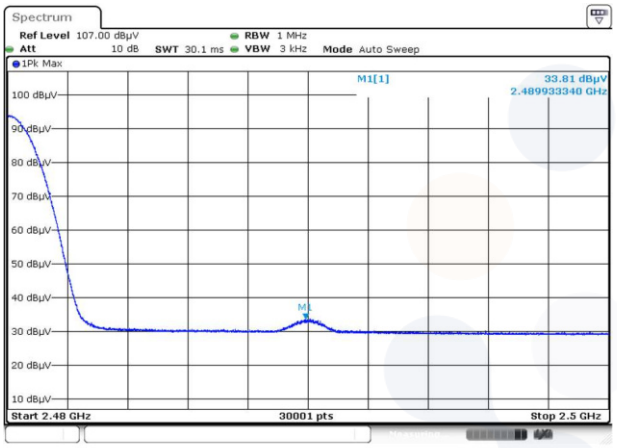
GFSK_High Channel

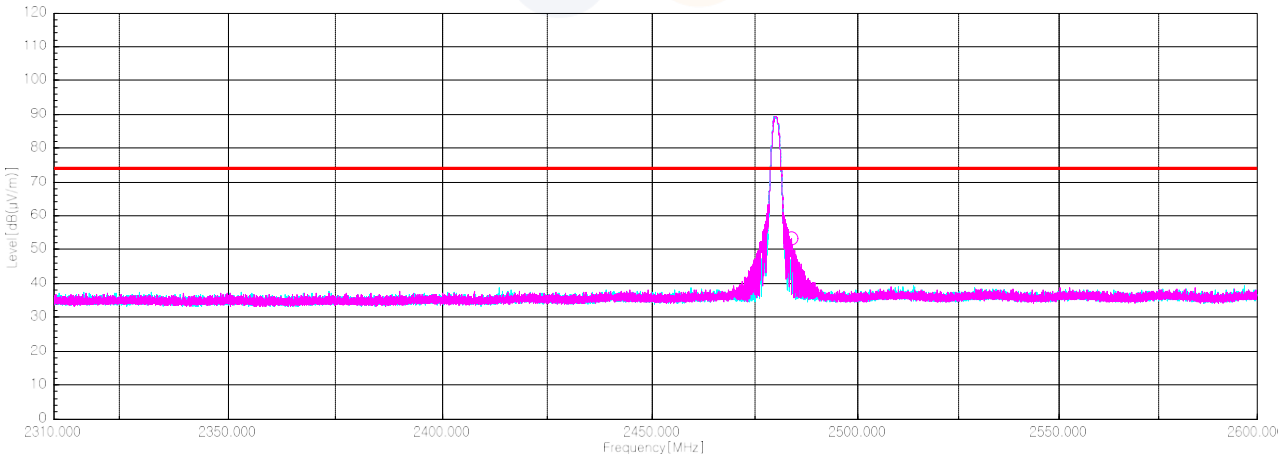
Frequency	Pol.	Reading	Ant. Factor	Amp. + Cable	DCCF	Result	Limit	Margin
(MHz)	(V/H)	(dB(μV))	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Peak data								
2 489.93[1)]	H	58.10	27.90	-32.57	-	53.43	74.00	20.57
4 939.85[1)]	V	53.10	32.94	-42.44	-	43.60	74.00	30.40
5 294.62	V	54.50	32.91	-42.05	-	45.36	74.00	28.64
7 415.97[1)]	V	52.50	36.47	-41.28	-	47.69	74.00	26.31
Average Data								
2 489.93[1)]	H	33.81	27.90	-32.57	-	29.14	54.00	24.86

Average Data

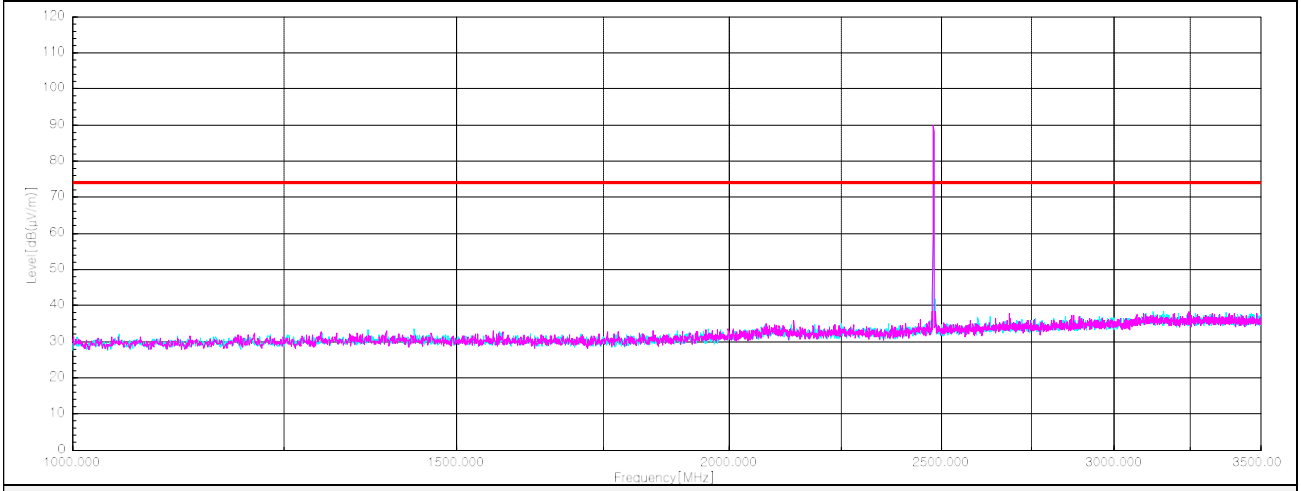


Blank

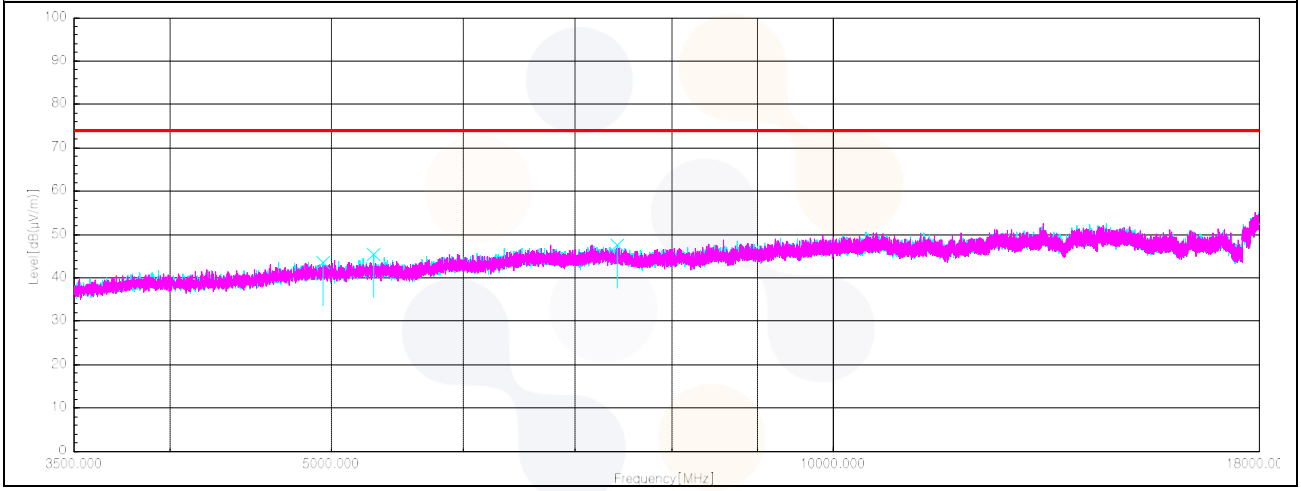
Horizontal/Vertical for Band-edge



Horizontal/Vertical for 1 ㎓ ~ 3.5 ㎓



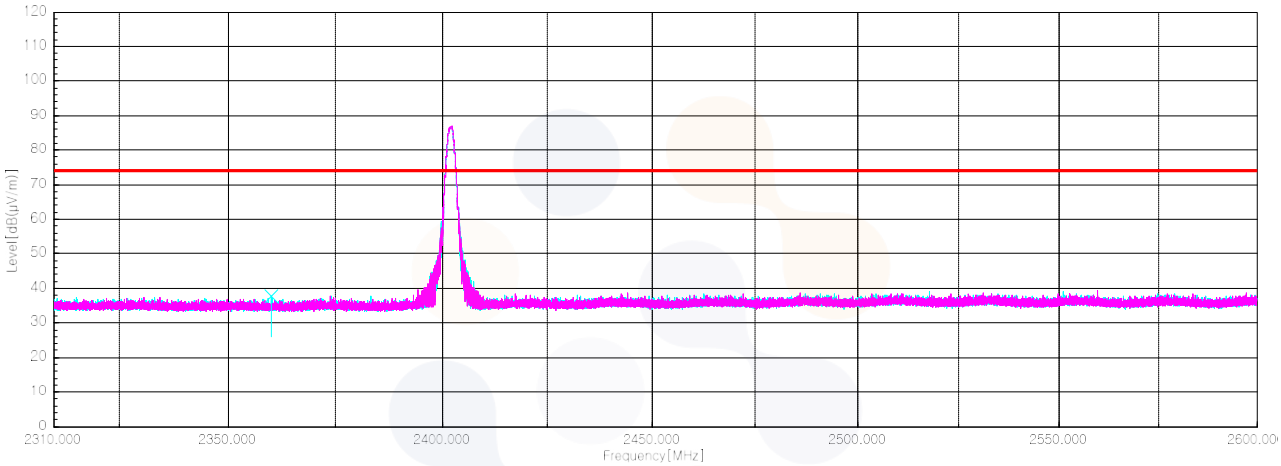
Horizontal/Vertical for 3.5 ㎓ ~ 18 ㎓



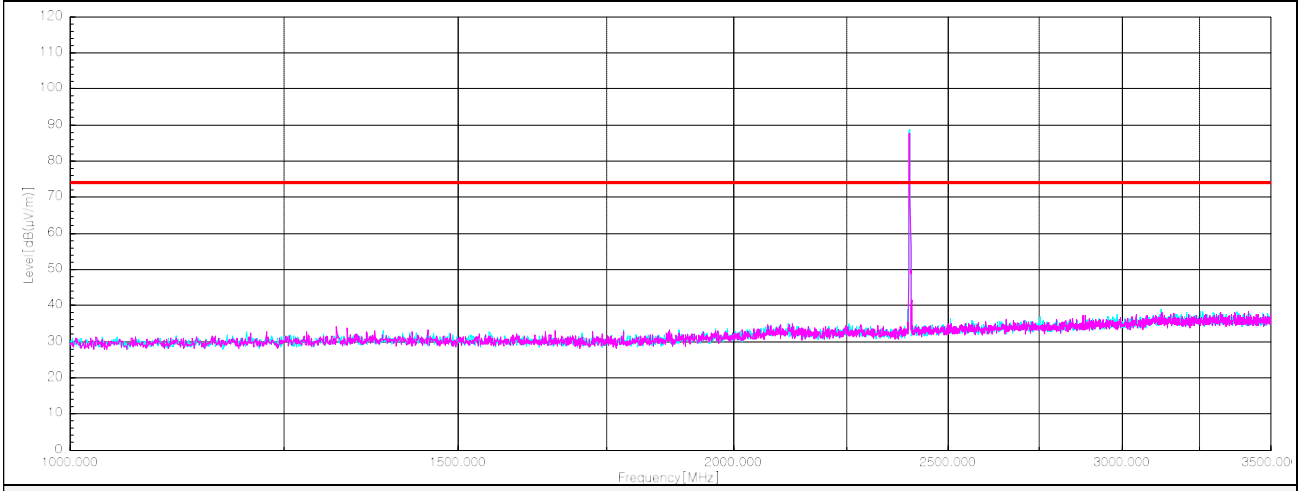
8DPSK_Low Channel

Frequency	Pol.	Reading	Ant. Factor	Amp. + Cable	DCCF	Result	Limit	Margin
(MHz)	(V/H)	(dB(μV))	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Peak data								
2 359.90[1)]	V	43.50	26.90	-32.84	-	37.56	74.00	36.44
4 828.68[1)]	H	52.30	32.26	-42.33	-	42.23	74.00	31.77
7 304.80[1)]	V	51.60	36.79	-41.18	-	47.21	74.00	26.79
Average Data								
No spurious emissions were detected within 20 dB of the limit.								

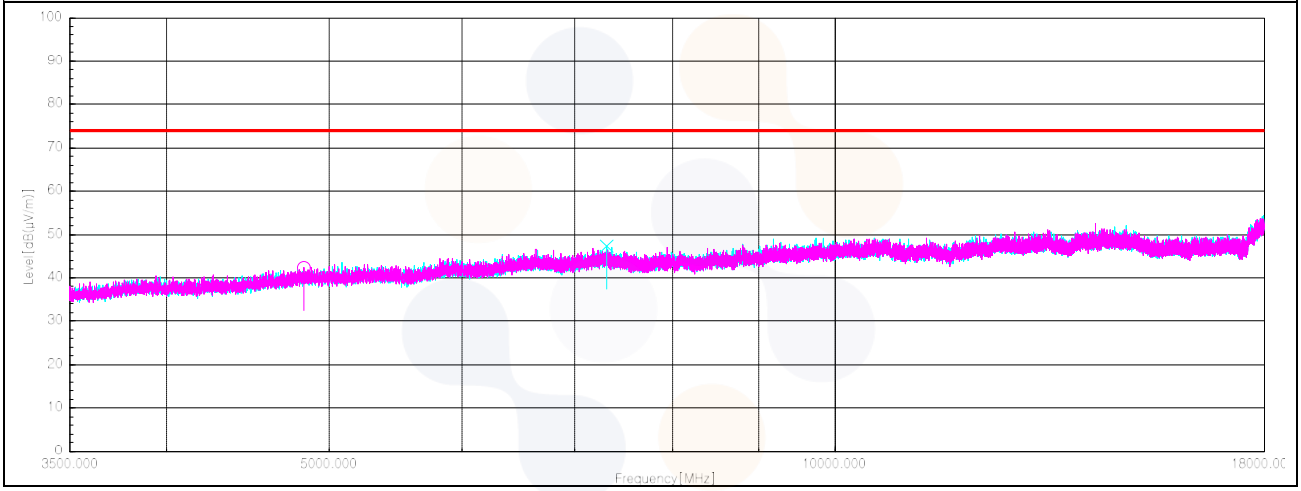
Horizontal/Vertical for Band-edge



Horizontal/Vertical for 1 ㎓ ~ 3.5 ㎓



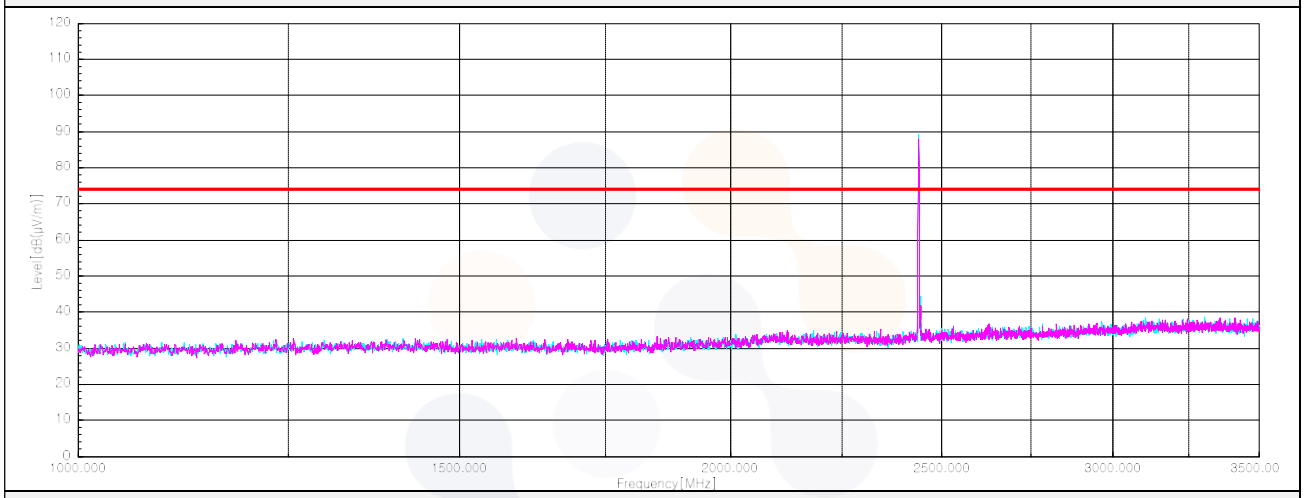
Horizontal/Vertical for 3.5 ㎓ ~ 18 ㎓



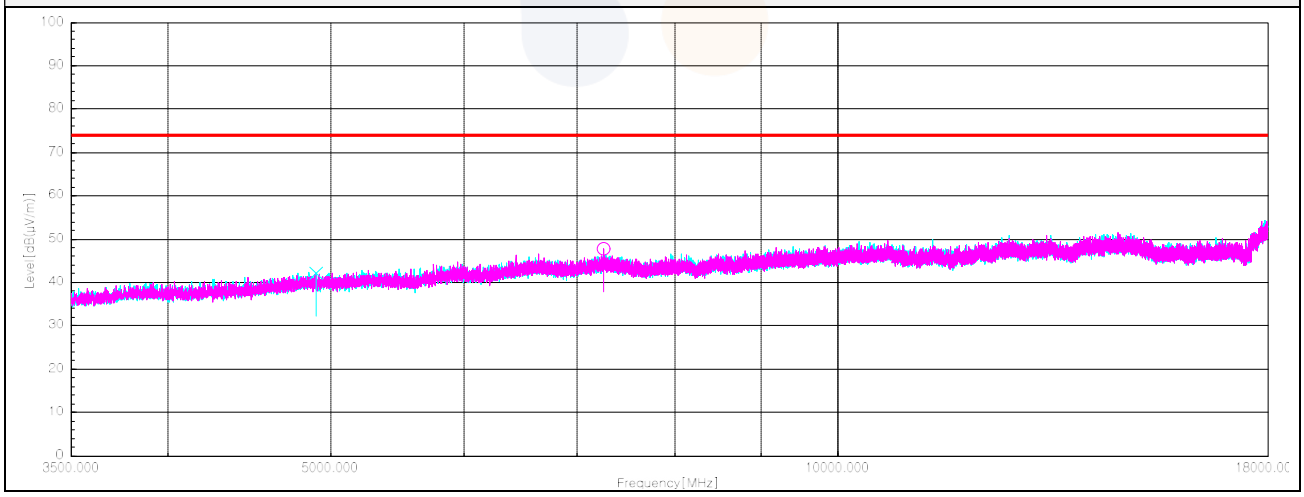
8DPSK_Middle Channel

Frequency	Pol.	Reading	Ant. Factor	Amp. + Cable	DCCF	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Peak data								
4 893.93[1)]	V	51.90	32.58	-42.38	-	42.10	74.00	31.90
7 258.40[1)]	H	52.10	36.92	-41.14	-	47.88	74.00	26.12
Average Data								
No spurious emissions were detected within 20 ㏈ of the limit.								

Horizontal/Vertical for 1 ㎓ ~ 3.5 ㎓



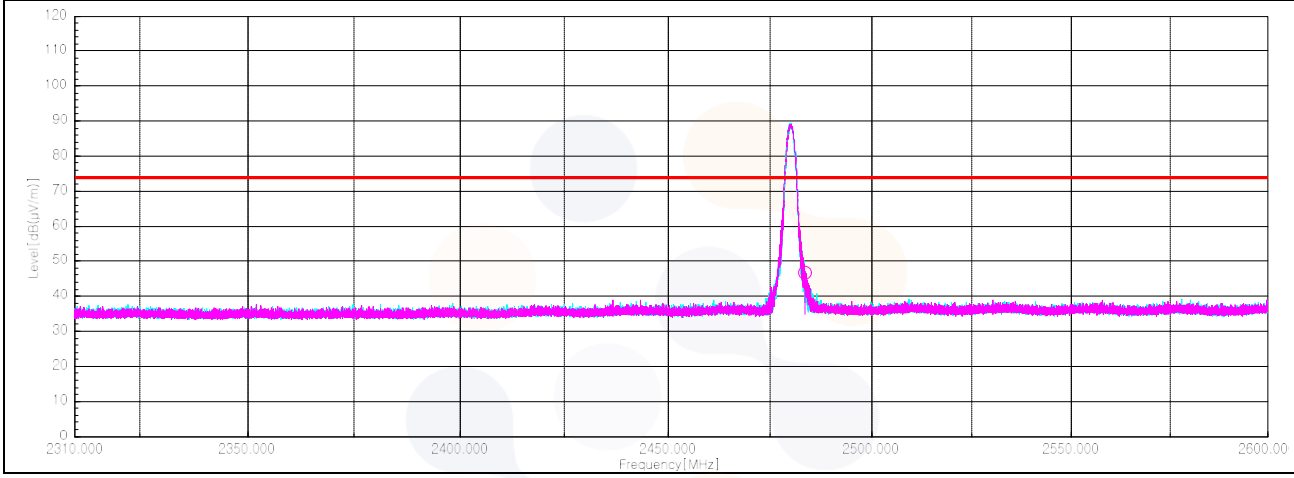
Horizontal/Vertical for 3.5 ㎓ ~ 18 ㎓



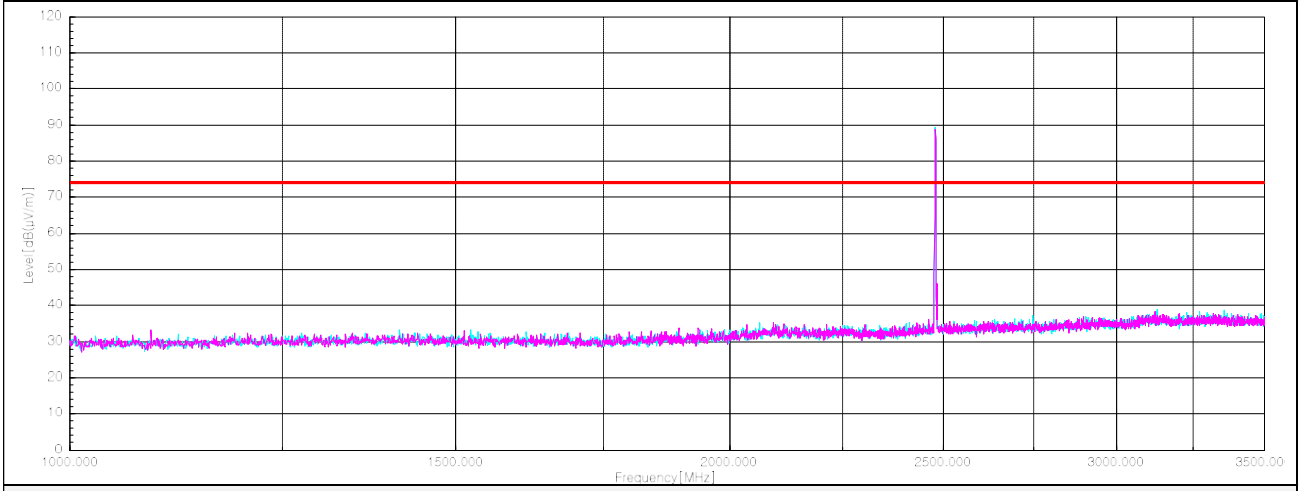
8DPSK_High Channel

Frequency	Pol.	Reading	Ant. Factor	Amp. + Cable	DCCF	Result	Limit	Margin
(MHz)	(V/H)	(dB(μV))	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
Peak data								
2 483.58[1)]	H	51.60	27.84	-32.59	-	46.85	74.00	27.15
6 012.85	H	51.00	34.30	-40.70	-	44.60	74.00	29.40
7 458.98[1)]	V	51.70	36.26	-41.32	-	46.64	74.00	27.36
Average Data								
No spurious emissions were detected within 20 dB of the limit.								

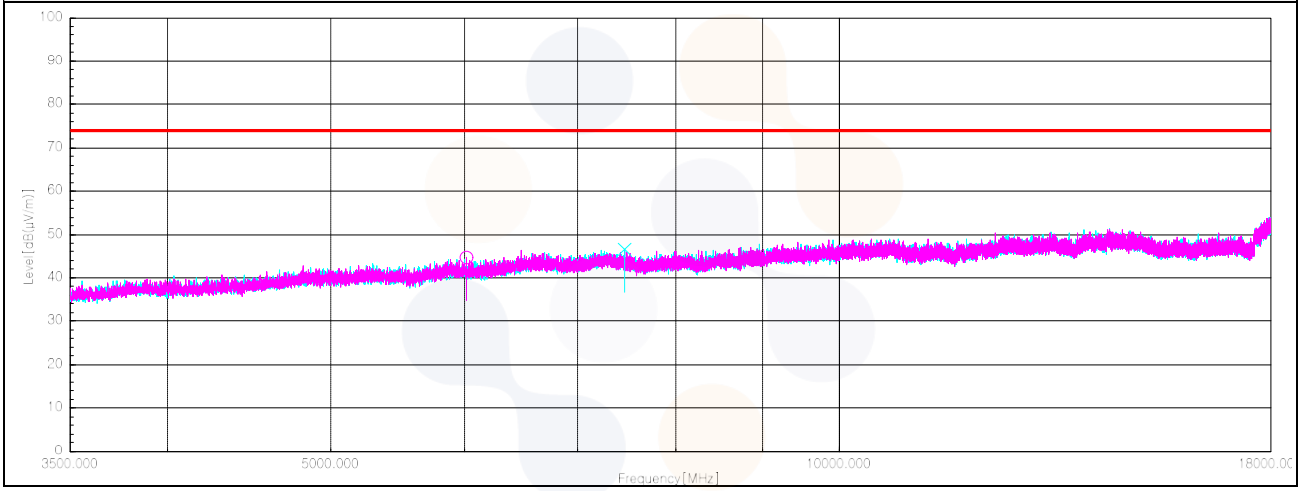
Horizontal/Vertical for Band-edge



Horizontal/Vertical for 1 ㎓ ~ 3.5 ㎓

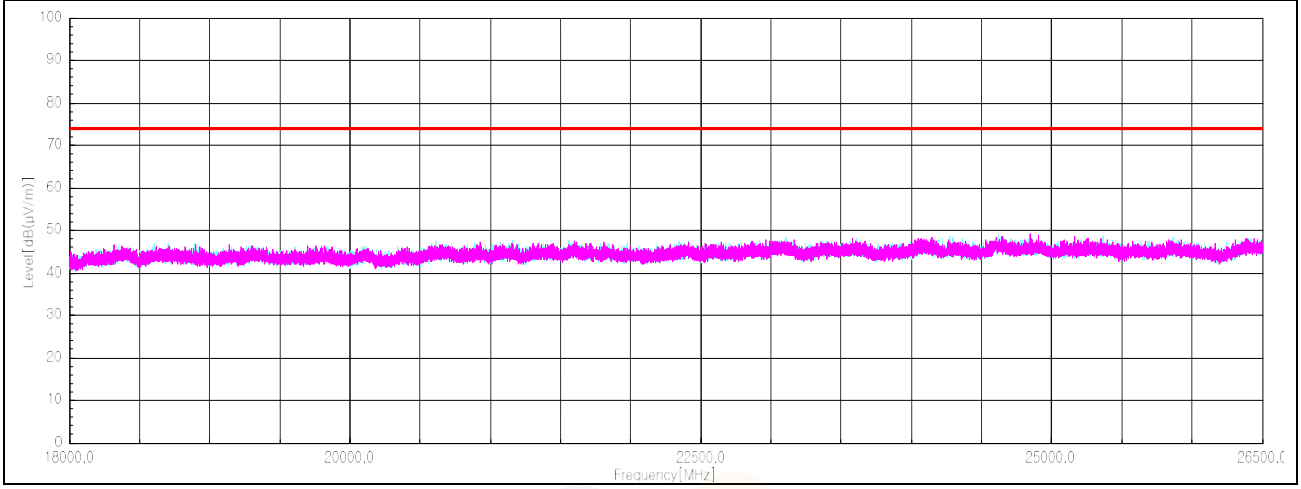


Horizontal/Vertical for 3.5 ㎓ ~ 18 ㎓



Test results (Above 18 ㎓) – Worst case: GFSK 2 480 ㎒

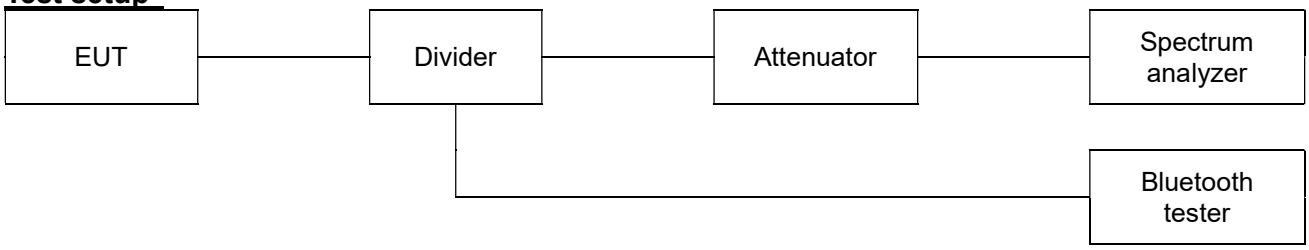
Horizontal/Vertical for 18 ㎓ ~ 26.5 ㎓



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) and RSS-247(5.5), In any 100 ㎑ 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 ㏈ below that in the 100 ㎑ 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 ㏈c

Test procedure

ANSI C63.10-2013 - Section 6.10.4, 7.8.8

Test settings

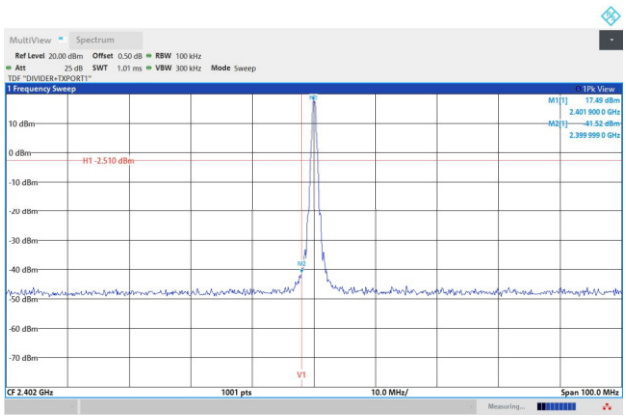
- **Band-edge**
  1) Span : Wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation
  2) Reference level : As required to keep the signal from exceeding the maximum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

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

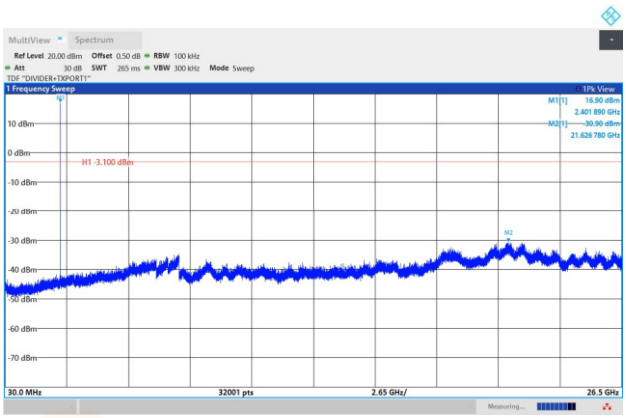
Test results

GFSK

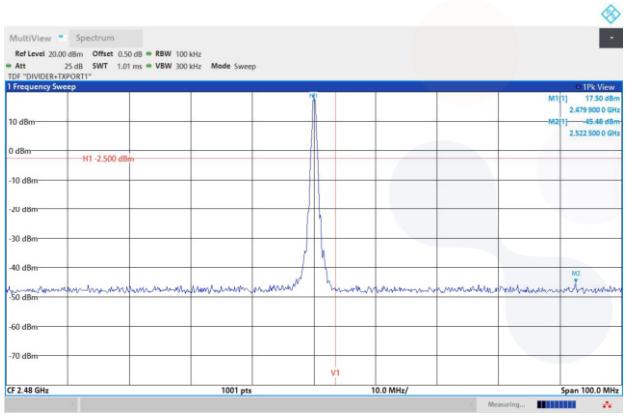
Conducted band-edge / Low ch.



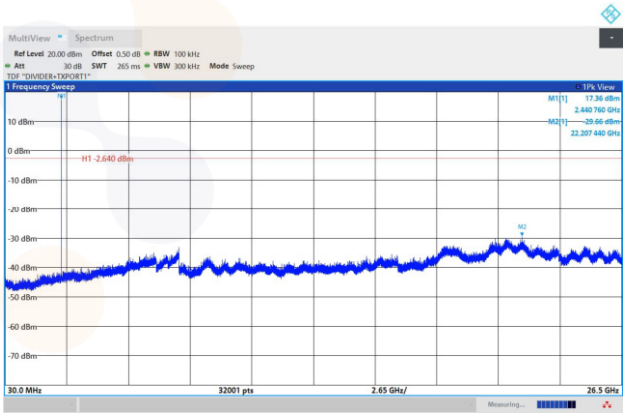
Conducted spurious / Low ch.



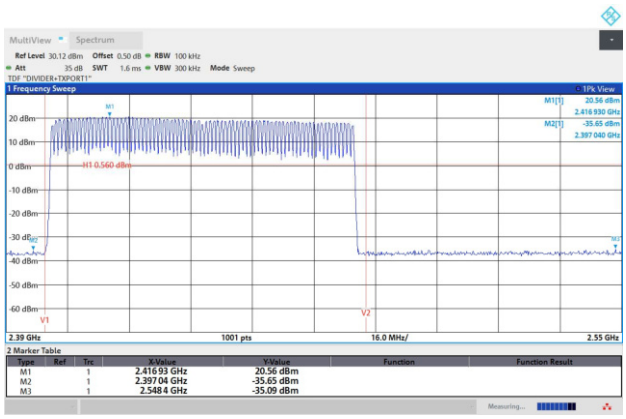
Conducted band-edge / High ch.



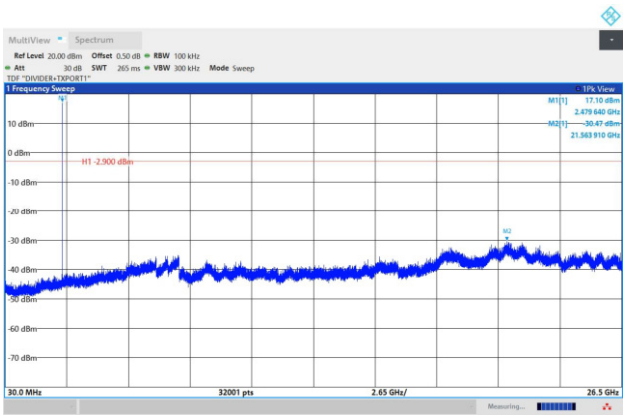
Conducted spurious / Mid ch.



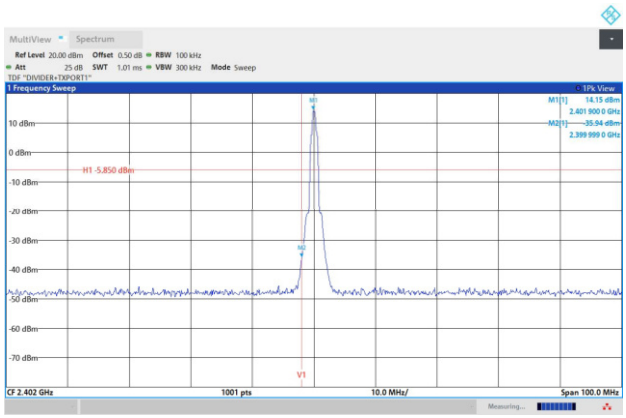
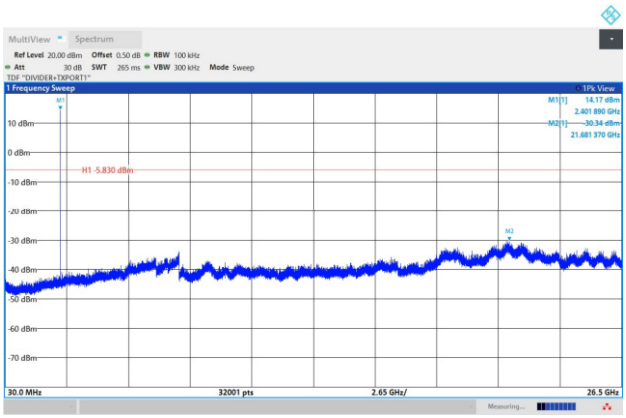
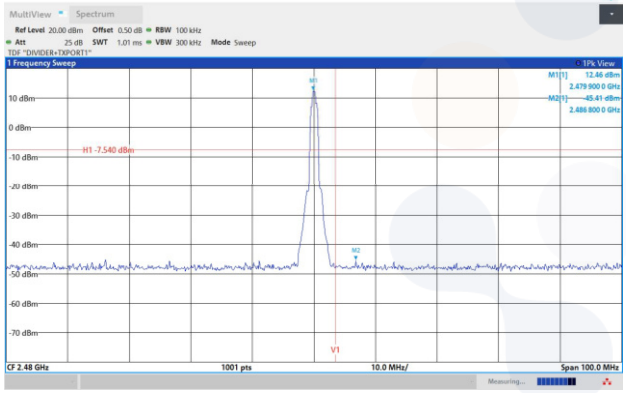
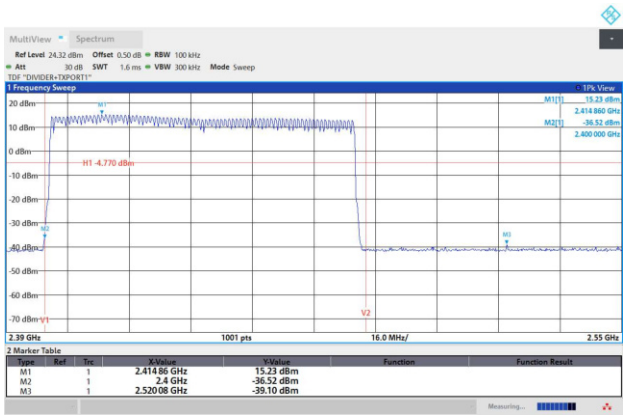
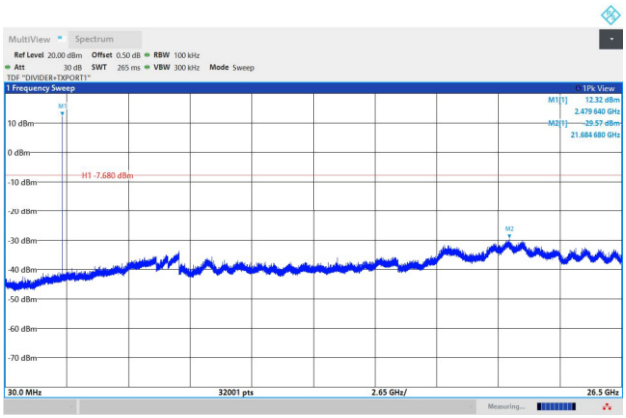
Conducted band-edge / Hopping ch.



Conducted spurious / High ch.

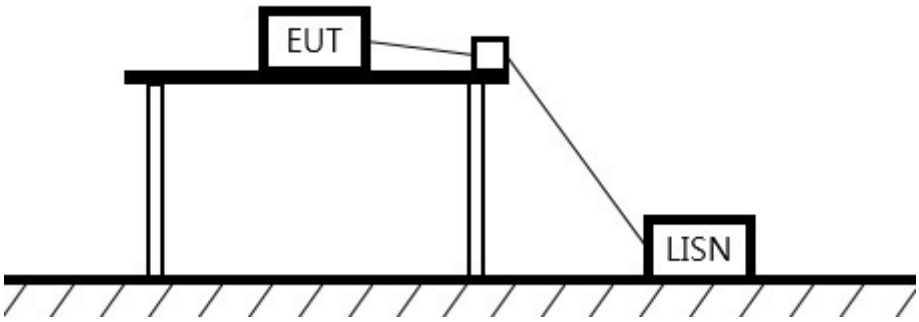


8DPSK

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) and RSS-Gen(8.8), 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 ㎑ to 30 ㎒, 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.

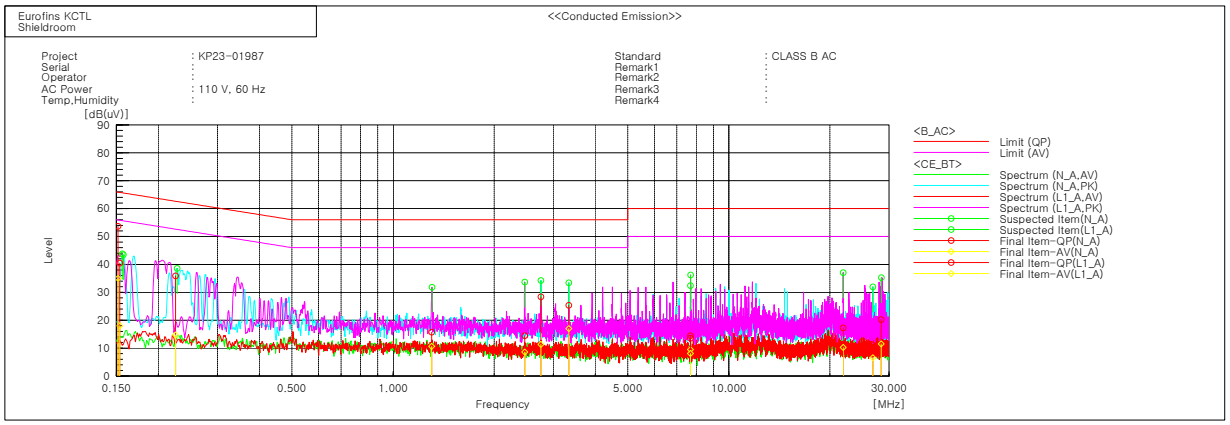
Frequency of Emission (㎒)	Conducted limit (dBμV/m)	
	Quasi-peak	Average
0.15 – 0.50	66 - 56*	56 - 46*
0.50 – 5.00	56	46
5.00 – 30.0	60	50

Measurement procedure

1. The EUT was placed on a wooden table of size, 1 m by 1.5 m, raised 80 ㎝ in which is located 40 ㎝ 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 50Ω/50μH 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 ㎒ to 30 ㎒.
5. The measurements were made with the detector set to peak amplitude within a bandwidth of 10 ㎑ or to quasi-peak and average within a bandwidth of 9 ㎑. The EUT was in transmitting mode during the measurements.

Test results

Worst case: GFSK 2 480 ㎒



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	0.15349	30.6	8.1	9.9	40.5	18.0	65.8	55.8	25.3	37.8
2	0.22492	26.0	4.8	9.9	35.9	14.7	62.6	52.6	26.7	37.9
3	2.75623	18.5	1.5	9.9	28.4	11.4	56.0	46.0	27.6	34.6
4	3.33818	15.4	7.1	9.9	25.3	17.0	56.0	46.0	30.7	29.0
5	7.6853	4.4	-0.6	10.1	14.5	9.5	60.0	50.0	45.5	40.5
6	26.84701	0.2	-4.4	11.0	11.2	6.6	60.0	50.0	48.8	43.4

--- 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	0.1517	43.7	25.1	9.9	53.6	35.0	65.9	55.9	12.3	20.9
2	1.30256	5.9	0.9	9.8	15.7	10.7	56.0	46.0	40.3	35.3
3	2.46717	4.7	-1.2	9.8	14.5	8.6	56.0	46.0	41.5	37.4
4	7.68651	3.5	-2.0	10.1	13.6	8.1	60.0	50.0	46.4	41.9
5	21.91516	6.5	-0.6	10.8	17.3	10.2	60.0	50.0	42.7	39.8
6	28.44857	9.3	0.5	11.0	20.3	11.5	60.0	50.0	39.7	38.5

8. Measurement equipment

Equipment Name	Manufacturer	Model No.	Serial No.	Next Cal. Date
Spectrum Analyzer	R&S	FSV3044	101427	24.03.28*
Attenuator	HUBER+SUHNER	6610_SK-50-1 /199_NE	ATT10	24.04.10*
DC Power Supply	AGILENT	E3632A	MY40000265	24.04.27*
Power Divider	Aeroflex/ Weinschel,Inc	1580-1	NX380	23.07.12
Power Sensor	R&S	NRP-Z81	1137.9009.02-106223-bB	24.04.25*
Attenuator	R&S	DNF Dämpfungsglied 10 dB in N-50 Ohm	31209	24.04.25*
Bluetooth Tester	TESCOM	TC-3000C	3000C000427	24.04.24*
Spectrum Analyzer	R&S	FSV40	100988	23.07.11
PSA Spectrum Analyzer	Agilent	E4440A	MY46186407	24.03.22
Broadband Pre Amplifier	SCHWARZBECK	BBV9718D	53	24.03.17
Low Noise Amplifier	TESTEK	TK-PA18H	220123-L	23.12.02
Low Noise Amplifier	TESTEK	TK-PA1840H	220133-L	23.12.02
Amplifier	SONOMA INSTRUMENT	310N	421821	23.12.14
Horn Antenna	SCHWARZBECK	BBHA9120D	2764	23.12.06
Horn Antenna	SCHWARZBECK	BBHA9170	1267	23.12.05
Bi-log Antenna	Teseq GmbH	CBL 6112D	63756	24.11.17
Loop Antenna	R&S	HFH2-Z2	100355	24.08.10
High Pass Filter	Wainwright Instruments GmbH	WHKX12-2805-3000-18000-40SS	SN59	23.12.14
TWO-LINE V-Network	R&S	ENV216	101358	23.09.29
EMI Test Receiver	R&S	ESCI3	100001	23.08.18
Signal Generator	R&S	SMB100A	176206	24.01.19

* Tests related to this equipment were progressed after the calibration was completed.

End of test report