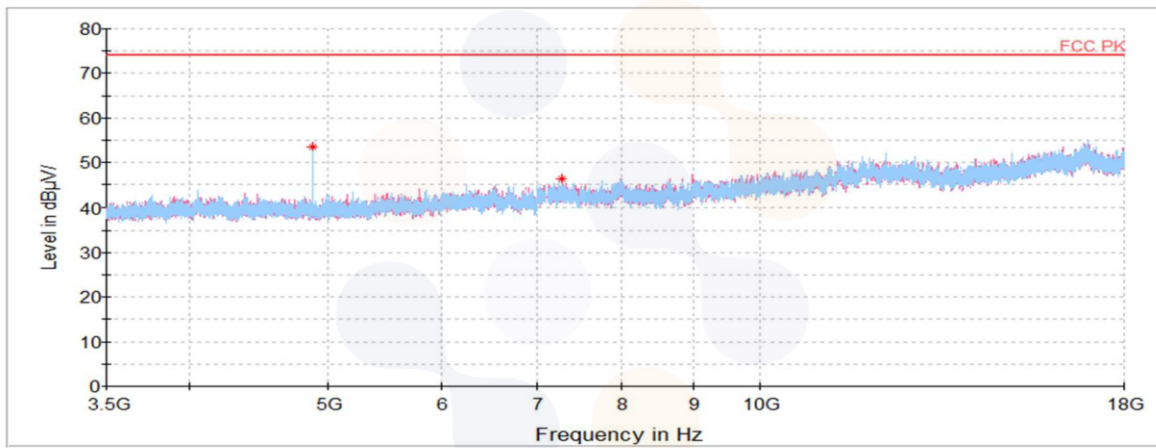
Frequency	Pol.	Reading	Antenna Factor	Amp. + Cable	Result	Limit	Margin
(MHz) ¹⁾	(V/H)	(dB(μV))	(dB)	(dB)	(dB(μW/m))	(dB(μW/m))	(dB)
Peak Data							
4 881.98 ¹⁾	H	75.90	33.40	-55.75	53.55	74.00	20.45
7 279.06 ¹⁾	V	63.10	35.20	-51.96	46.34	74.00	27.66
Average Data							
4 881.98 ¹⁾	H	74.39	33.40	-55.75	52.04	54.00	1.96



Horizontal/Vertical for 1 GHz ~ 3.5 GHz



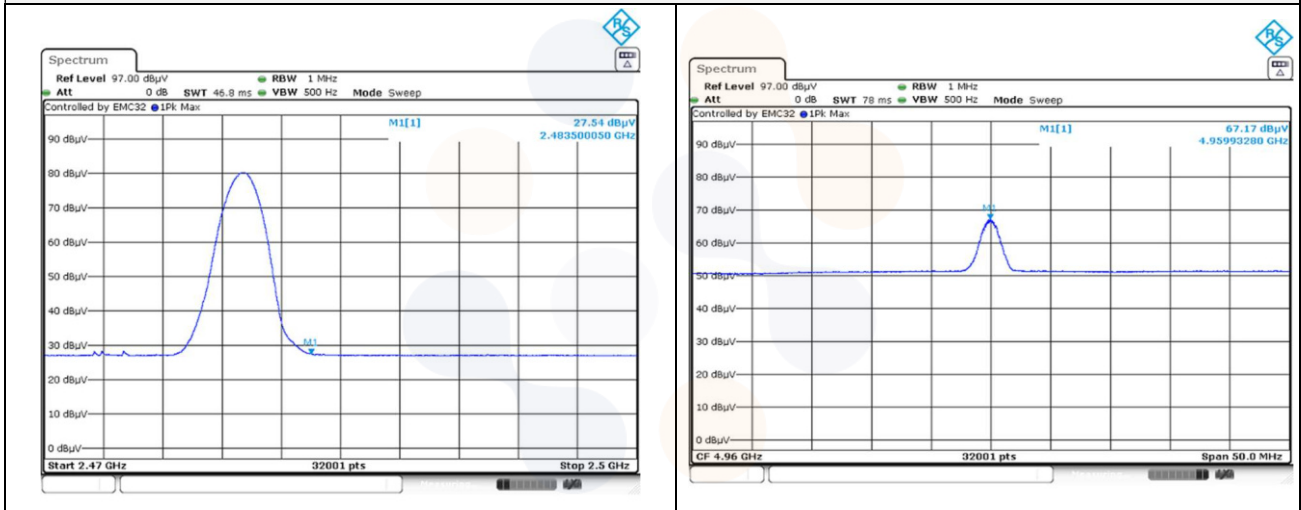
Horizontal/Vertical for 3.5 GHz ~ 18 GHz



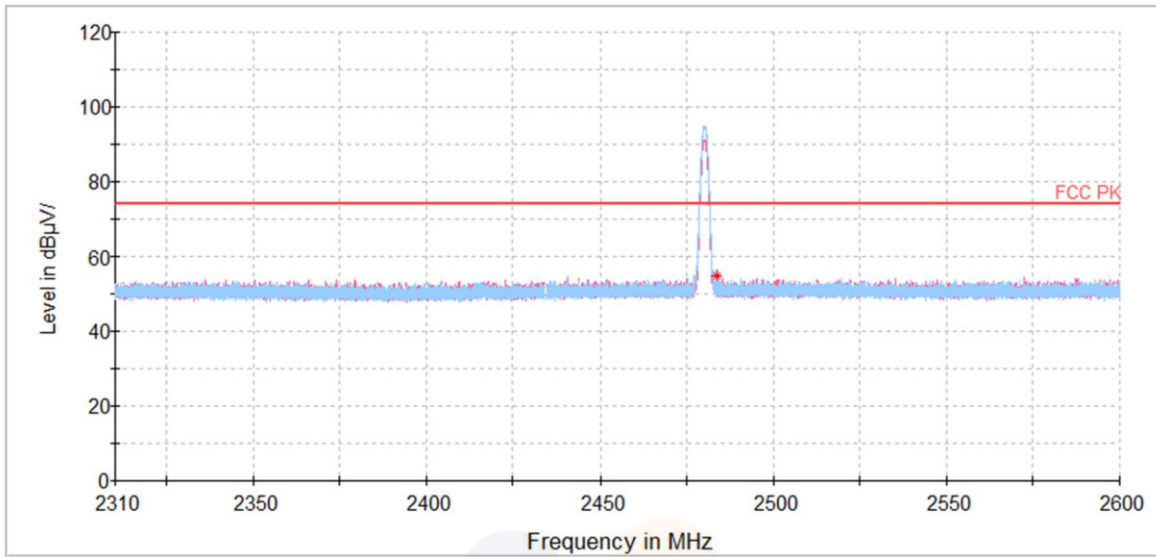
2 480 MHz

Frequency (MHz)	Pol. (V/H)	Reading (dB(μV))	Antenna Factor (dB)	Amp. + Cable (dB)	Result (dB(μV/m))	Limit (dB(μV/m))	Margin (dB)
Peak data							
2 483.50 ¹⁾	H	40.68	32.27	-18.11	54.84	74.00	19.16
4 959.93 ¹⁾	H	74.81	33.40	-55.59	52.62	74.00	21.38
7 439.92 ¹⁾	V	61.44	35.20	-51.95	44.69	74.00	29.31
9 920.33	H	61.66	36.80	-48.47	49.99	74.00	24.01
Average data							
2 483.50 ¹⁾	H	27.54	32.27	-18.11	41.70	54.00	12.30
4 959.93 ¹⁾	H	67.17	33.40	-55.59	44.98	54.00	9.02

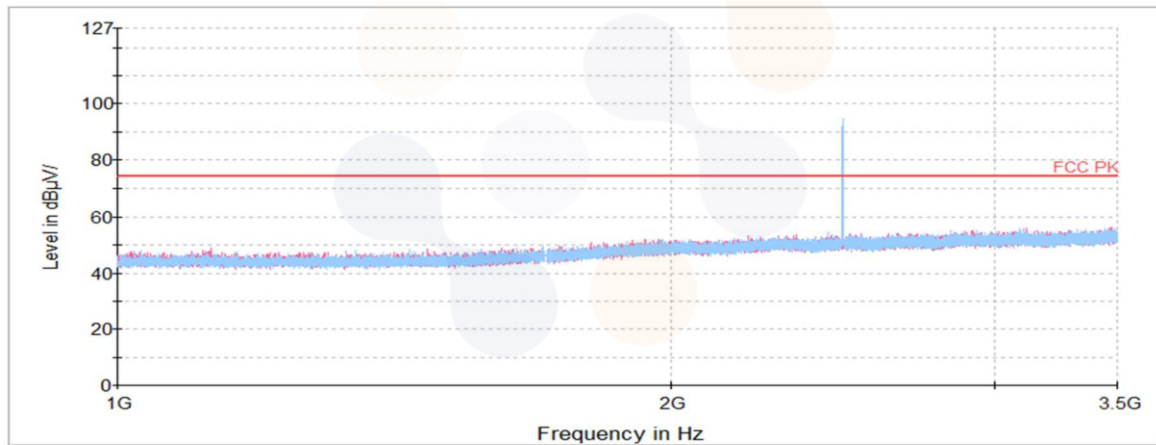
Average data



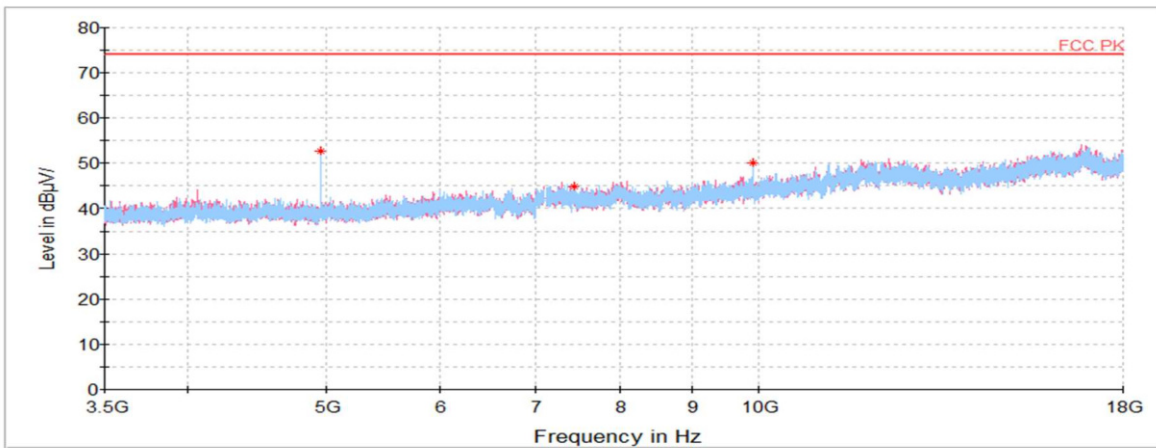
Horizontal/Vertical for Band-edge



Horizontal/Vertical for 1 GHz ~ 3.5 GHz



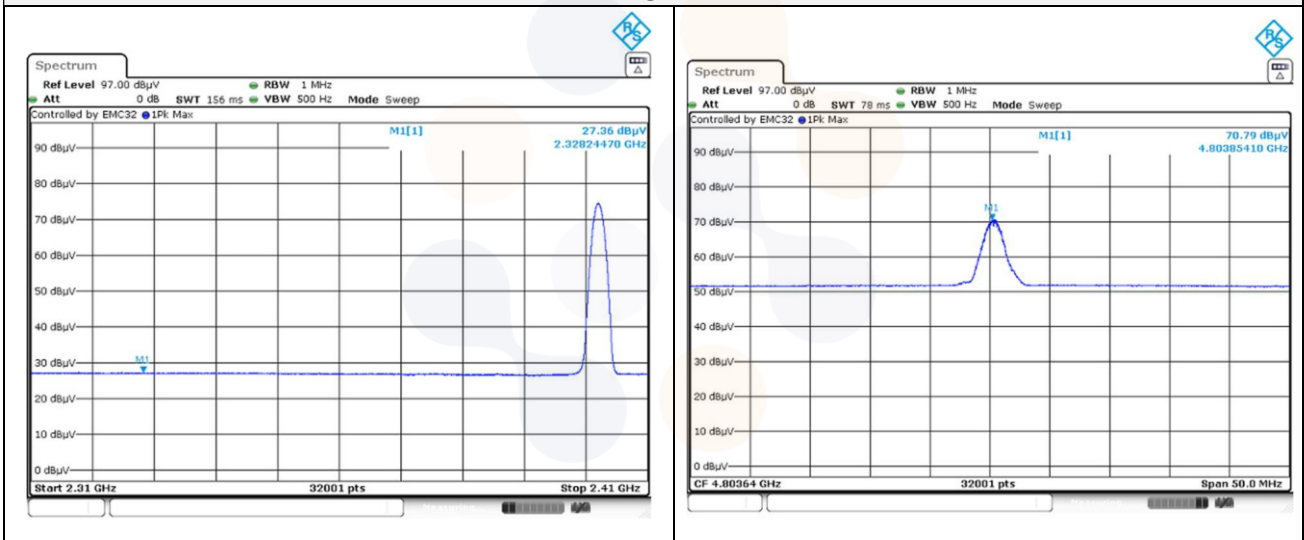
Horizontal/Vertical for 3.5 GHz ~ 18 GHz



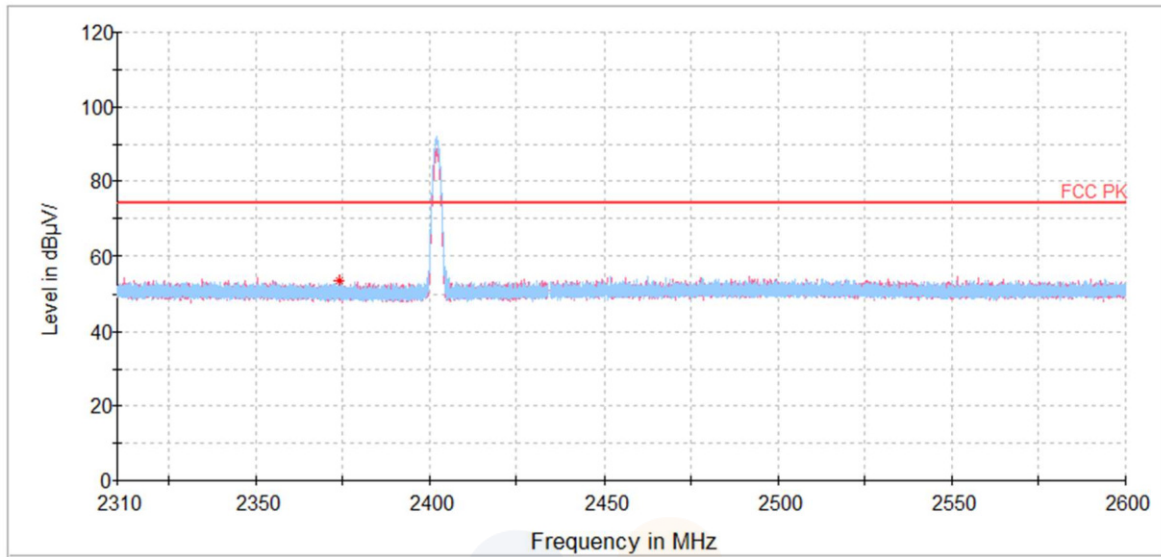
8DPSK
2 402 MHz

Frequency (MHz)	Pol. (V/H)	Reading (dB(μV))	Antenna Factor (dB)	Amp. + Cable (dB)	Result (dB(μV/m))	Limit (dB(μV/m))	Margin (dB)
Peak data							
2 328.24 ¹⁾	H	39.82	31.96	-18.26	53.52	74.00	20.48
4 803.85 ¹⁾	H	78.86	33.40	-55.94	56.32	74.00	17.68
7 089.66	H	62.21	35.20	-51.97	45.44	74.00	28.56
9 607.67	H	61.97	36.43	-48.97	49.43	74.00	24.57
Average data							
2 328.24 ¹⁾	H	27.36	31.96	-18.26	41.06	54.00	12.94
4 803.85 ¹⁾	H	70.79	33.40	-55.94	48.25	54.00	5.75

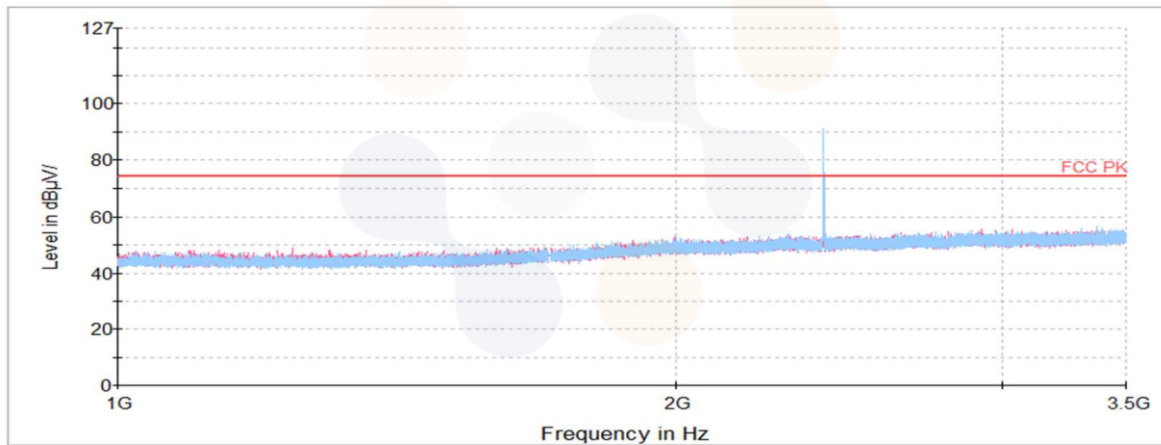
Average data



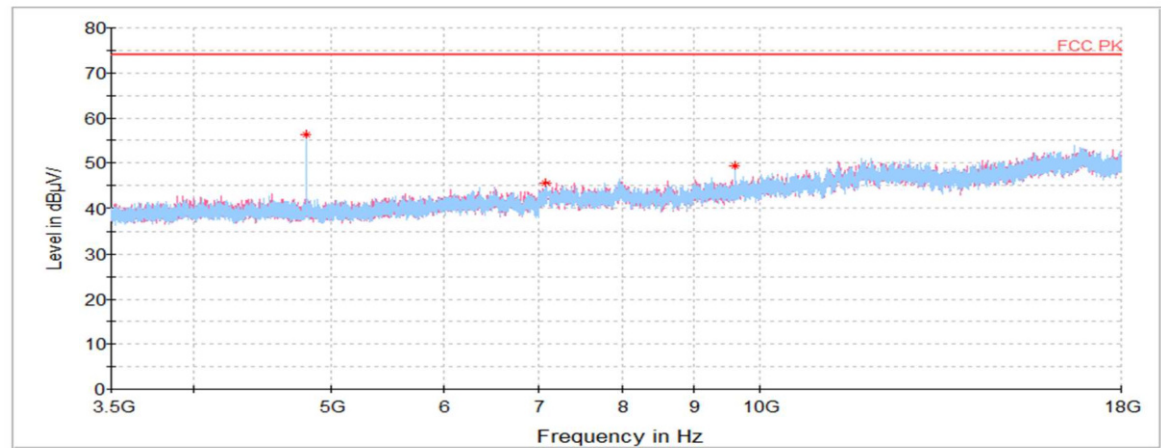
Horizontal/Vertical for Band-edge



Horizontal/Vertical for 1 GHz ~ 3.5 GHz

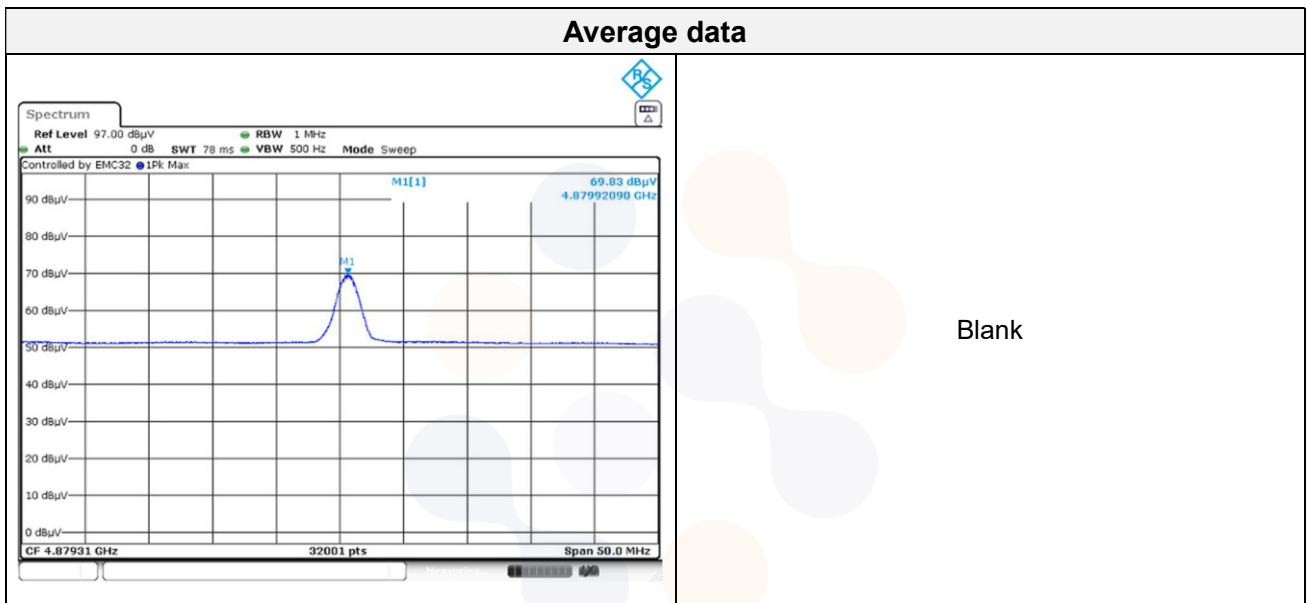


Horizontal/Vertical for 3.5 GHz ~ 18 GHz

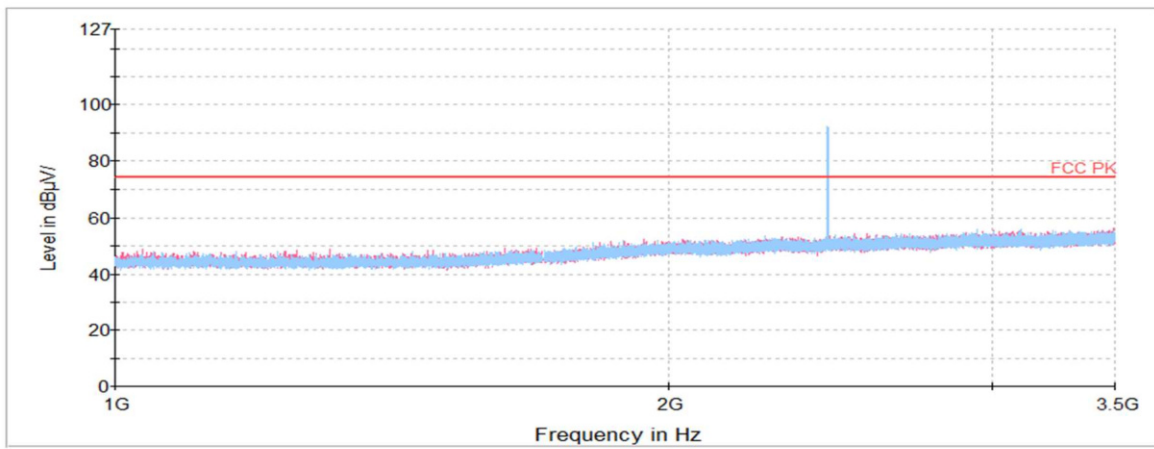


2 441 MHz

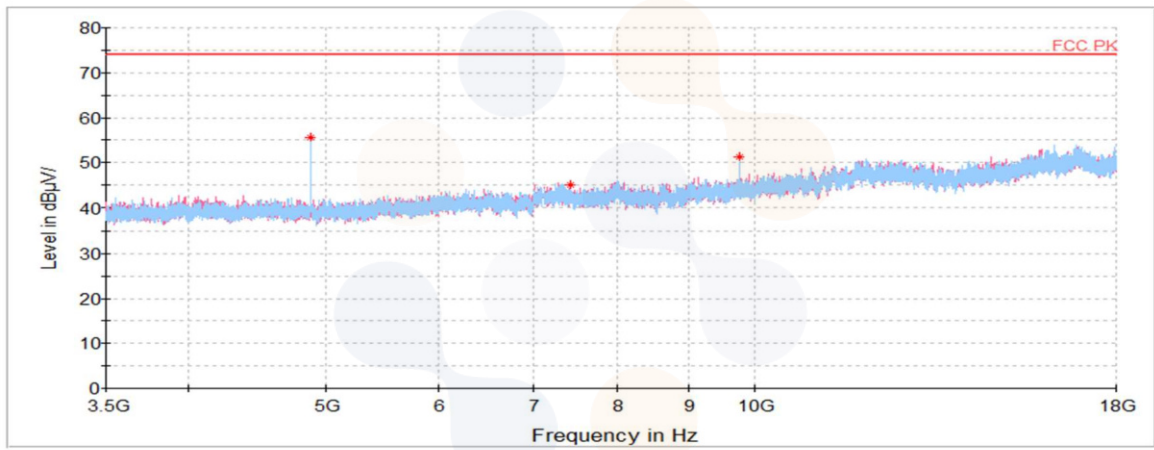
Frequency (MHz)	Pol. (V/H)	Reading (dB(μV))	Antenna Factor (dB)	Amp. + Cable (dB)	Result (dB(μW/m))	Limit (dB(μW/m))	Margin (dB)
Peak data							
4 879.92 ¹⁾	H	77.88	33.40	-55.76	55.52	74.00	18.48
7 418.17 ¹⁾	H	61.83	35.20	-51.95	45.08	74.00	28.92
9 759.47	H	63.32	36.61	-48.73	51.20	74.00	22.80
Average data							
4 879.92 ¹⁾	H	69.83	33.40	-55.76	47.47	54.00	6.53



Horizontal/Vertical for 1 GHz ~ 3.5 GHz



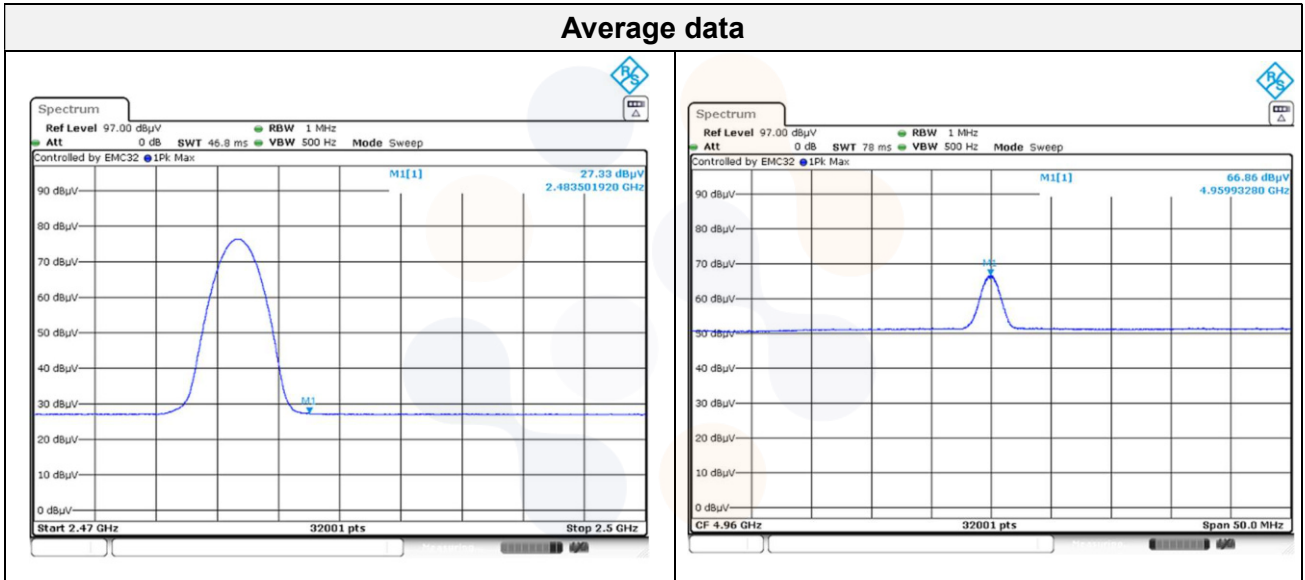
Horizontal/Vertical for 3.5 GHz ~ 18 GHz



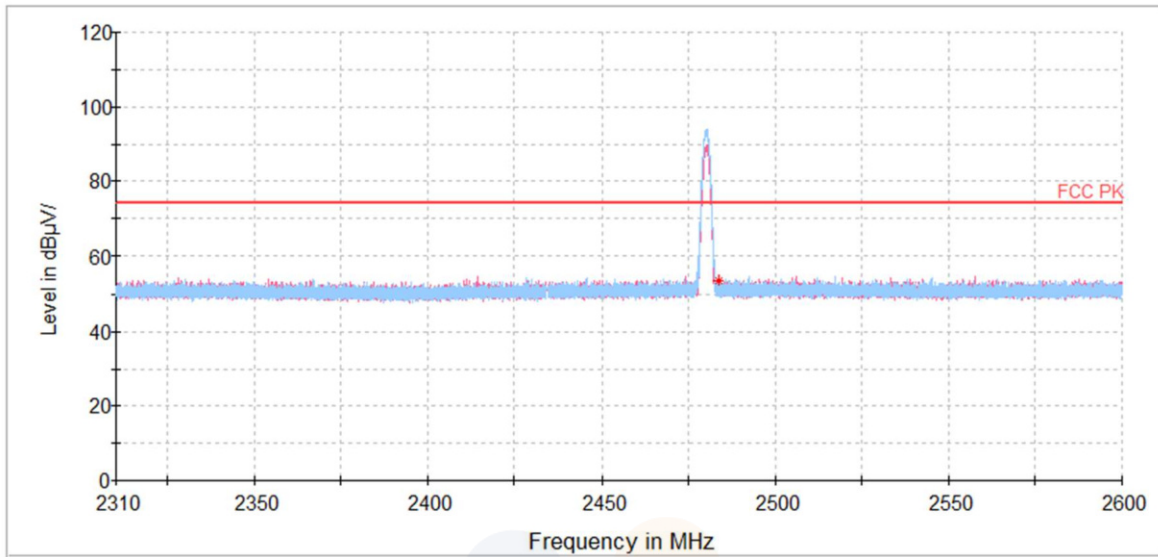
2 480 MHz

Frequency (MHz)	Pol. (V/H)	Reading (dB(μV))	Antenna Factor (dB)	Amp. + Cable (dB)	Result (dB(μV/m))	Limit (dB(μV/m))	Margin (dB)
Peak data							
2 483.50 ¹⁾	H	39.59	32.27	-18.11	53.75	74.00	20.25
4 959.93 ¹⁾	H	74.68	33.40	-55.59	52.49	74.00	21.51
7 422.25 ¹⁾	H	61.48	35.20	-51.95	44.73	74.00	29.27
9 919.42	H	61.88	36.80	-48.47	50.21	74.00	23.79
Average data							
2 483.50 ¹⁾	H	27.33	32.27	-18.11	41.49	54.00	12.51
4 959.93 ¹⁾	H	66.86	33.40	-55.59	44.67	54.00	9.33

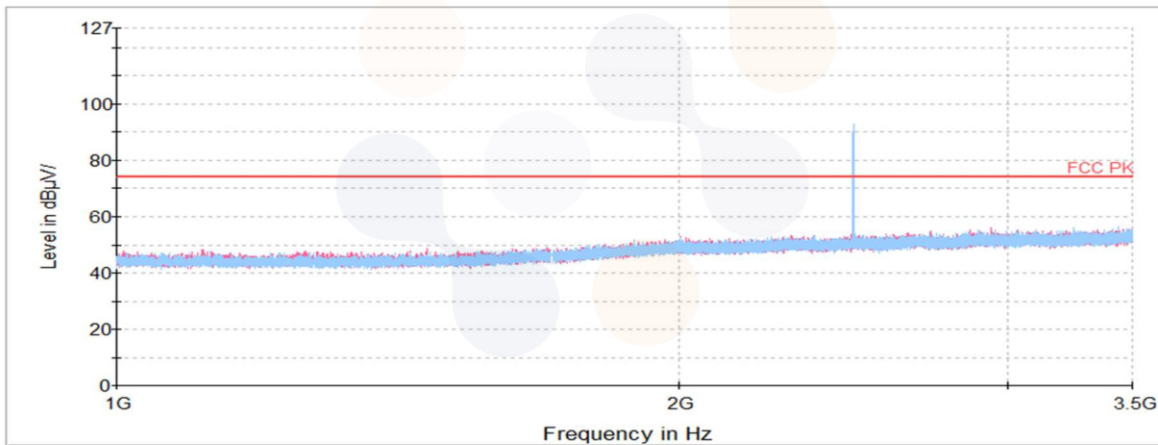
Average data



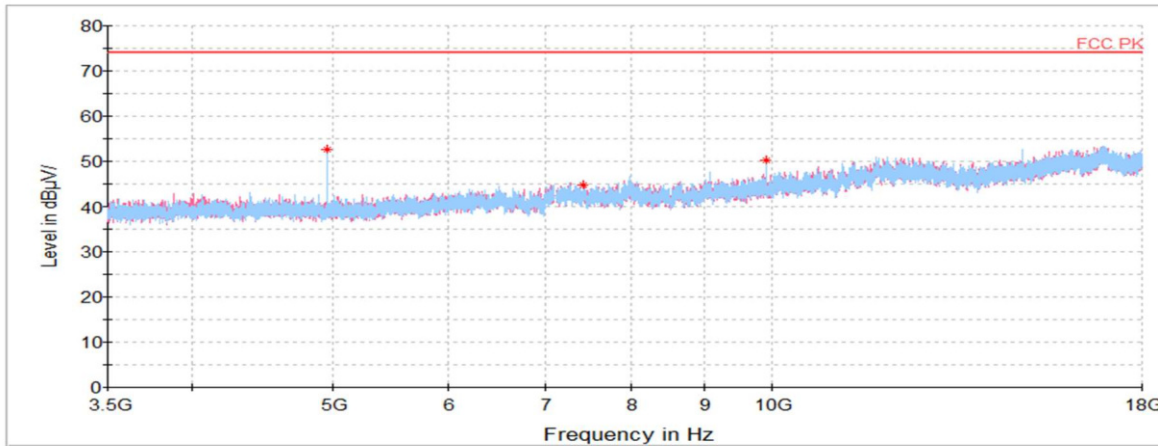
Horizontal/Vertical for Band-edge



Horizontal/Vertical for 1 GHz ~ 3.5 GHz

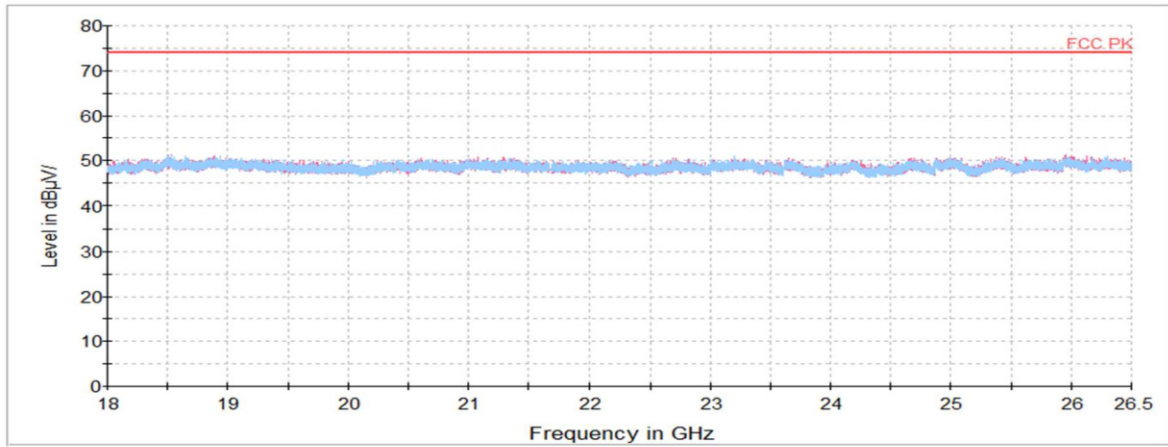


Horizontal/Vertical for 3.5 GHz ~ 18 GHz



Test results (Above 18 GHz) – Worst Case : GFSK_2 441 MHz

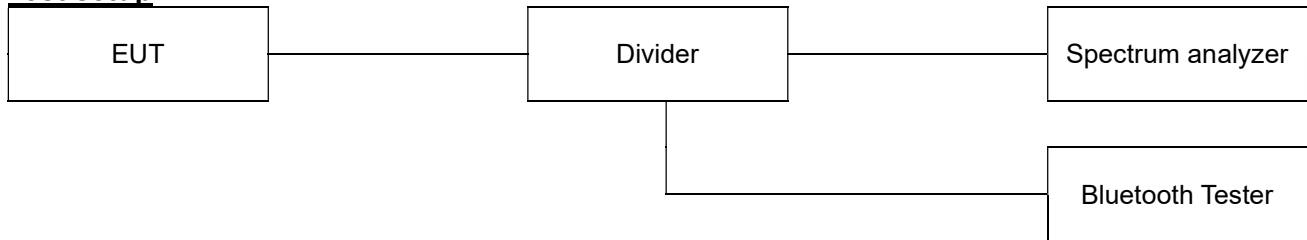
Horizontal/Vertical for 18 GHz ~ 26.5 GHz



Note: The Worst case was based on the lowest margin condition considering Harmonic and Spurious Emission.

7.7. Conducted Spurious Emission

Test setup



Limit

According to §15.247(d), In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operation, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation specified in §15.209(a) is not required. In addition, radiated emission limits specified in §15.209(a) (see §15.205(c)).

Limit : 20 dBc

Test procedure

ANSI C63.10-2013 - Section 6.10.4, 7.8.8

Test settings

▪ Band-edge

- 1) Span : Wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation
- 2) Reference level : As required to keep the signal from exceeding the maximum instrument input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than $[10 \log(\text{OBW}/\text{RBW})]$ below the reference level.
- 3) Attenuation: Auto (at least 10 dB preferred)
- 4) Sweep time = Coupled
- 5) RBW : 100 kHz
- 6) VBW : 300 kHz
- 7) Detector : Peak
- 8) Trace : Max hold

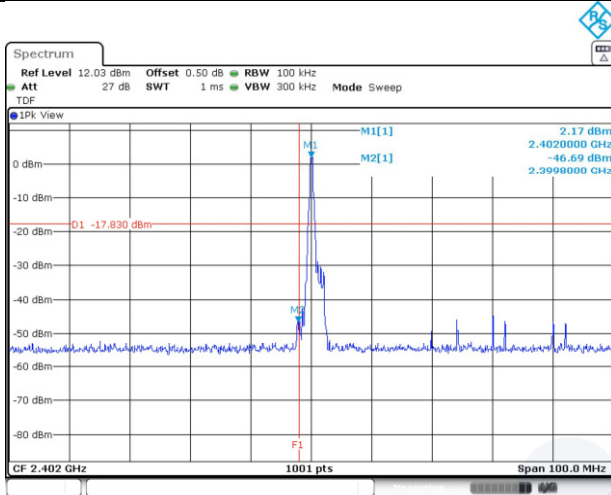
▪ Spurious emissions

- 1) Span : 30 MHz to 10 times the operating frequency in GHz
- 2) RBW : 100 kHz
- 3) VBW : 300 kHz
- 4) Sweep time : Coupled
- 5) Detector : Peak

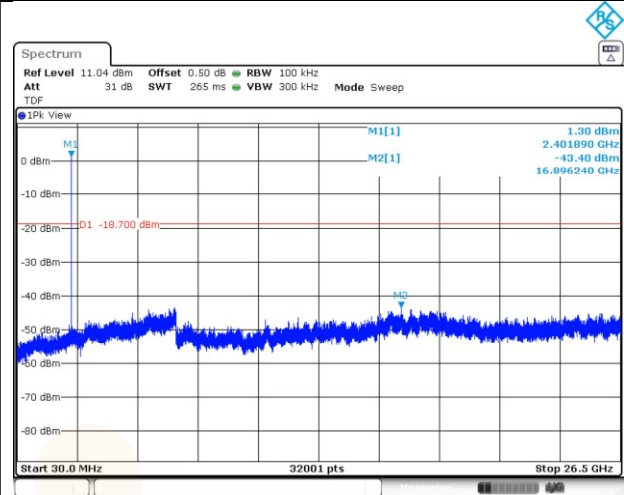
Test results

GFSK

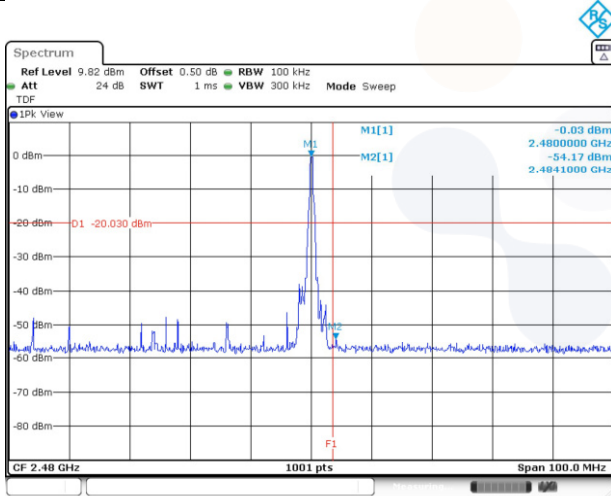
Conducted band-edge / Low ch



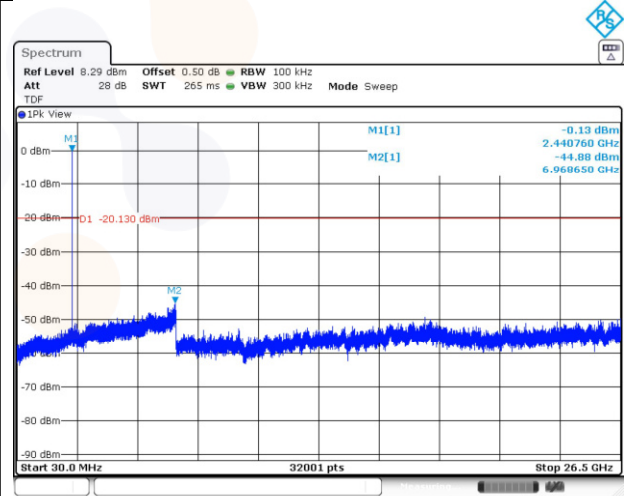
Conducted spurious / Low ch.



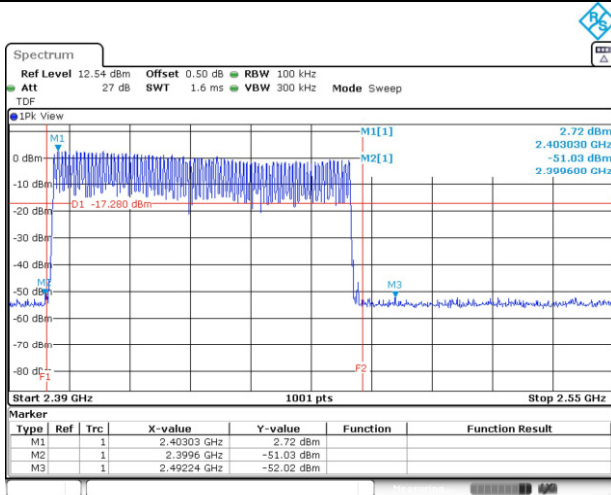
Conducted band-edge / High ch.



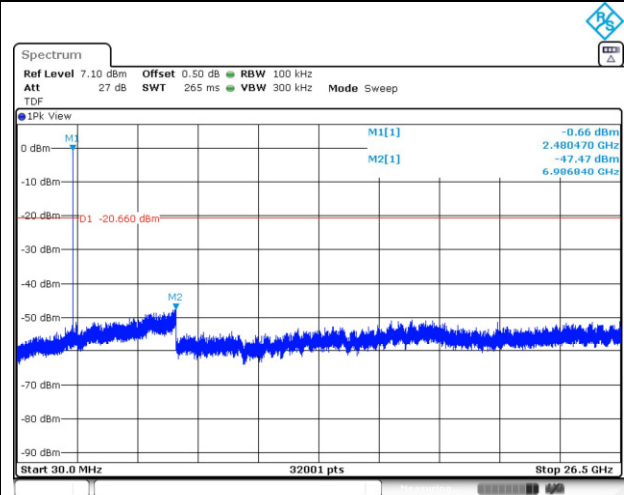
Conducted spurious / Mid ch.



Conducted band-edge / Hopping ch.

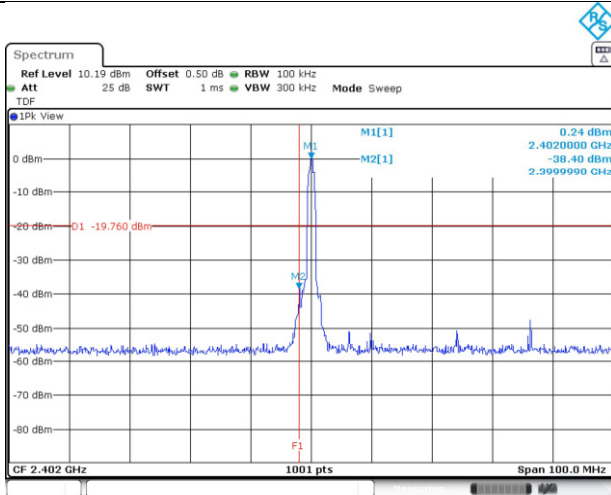


Conducted spurious / High ch.

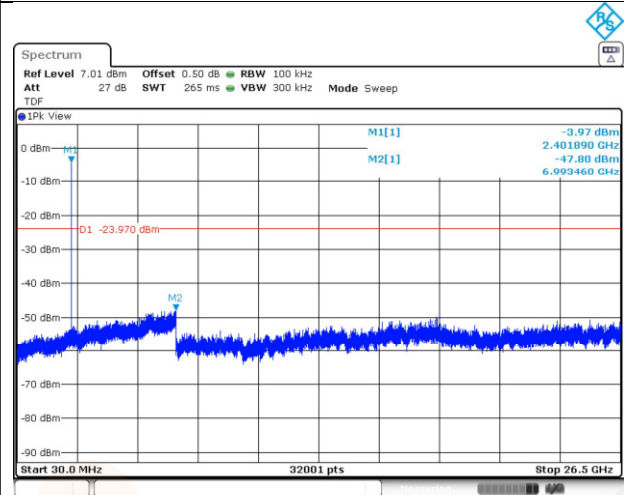


8DPSK

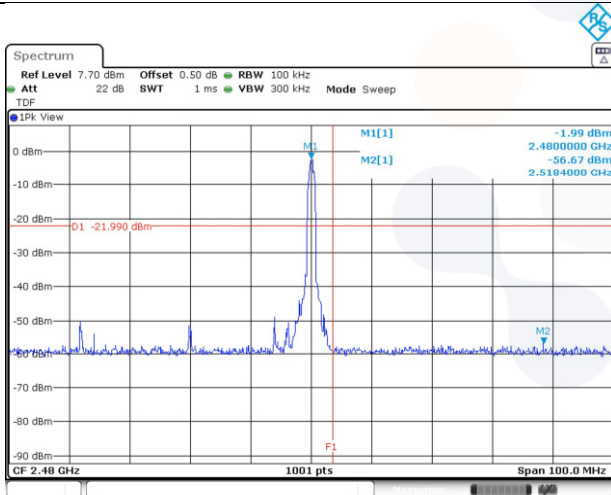
Conducted band-edge / Low ch



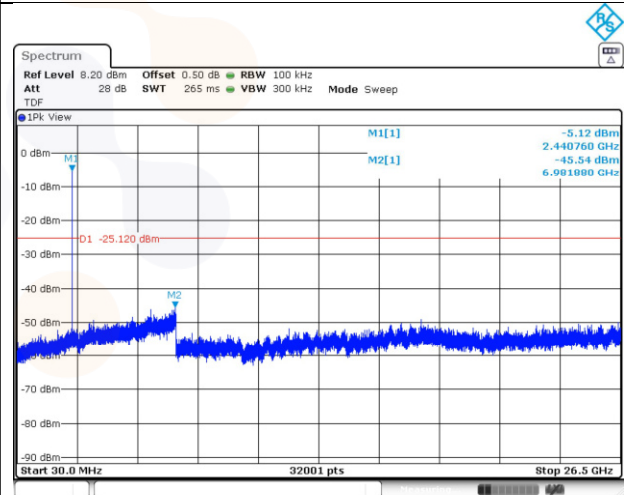
Conducted spurious / Low ch.



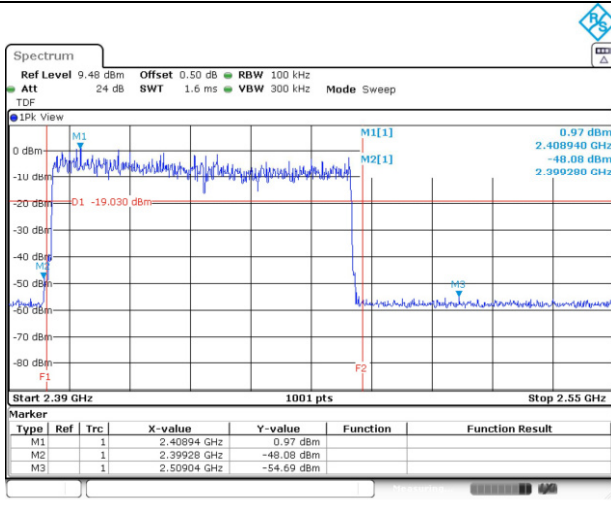
Conducted band-edge / High ch.



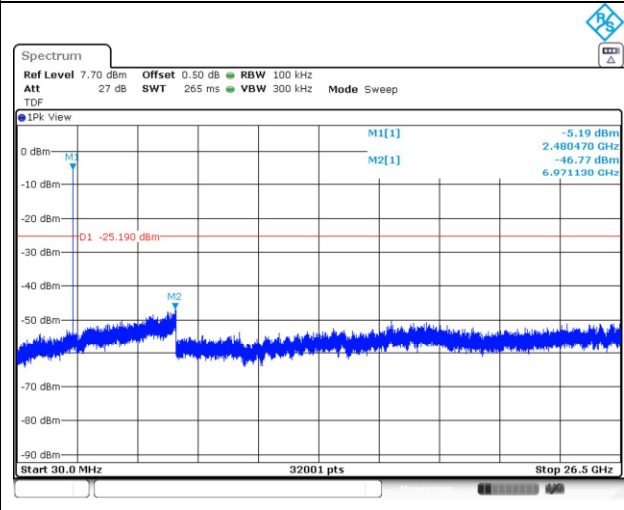
Conducted spurious / Mid ch.



Conducted band-edge / Hopping ch.

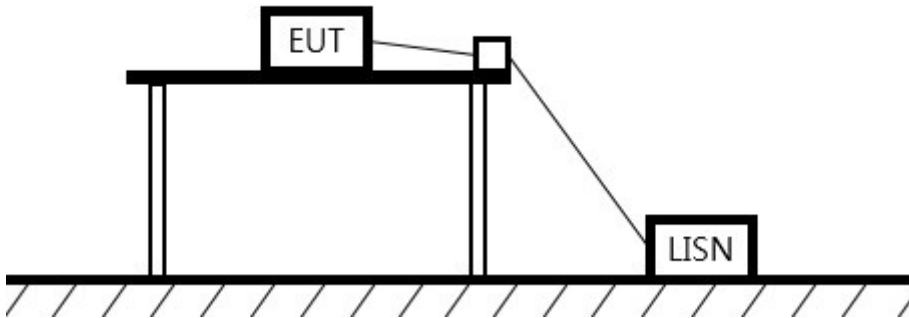


Conducted spurious / High ch.



7.8. AC Conducted Emission

Test setup



Limit

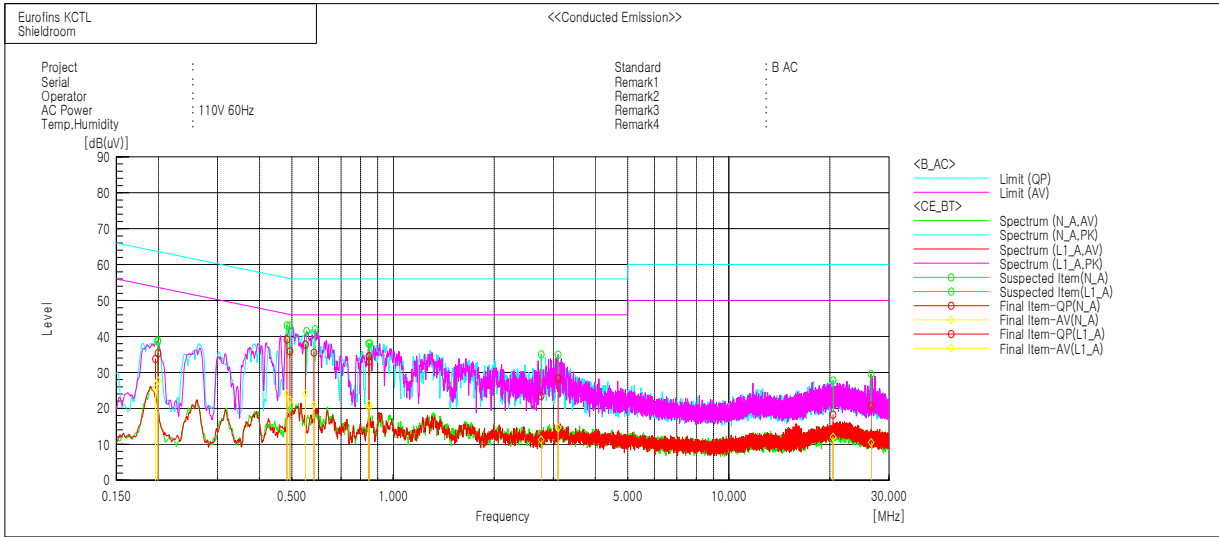
According to 15.207(a), for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50uH/50 ohm line impedance stabilization network (LISN). Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequencies ranges.

Frequency of Emission (MHz)	Conducted limit (dB μ V/m)	
	Quasi-peak	Average
0.15 – 0.50	66 - 56*	56 - 46*
0.50 – 5.00	56	46
5.00 – 30.0	60	50

Measurement procedure

1. The EUT was placed on a wooden table of size, 1 m by 1.5 m, raised 80 cm in which is located 40 cm away from the vertical wall and 1.5m away from the side wall of the shielded room.
2. Each current-carrying conductor of the EUT power cord was individually connected through a 50 Ω /50 μ H LISN, which is an input transducer to a spectrum analyzer or an EMI/Field Intensity — Meter, to the input power source.
3. Exploratory measurements were made to identify the frequency of the emission that had the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable position, and with a typical system equipment configuration and arrangement. Based on the exploratory tests of the EUT, the one EUT cable configuration and arrangement and mode of operation that had produced the emission with the highest amplitude relative to the limit was selected for the final measurement.
4. The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment is the system) was then performed over the frequency range of 0.15 MHz to 30 MHz.
5. The measurements were made with the detector set to peak amplitude within a bandwidth of 10 kHz or to quasi-peak and average within a bandwidth of 9 kHz. The EUT was in transmitting mode during the measurements.

Test results -Worst case: GFSK_2 402 MHz



Final Result

--- N_A Phase ---

No.	Frequency [MHz]	Reading QP [dB(uV)]	Reading CAV [dB(uV)]	c.f [dB]	Result QP [dB(uV)]	Result CAV [dB(uV)]	Limit QP [dB(uV)]	Limit AV [dB(uV)]	Margin QP [dB]	Margin CAV [dB]
1	0.19619	23.8	15.6	9.9	33.7	25.5	63.8	53.8	30.1	28.3
2	0.48318	29.2	14.1	9.9	39.1	24.0	56.3	46.3	17.2	22.3
3	0.58118	25.6	10.9	9.9	35.5	20.8	56.0	46.0	20.5	25.2
4	0.84816	24.6	10.3	9.9	34.5	20.2	56.0	46.0	21.5	25.8
5	2.76093	13.6	1.5	9.8	23.4	11.3	56.0	46.0	32.6	34.7
6	20.45107	7.5	1.3	10.7	18.2	12.0	60.0	50.0	41.8	38.0

--- L1_A Phase ---

No.	Frequency [MHz]	Reading QP [dB(uV)]	Reading CAV [dB(uV)]	c.f [dB]	Result QP [dB(uV)]	Result CAV [dB(uV)]	Limit QP [dB(uV)]	Limit AV [dB(uV)]	Margin QP [dB]	Margin CAV [dB]
1	0.19952	25.5	17.8	9.9	35.4	27.7	63.6	53.6	28.2	25.9
2	0.49336	25.9	12.3	9.9	35.8	22.2	56.1	46.1	20.3	23.9
3	0.54787	27.9	14.2	9.9	37.8	24.1	56.0	46.0	18.2	21.9
4	0.84741	23.2	11.4	9.8	33.0	21.2	56.0	46.0	23.0	24.8
5	3.10017	18.3	4.8	9.9	28.2	14.7	56.0	46.0	27.8	31.3
6	26.51964	9.8	-0.4	10.9	20.7	10.5	60.0	50.0	39.3	39.5

8. Measurement equipment

Equipment Name	Manufacturer	Model No.	Serial No.	Next Cal. Date
Spectrum Analyzer	R&S	FSV30	100732	24.07.03
Attenuator	API Inmet	40AH2W-10	18	24.05.03
DC Power Supply	AGILENT	E3632A	MY40007371	24.04.27
Divider	Marki Microwave, Inc.	PD-0040	D0005	24.07.04
Signal Generator	R&S	SMB100A	176206	24.01.19
Attenuator	R&S	DNF Dämpfungsglied 10 dB in N-50 Ohm	0002	24.04.25
Power Sensor	R&S	NRP-Z81	1137.9009.02- 106224-tg	24.04.25
Bluetooth Tester	TESCOM	TC-3000C	3000C000270	24.07.04
Vector Signal Generator	R&S	SMBV100A	257566	24.07.04
Spectrum Analyzer	R&S	FSV40	100989	23.10.14
Horn antenna	ETS.lindgren	3117	155787	23.09.29
Horn antenna	ETS.lindgren	3116	86632	24.01.25
Attenuator	API Inmet	40AH2W-10	12	24.05.03
AMPLIFIER	B&Z Technologies	BZRT-00504000- 481055-382525	26299-27735	23.09.19
AMPLIFIER	B&Z Technologies	BZR-0050400- 551028-252525	27736	23.09.19
Antenna Mast	Innco Systems	MA4640-XP-ET	-	-
Controller	Innco Systems	CO3000	1175/45850319/ P	-
High pass Filter	Qotana	DBHF058004000A	20070100016	24.07.04
High pass Filter	WT	WT-A1698-HS	WT160411001	24.04.25
EMI TEST RECEIVER	R&S	ESCI7	100732	24.03.03
Bi-Log Antenna	TESEQ	CBL 6112D	62438	24.08.24
Amplifier	SONOMA INSTRUMENT	310N	284608	23.08.18
ATTENUATOR	KEYSIGHT	8491B-6dB	MY39271060	24.04.27
LOOP Antenna	R&S	HFH2-Z2	100355	24.08.10
Antenna Mast	Innco Systems	MA4000-EP	303	-
Turn Table	Innco Systems	CO3000	1175/45850319/ P	-
TWO-LINE V - NETWORK	R&S	ENV216	101358	23.09.29
EMI TEST RECEIVER	R&S	ESCI3	100001	23.08.18

End of test report