Test Report

T004 (EN ISO/IEC 17025)

INTENTIONAL RADIATOR TESTS ACCORDING TO FCC PART 15 C AND ISED CANADA REQUIREMENTS

Equipment Under Test:	Sensor Battery
Model:	Portrait SBT01
Manufacturer:	GE Healthcare Finland Oy Kuortaneenkatu 2 FI-00510, Helsinki Finland
Customer:	GE Healthcare Finland Oy Kuortaneenkatu 2 FI-00510, Helsinki Finland
FCC Rule Part:	15.247: 2019
IC Rule Part:	RSS-247, Issue 2, 2017 RSS-GEN Issue 5 Amendment 2, 2021
KDB:	558074 D01 15.247 Meas Guidance v05r02 Guidance for Compliance Measurements on Digital Transmission Systems, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating Under §15.247 of the FCC rules (April 2, 2019)

Date:	29 March 2021	Date:	29 March 2021
Issued by:		Checked by:	
	Henri Mäki Testing Engineer		Mikko Halonen Development Engineer

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GENERAL REMARKS

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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	29 March 2021

PRODUCT DESCRIPTION

Equipment Under Test

Trade mark:	GE
Model:	Portrait SBT01
Type:	Sensor Battery
Serial no:	Sample 1: SRX21020128SP (EMC4) Sample 2: X0017480004PZR (RF_SB_RFV_C1)
FCC ID:	2AO8L-SBT01
IC:	25821-SBT01

General Description

Portrait SBT01 (later Sensor Battery) is a part of GE Healthcare's Portrait Mobile Monitoring Solution system. The Sensor Battery enables continuous monitoring of patients by acquiring signals from body-worn sensor and further transmitting data to a Portrait HUB01 through the GE proprietary Medical Body Area Network (MBAN) radio. In addition to the active MBAN radio, the Sensor Battery has passive NFC (ISO/IEC 14443) and RFID (EPCglobal Gen-2) radios. The NFC is used to pair a sensor with a Hub. The RFID is used for asset management. All Sensor Battery antennas are integrated in the mechanics. Besides the wireless interfaces, the Sensor Battery incorporates the GE proprietary DSI (Digital Sensor Interface) connector. The two galvanic pins of the DSI connector are used for two-way power delivery: charging a Sensor Battery (while located in the Portrait BCH01 Bedside Charger) and powering up a connected sensor (during patient monitoring). The optical UART interface of the DSI is used as data interface between a Sensor Battery and a connected sensor. The DSI also enables a SW update for the Sensor Battery.

This test report contains the results for MBAN operating in 2400-2483.5 MHz frequency band.

Classification

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

Samples and Modifications

No.	Name	Description
1	EMC4	Radiated sample, rev J (mass production equivalent), no modifications
2	RF_SB_RFV_C1	Conducted sample

In sample 2 the PWB RF is reworked to be rev J (mass production) equivalent. The RF test cables were plugged into existing production test connectors. The production test connectors locate on the PWB next to antenna inputs.

Ratings and declarations

Operating Frequency Range (OFR):	2402.0 – 2478.8 MHz
Channels:	31
Channel separation:	2.5 / 2.6 / 2.7 MHz
Transmission technique:	Digital modulation
Modulation:	GFSK
Antenna type:	Integrated custom antenna
Integral Antenna gain:	2.6 dBi (highest gain in the frequency range)

Power Supply

Operating voltage range: 3.6 V_{DC} (nominal battery voltage)

Mechanical Size of the EUT

Height: 36 mm Width: 53 mm Length: 17 mm

Peripherals

Peripheral	Description / Usage
3 x Sensor Batteries	GE Portrait SBT01. Peripheral units for conducted emissions on power supply lines test.
Mobile patient monitor	GE Portrait HUB01. Peripheral unit for conducted emissions on power supply lines test.
Charger unit	GE Portrait BCH01, battery charging unit for the EUT and peripheral sensor batteries and mobile patient monitor. Used during conducted emissions on power supply lines test.
SpO2-sensor	GE Portrait SpO2 P-SP01. Companion device during testing.
Resp-sensor	GE Portrait RR P-RR01. Companion device during testing.
AC/DC adapter	XP Power ACM36US12-XZ1110A, power supply for the charger unit.
Laptop	Dell Precision 3541, companion device for conducted emissions on power supply lines test.
AC/DC adapter	Dell HA65NM130, power supply for the laptop.

The peripherals were provided by the customer.

SUMMARY OF TESTING

Test Specification	Description of Test	Result
ANSI C63.10-2013, clause 7.5	Duty Cycle	-
§15.203	Antenna requirement	PASS
§15.207(a) / RSS-GEN 8.8	Conducted Emissions on Power Supply Lines	PASS
§15.247(b)(3) / RSS-247 5.4(d)	Maximum Peak Conducted Output Power	PASS
§15.247(a)(2) / RSS-247 5.2(a)	6 dB Bandwidth	PASS
§15.247(e) / RSS-247 5.2(b)	Power Spectral Density	PASS
RSS-GEN 6.7	99% Occupied Bandwidth	PASS
§15.247(d) / RSS-247 5.5	100 kHz Bandwidth of Frequency Band Edges and Conducted Spurious Emissions	PASS
§15.209(a), §15.247(d) / RSS-247 5.5	Radiated Emissions Within the Restricted Bands	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 C63.10-2013.

EUT Test Conditions during Testing

The EUT was in continuous transmit mode during all the tests (excluding Duty Cycle -test). The EUT was configured into the wanted channel using software provided by the manufacturer:

- duty cycle test: wearable.puck.swup.1.0.0.4.0.22-1153.1.ecf96a6
- other tests: mban-test-mode-wearable-puck-swup-1.0.0.4.0.22-1153.1.ecf96a6

All measurements were performed with the transmit power set to the maximum level the equipment hardware is capable of.

During radiated emissions measurements the peripheral SpO2-sensor was connected to the EUT.

During Conducted Emissions on Power Supply Lines measurement the EUT and peripherals were placed on a charger unit and the batteries were charging. The charger unit was connected via USB to a peripheral laptop, which was reading the battery charge levels during the test. The peripheral mobile patient monitor was set to transmit continuously on middle channel. The AC mains input voltage was 120 V, 60 Hz.

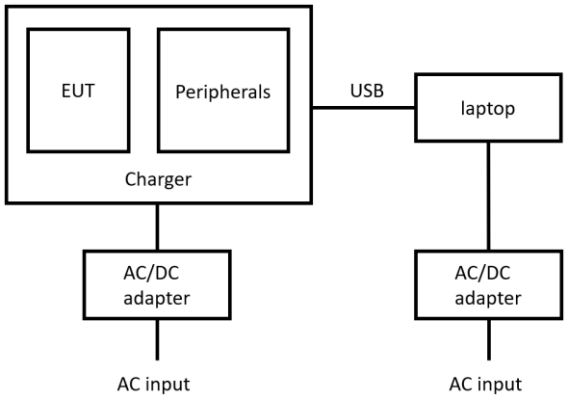


Figure 1: Test setup block diagram for conducted emissions on power supply lines

Table 1: Test frequencies

Channel	Frequency (MHz)
15 Low	2402.0
31 Mid	2443.0
45 High	2478.8

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

Duty Cycle

Standard:	ANSI C63.10-2013
Tested by:	HEM
Date:	11 January 2021
Temperature:	21.9 °C
Humidity:	25.5 %RH
Barometric pressure:	1005.1 mbar
Measurement uncertainty:	±0.1 %, level of confidence 95 % (k = 2)

FCC rule: 15.35(c)

The average field strength may be found by measuring the peak pulse amplitude and subtracting the duty cycle correction factor (DCCF) from the peak pulse amplitude. The correction factor may be applied to all emissions that demonstrate the same pulse timing characteristics as the fundamental emission.

During testing the EUT was connected to a peripheral sensor and set to communicate with peripheral mobile patient monitor (HUB). The results with both SpO2- and Resp-sensors are reported.

The test was performed with an automated software.

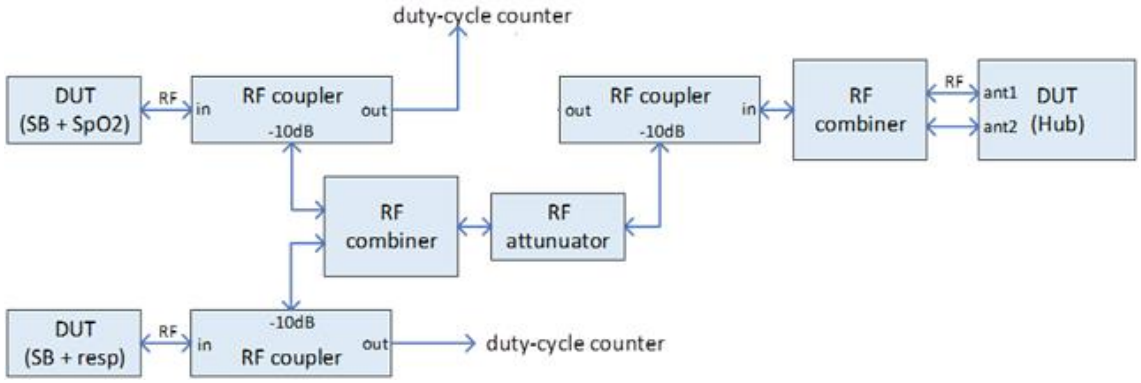


Figure 2: Duty cycle measurement setup

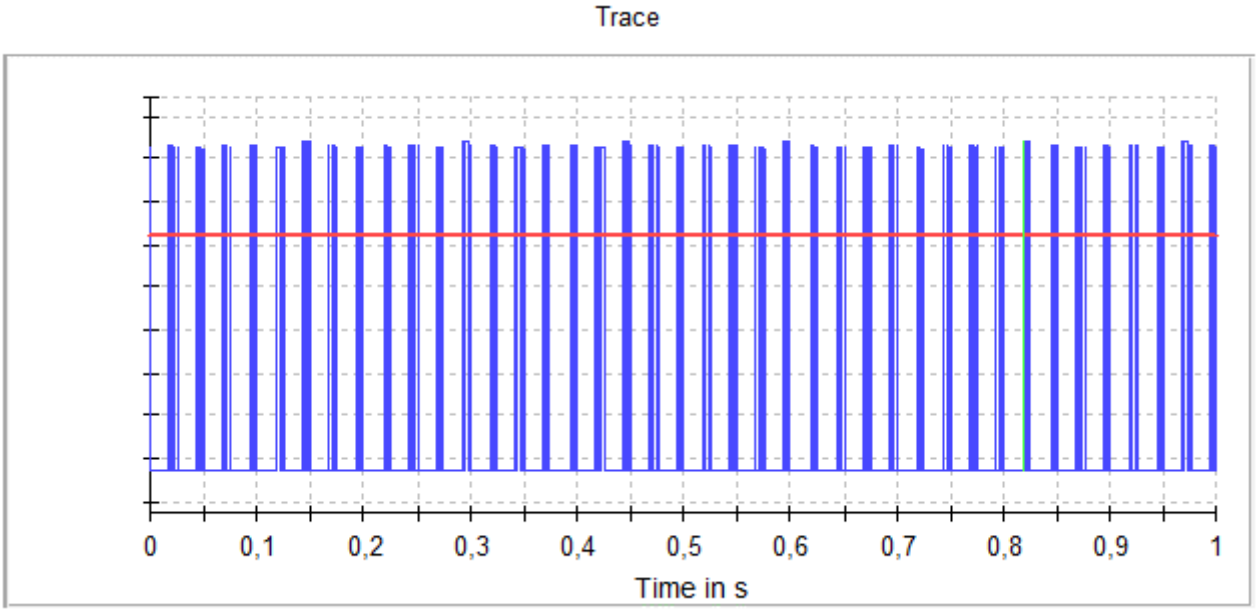
Results

Table 2: Duty cycle results

EUT	Duty Cycle (%)	DCCF (dB)
SB + SpO2	**8.405**	**-21.5**
SB + resp	**7.845**	**-22.1**

At the request of the customer the duty cycle of 33 %, which is the theoretical maximum at which the EUT is able to operate, is used to determine the duty cycle correction factor:

$$DCCF = 20\log(0.33)\,\mathrm{dB} \approx -9.63\,\mathrm{dB}$$



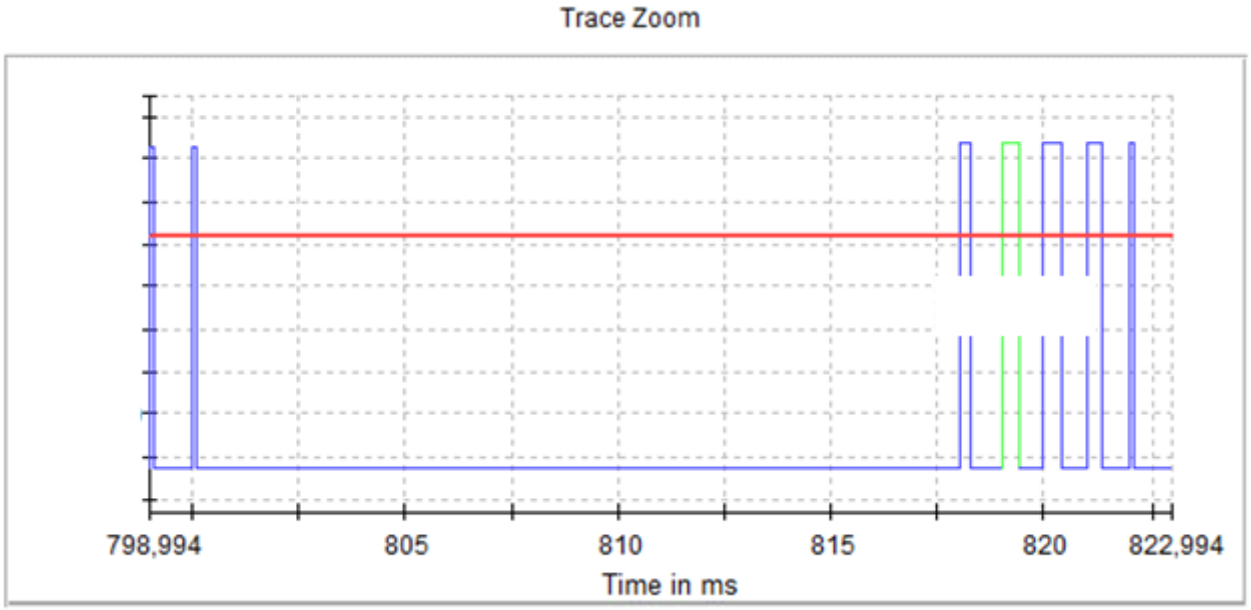
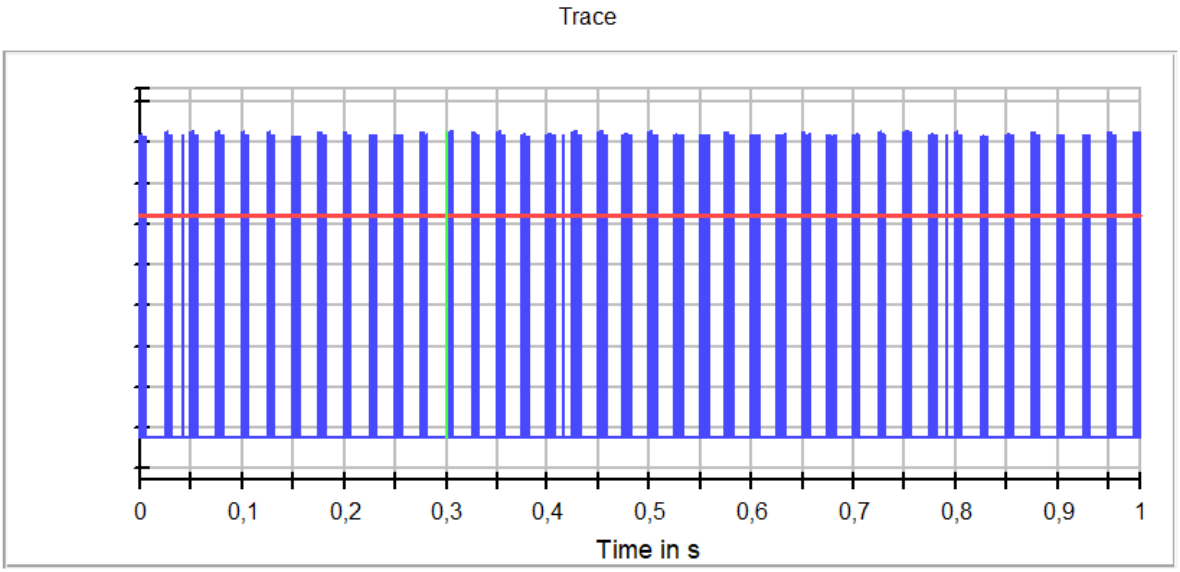


Figure 3: Duty cycle, EUT + SpO2-sensor



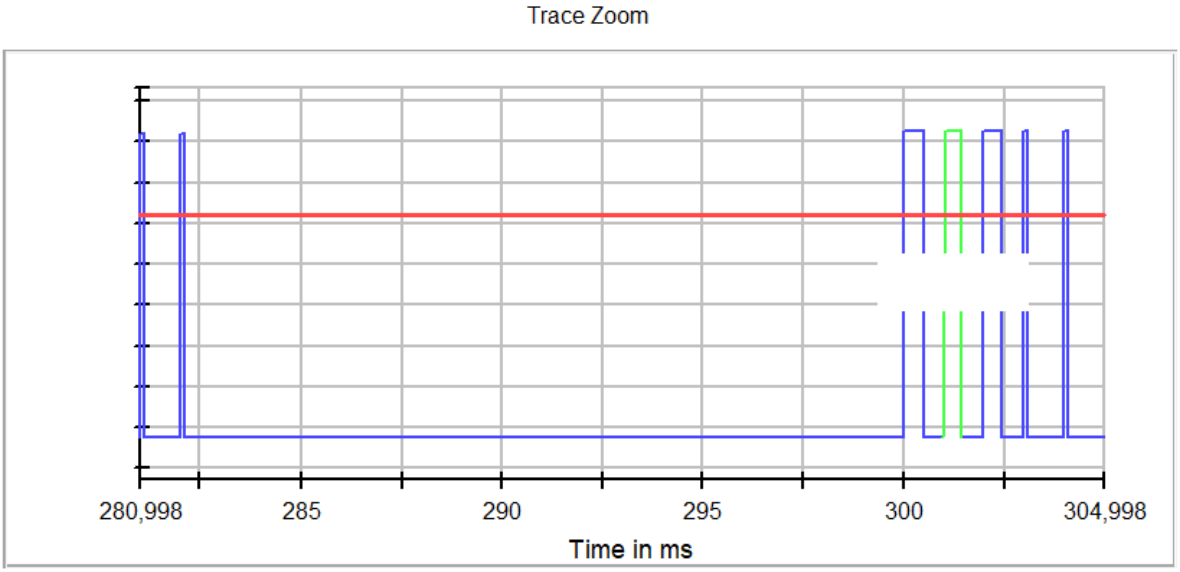


Figure 4: Duty cycle, EUT + Resp-sensor

Antenna requirement

Standard: FCC Rule §15.203
Tested by: HEM
Date: 11 January 2021

FCC Rule: 15.203

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

Specification	Requirement (at least one of the following shall be applied)	Conclusion
§15.203	1. Permanently attached antenna 2. Unique coupling to the intentional radiator 3. Professionally installed radio. The installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.	**PASS**
Note	Option 1 is used	

Conducted Emissions In The Frequency Range 150 kHz - 30 MHz

Standard:	ANSI C63.10-2013
Tested by:	HEM
Date:	1 February 2021
Temperature:	23.1 °C
Humidity:	17.1 %RH
Barometric pressure:	990.6 mbar
Measurement uncertainty:	± 2.9 dB, level of confidence 95 % (k = 2)

FCC Rule: 15.207(a)
RSS-GEN 8.8

Conducted disturbance voltage was measured with an artificial main network from 150 kHz to 30 MHz with 4 kHz steps and a resolution bandwidth of 9 kHz. Measurements were carried out with peak and average detectors.

Frequency of emission (MHz)	Conducted limit (dBµV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

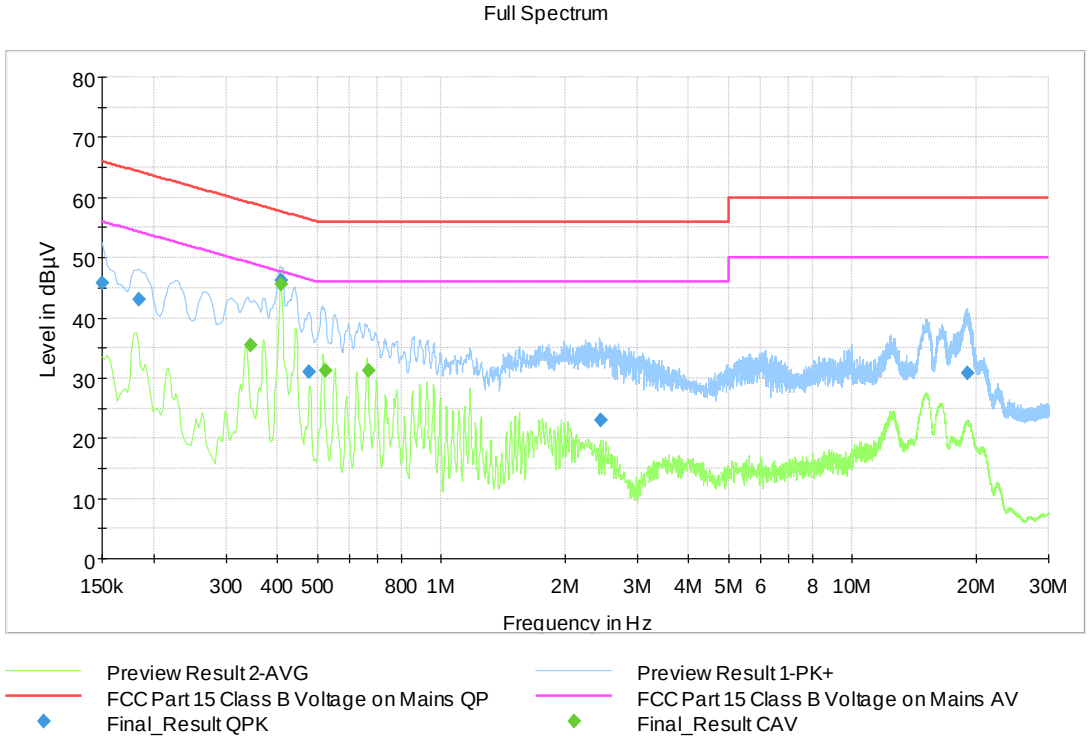


Figure 5: The measured curves with peak- and average detector

Final measurements from the worst frequencies

Table 3: Final QuasiPeak measurements from the worst frequencies

Frequency (MHz)	QuasiPeak (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.150000	45.77	66.00	20.23	15 x 1000.0	9.000	L1	9.6
0.183750	43.10	64.31	21.21	15 x 1000.0	9.000	L1	9.6
0.407750	46.28	57.69	11.41	15 x 1000.0	9.000	L1	9.7
0.477500	31.06	56.38	25.32	15 x 1000.0	9.000	L1	9.7
2.439750	23.06	56.00	32.94	15 x 1000.0	9.000	N	9.9
19.069500	30.88	60.00	29.12	15 x 1000.0	9.000	N	10.5

Table 4: Final Average measurements from the worst frequencies

Frequency (MHz)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.345500	35.55	49.07	13.52	15 x 1000.0	9.000	L1	9.6
0.409500	45.69	47.66	1.97	15 x 1000.0	9.000	L1	9.7
0.523750	31.33	46.00	14.67	15 x 1000.0	9.000	L1	9.7
0.667750	31.31	46.00	14.69	15 x 1000.0	9.000	L1	9.7

The correction factor in the final result table contains the sum of the transducers (cables).
The result value is the measured value corrected with the correction factor.

Maximum Peak Conducted Output Power

Standard:	ANSI C63.10 -2013
Tested by:	HEM
Date:	11 January 2021
Temperature:	21.9 °C
Humidity:	25.5 % RH
Barometric pressure:	1005.1 mbar
Measurement uncertainty:	± 2.87 dB, level of confidence 95 % (k = 2)

FCC Rule: 15.247(b)(3)
RSS-247 5.4(d)

For systems using digital modulation in the 2400-2483.5 MHz bands the limit is 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power.

Measured values are peak values.

Results:

Table 5: Maximum conducted output power

Channel	Conducted Power [dBm]	Limit [dBm]	Margin [dBm]	Result
Low	10.9	30	19.1	**PASS**
Mid	11.1	30	18.9	**PASS**
High	10.9	30	19.1	**PASS**

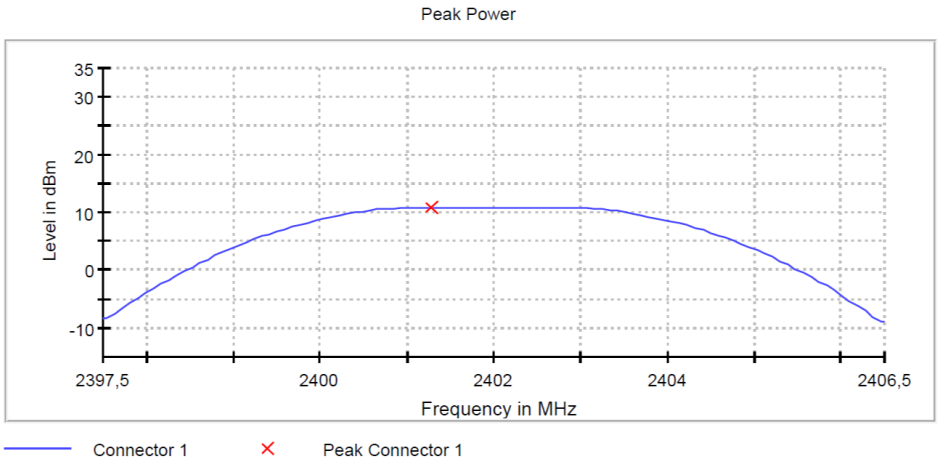


Figure 6: Conducted power, Channel LOW

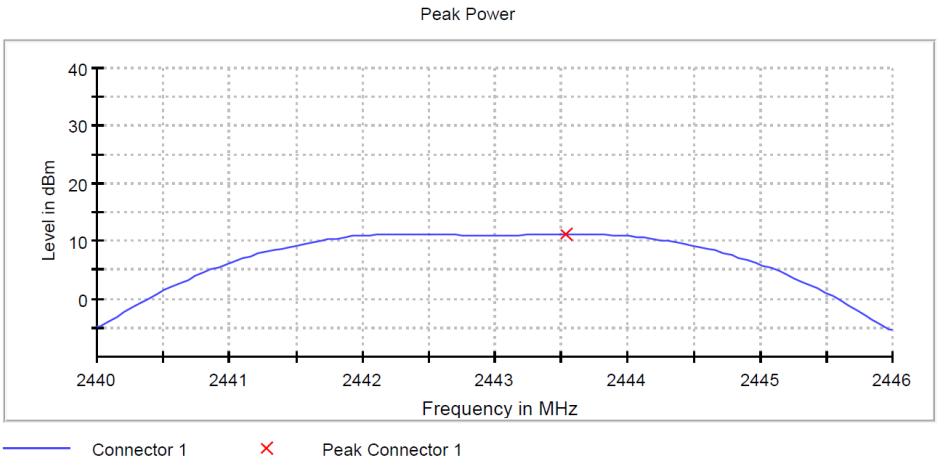


Figure 7: Conducted power, Channel MID

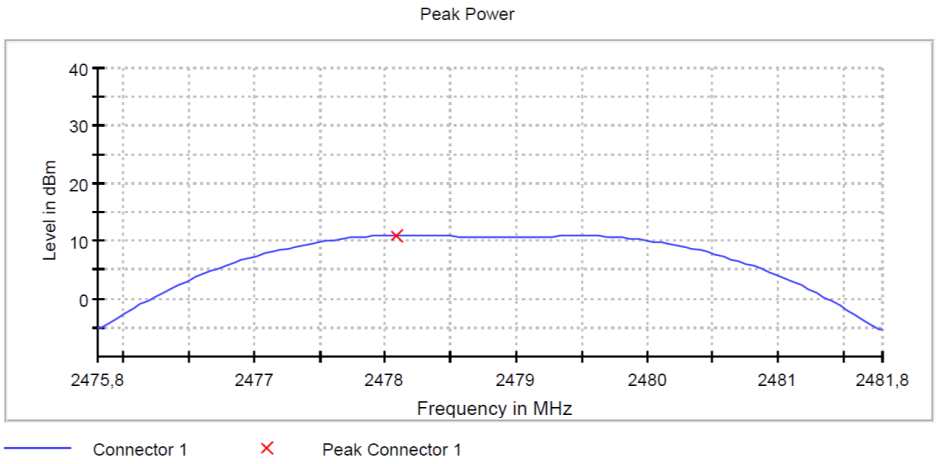


Figure 8: Conducted power, Channel HIGH

Table 6: Measurement settings, maximum conducted output power

Setting	Instrument Value	Target Value
Start Frequency	2.39900 GHz	2.39900 GHz
Stop Frequency	2.40500 GHz	2.40500 GHz
Span	6.000 MHz	6.000 MHz
RBW	2.000 MHz	>= 1.980 MHz
VBW	10.000 MHz	>= 6.000 MHz
SweepPoints	101	~ 101
Sweeptime	953.450 ns	AUTO
Reference Level	20.000 dBm	20.000 dBm
Attenuation	40.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Max Stable Difference	0.05 dB	0.50 dB

Transmitter Radiated Spurious Emissions 9 kHz – 26.5 GHz

Standard:	ANSI C63.10-2013
Tested by:	HEM, PKA
Date:	27 – 29 January 2021
Temperature:	22.6 – 23.7 °C
Humidity:	18.2 – 25.9 %RH
Barometric pressure:	988.3 – 997.8 mbar
Measurement uncertainty:	± 4.51 dB, level of confidence 95 % (k = 2)

FCC Rule: 15.247(d), 15.209(a)

RSS-247 5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, 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. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a).

The correction factor in the final result table contains the sum of the transducers (antenna + amplifier + cables).

Peak values of emissions below 1000 MHz measured for reference as well as transmitter fundamental.

Frequency range [MHz]	Limit [µV/m]	Limit [dBµV/m]	Detector
30 - 80	100	40.0	Quasi-peak
88 - 216	150	43.5	Quasi-peak
216 - 960	200	46.0	Quasi-peak
960 - 1000	500	53.9	Quasi-peak
Above 1000	500	53.9	Average
Above 1000	5000	73.9	Peak

Investigative measurements were made to determine the worst EUT orientation. The presented final results are the results in the worst orientation.

Results LOW channel

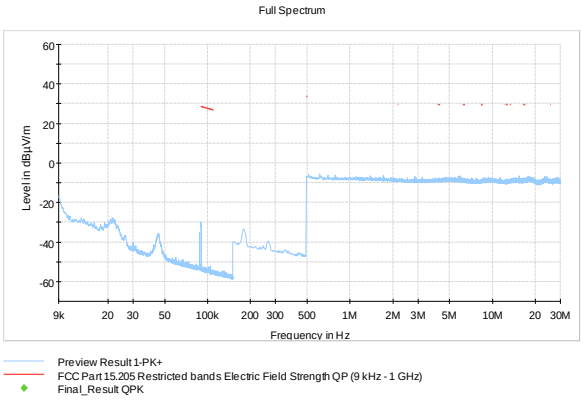


Figure 9: LOW channel (9 kHz – 30 MHz)

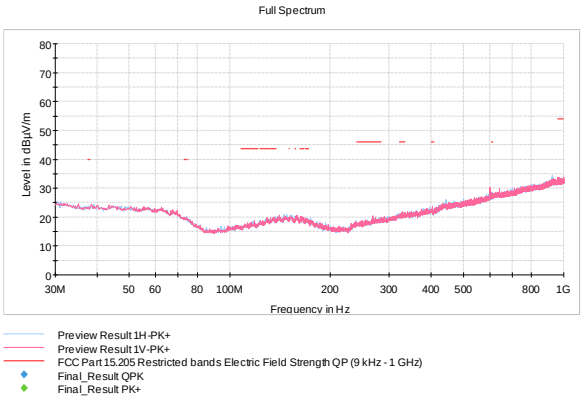


Figure 10: LOW channel (30 MHz – 1000 MHz)

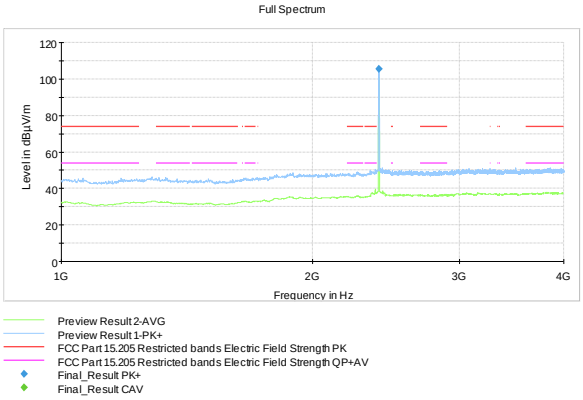


Figure 11: LOW channel (1 GHz – 4 GHz)

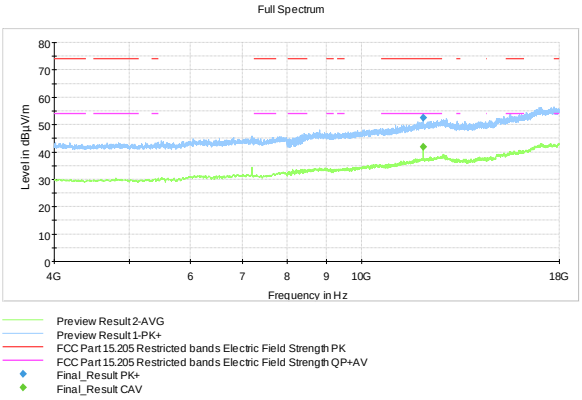


Figure 12: LOW channel (4 GHz – 18 GHz)

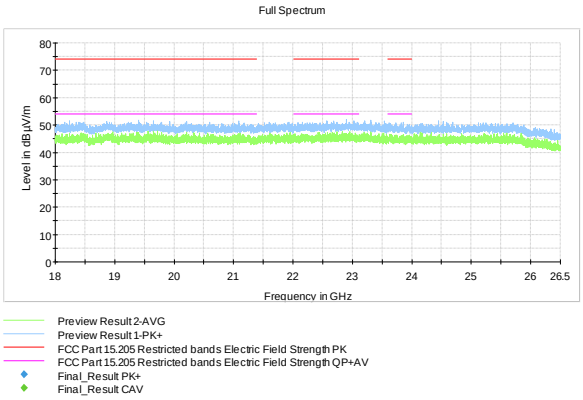


Figure 13: LOW channel (18 GHz – 26.5 GHz)

Table 7: Peak results LOW channel

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2401.200000	105.36	---	---	1000.0	1000.000	130.0	H	91.0	13.8
12013.075000	52.50	74.00	21.50	1000.0	1000.000	111.0	V	45.0	17.5

Table 8: Average results LOW channel

Frequency (MHz)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
12013.075000	41.94	54.00	12.06	1000.0	1000.000	105.0	V	47.0	17.5

Table 9: Quasi-peak results LOW channel

No final measurements were made; no emissions near the limit.

Results MID channel

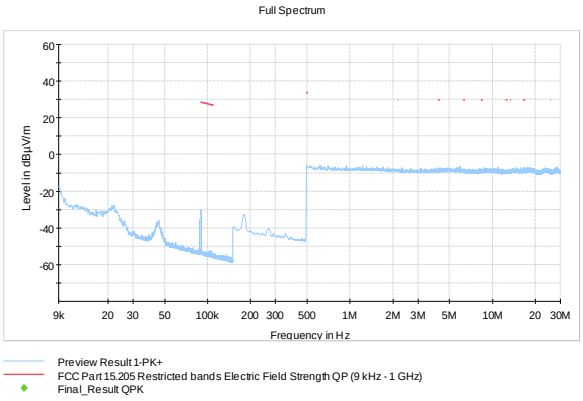


Figure 14: MID channel (9 kHz – 30 MHz)

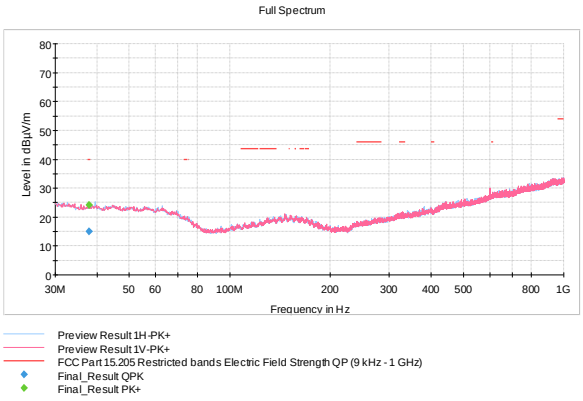


Figure 15: MID channel (30 MHz – 1000 MHz)

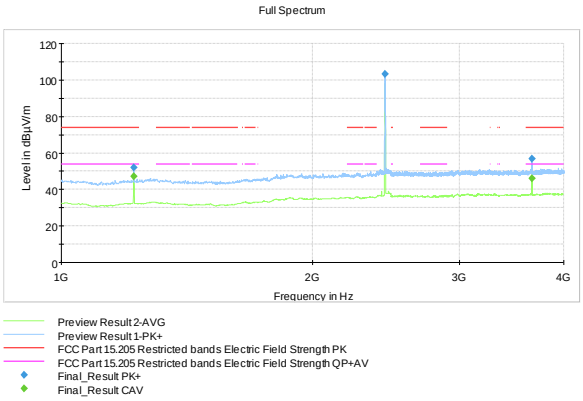


Figure 16: MID channel (1 GHz – 4 GHz)

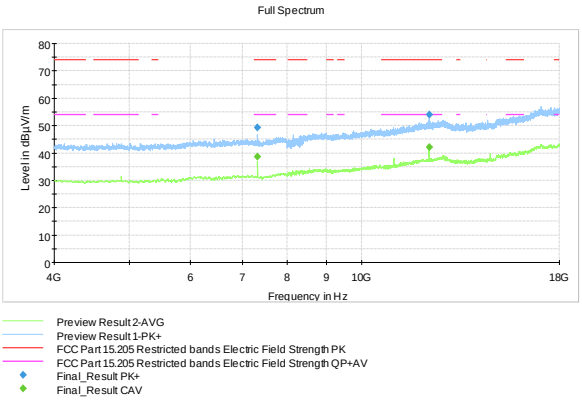


Figure 17: MID channel (4 GHz – 18 GHz)

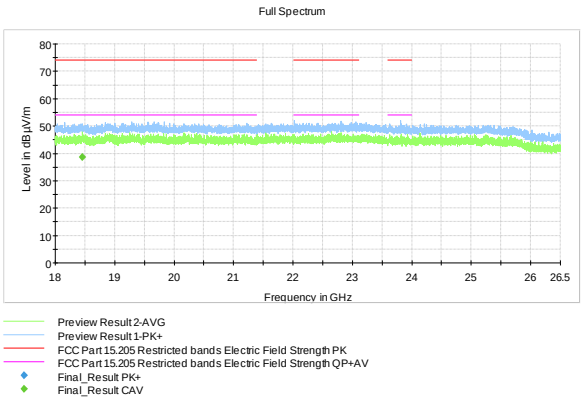


Figure 18: MID channel (18 GHz – 26.5 GHz)

Table 10: Peak results MID channel

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1221.475000	52.17	74.00	21.83	1000.0	1000.000	225.0	H	48.0	9.6
2442.250000	103.46	---	---	1000.0	1000.000	157.0	H	265.0	13.5
3665.500000	56.82	74.00	17.18	1000.0	1000.000	247.0	H	177.0	14.8
7330.775000	49.20	74.00	24.80	1000.0	1000.000	110.0	V	54.0	10.7
12218.275000	53.90	74.00	20.10	1000.0	1000.000	214.0	V	158.0	17.3

Table 11: Average results MID channel

Frequency (MHz)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1221.475000	47.33	54.00	6.67	1000.0	1000.000	220.0	H	58.0	9.6
3665.500000	46.10	54.00	7.90	1000.0	1000.000	216.0	H	175.0	14.8
7326.975000	38.76	54.00	15.24	1000.0	1000.000	100.0	V	54.0	10.7
12211.625000	42.21	54.00	11.79	1000.0	1000.000	219.0	V	151.0	17.3
18452.800000	38.58	54.00	15.42	1000.0	1000.000	134.0	V	333.0	7.3

Table 12: Quasi-peak results MID channel

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
37.925000	15.00	40.00	25.00	1000.0	120.000	231.0	V	334.0	16.7

Results HIGH channel

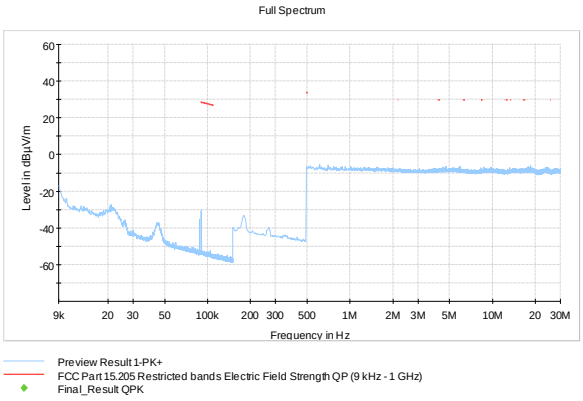


Figure 19: HIGH channel (9 kHz – 30 MHz)

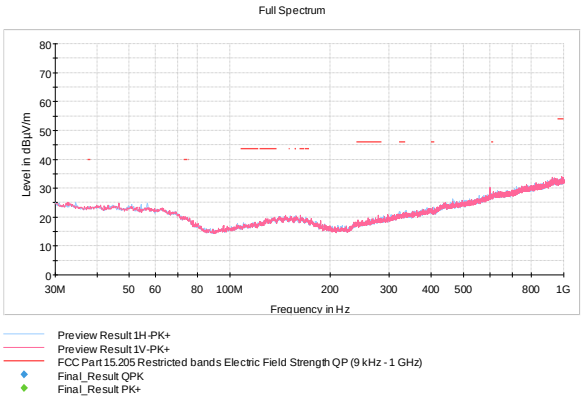


Figure 20: HIGH channel (30 MHz – 1000 MHz)

Figure 21: HIGH channel (1 GHz – 4 GHz)

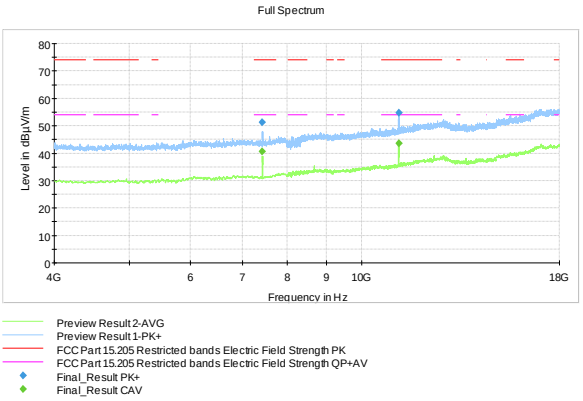


Figure 22: HIGH channel (4 GHz – 18 GHz)

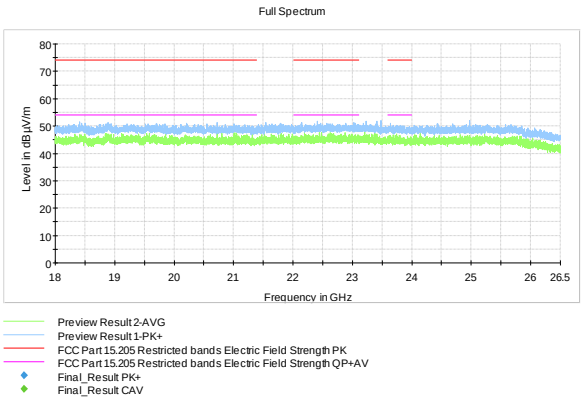


Figure 23: HIGH channel (18 GHz – 26.5 GHz)

Table 13: Peak results HIGH channel

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1239.775000	59.52	74.00	14.48	1000.0	1000.000	161.0	H	245.0	9.5
2478.000000	100.83	---	---	1000.0	1000.000	152.0	H	262.0	13.6
2487.500000	49.31	74.00	24.69	1000.0	1000.000	244.0	V	271.0	13.5
3719.250000	63.40	74.00	10.60	1000.0	1000.000	257.0	H	168.0	14.9
7434.125000	51.38	74.00	22.62	1000.0	1000.000	105.0	V	52.0	10.4
11157.675000	54.65	74.00	19.35	1000.0	1000.000	100.0	H	218.0	16.0

Table 14: Average results HIGH channel

Frequency (MHz)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1239.775000	49.89 *)	54.00	4.11	1000.0	1000.000	161.0	H	245.0	9.5
3719.250000	53.77 *)	54.00	0.23	1000.0	1000.000	257.0	H	168.0	14.9
7434.325000	40.65	54.00	13.35	1000.0	1000.000	111.0	V	47.0	10.4
11157.475000	43.54	54.00	10.46	1000.0	1000.000	116.0	H	218.0	16.0

*) calculated from measured peak-value with duty cycle correction factor

Table 15: Quasi-peak results HIGH channel

No final measurements were made; no emissions near the limit.

Radiated lower and upper band edge results

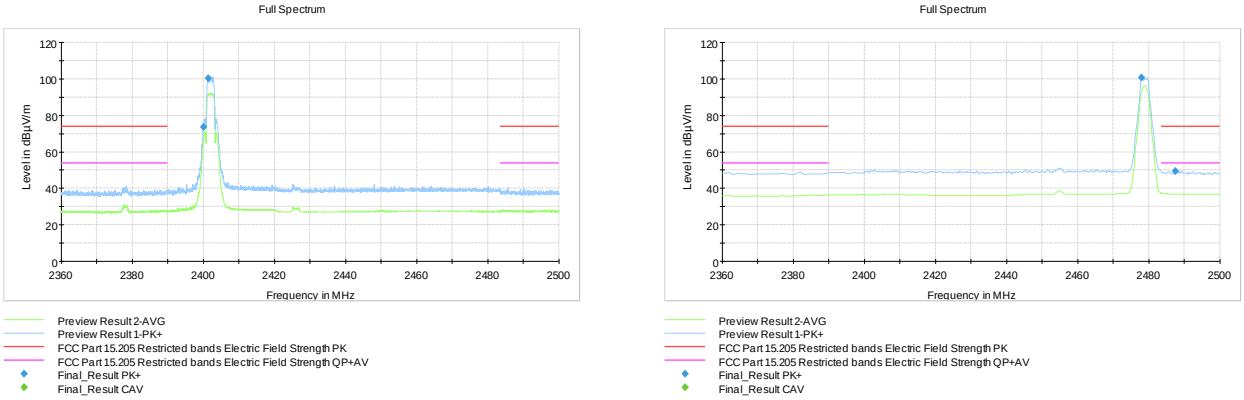


Figure 24: Radiated lower and upper band edge results

Table 16: Radiated lower and upper band edge results

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2400.000000	73.42	80.25 *)	6.83	1000.0	100.000	130.0	H	91.0	13.8
2401.400000	100.25	---	---	1000.0	100.000	130.0	H	93.0	13.8
2478.000000	100.83	---	---	1000.0	1000.000	152.0	H	262.0	13.6
2487.500000	49.31	74.00	24.69	1000.0	1000.000	244.0	V	271.0	13.5

*) -20 dBc

Transmitter Band Edge Measurement and Conducted Spurious Emissions

Standard:	ANSI C63.10-2013	
Tested by:	HEM	
Date:	11 January 2021	
Temperature:	21.9 °C	
Humidity:	25.5 %RH	
Barometric pressure:	1005.1 mbar	
Measurement uncertainty:	± 2.87 dB	Level of confidence 95 % (k = 2)

FCC Rule: 15.247(d), 15.209(a)

RSS-247 5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, 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 limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Table 17: Band edge attenuation

Band Edge Attenuation	
Lower Band Edge	**Upper Band Edge**
-26.5 dBc	-59.2 dBc
Limit: -20 dBc	

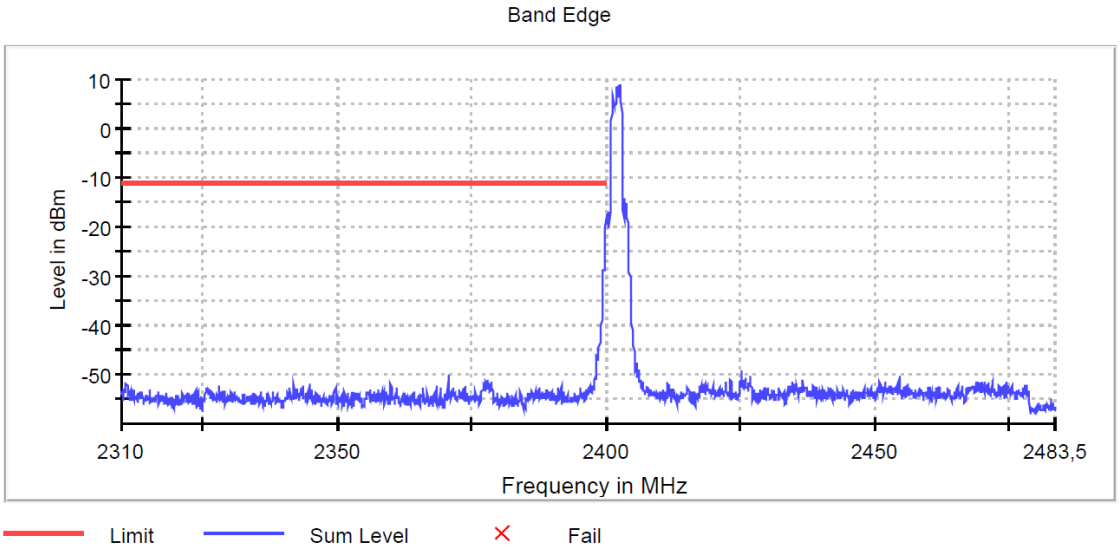


Figure 25: Lower Band Edge

Table 18: Lower band edge results

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2399.975000	-17.5	6.5	-11.1	PASS
2399.925000	-19.6	8.6	-11.1	PASS
2399.875000	-20.2	9.2	-11.1	PASS
2399.825000	-22.0	10.9	-11.1	PASS
2399.775000	-23.5	12.5	-11.1	PASS
2399.725000	-25.1	14.1	-11.1	PASS
2399.675000	-26.0	15.0	-11.1	PASS
2399.625000	-28.0	17.0	-11.1	PASS
2399.575000	-28.2	17.1	-11.1	PASS
2399.525000	-28.4	17.3	-11.1	PASS
2399.475000	-30.4	19.4	-11.1	PASS
2399.425000	-32.6	21.5	-11.1	PASS
2399.375000	-34.2	23.2	-11.1	PASS
2399.325000	-37.2	26.2	-11.1	PASS
2399.275000	-37.2	26.2	-11.1	PASS

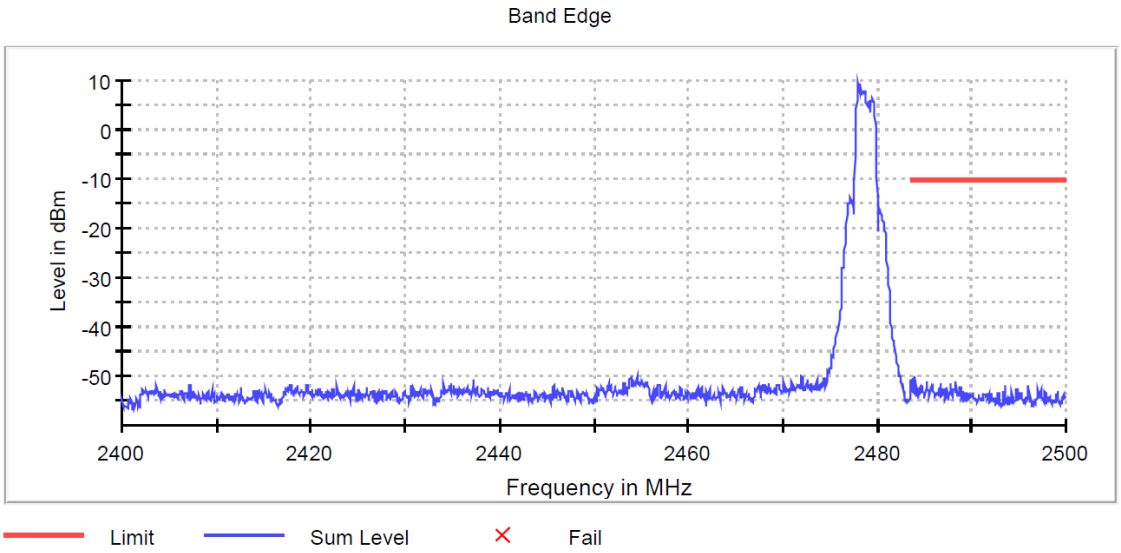


Figure 26: Upper Band Edge

Table 19: Upper band edge results

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2483.975000	-49.5	39.2	-10.4	PASS
2484.025000	-49.6	39.2	-10.4	PASS
2483.525000	-50.2	39.8	-10.4	PASS
2483.625000	-50.2	39.8	-10.4	PASS
2483.575000	-50.4	40.0	-10.4	PASS
2485.175000	-50.6	40.2	-10.4	PASS
2483.725000	-50.6	40.3	-10.4	PASS
2488.275000	-50.7	40.3	-10.4	PASS
2488.325000	-50.7	40.3	-10.4	PASS
2486.725000	-50.8	40.4	-10.4	PASS
2485.225000	-50.9	40.6	-10.4	PASS
2483.775000	-51.0	40.6	-10.4	PASS
2487.775000	-51.1	40.7	-10.4	PASS
2487.825000	-51.1	40.7	-10.4	PASS
2486.675000	-51.2	40.9	-10.4	PASS

Conducted spurious emissions results LOW channel

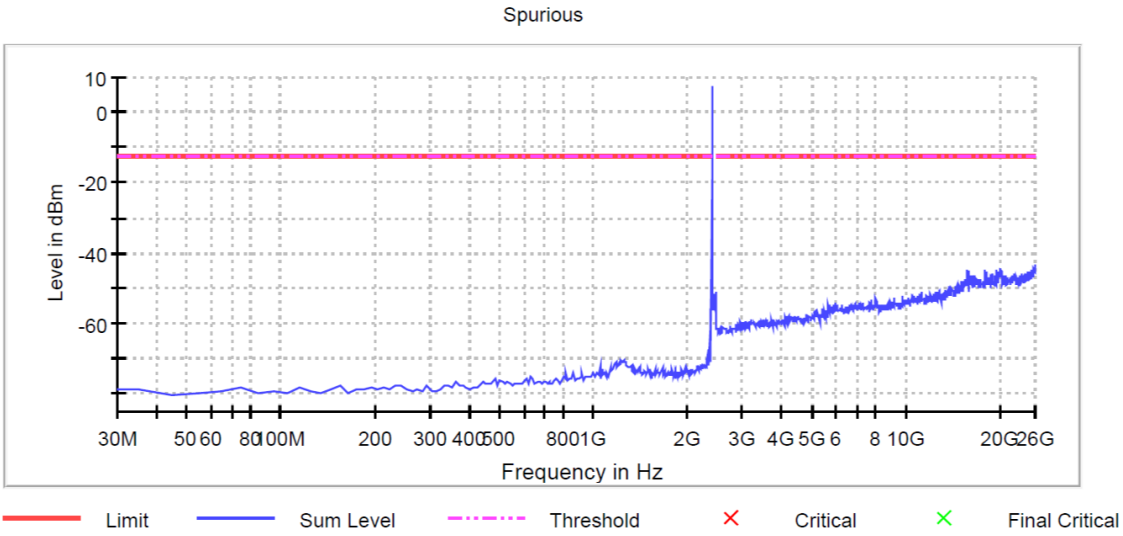


Figure 27: Conducted spurious emissions 30 MHz – 26 GHz LOW channel

Table 20: Pre measurements, conducted spurious emissions LOW channel

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)
2395.021008	-15.8	3.3	-12.5
25875.071717	-43.4	30.9	-12.5
25895.060242	-44.2	31.7	-12.5
20028.428071	-44.4	31.9	-12.5
25845.088929	-44.5	32.0	-12.5
25805.111878	-44.5	32.1	-12.5
15760.877922	-44.6	32.1	-12.5
25795.117616	-44.6	32.1	-12.5
25265.421696	-44.6	32.2	-12.5
20138.364960	-44.7	32.3	-12.5
25175.473332	-44.7	32.3	-12.5
25905.054505	-44.8	32.3	-12.5
25785.123353	-44.9	32.4	-12.5
25835.094666	-44.9	32.4	-12.5
25685.180727	-44.9	32.4	-12.5

Table 21: Final measurements, conducted spurious emissions LOW channel

No final measurements were made; no emissions near the limit.

Conducted spurious emissions results MID channel

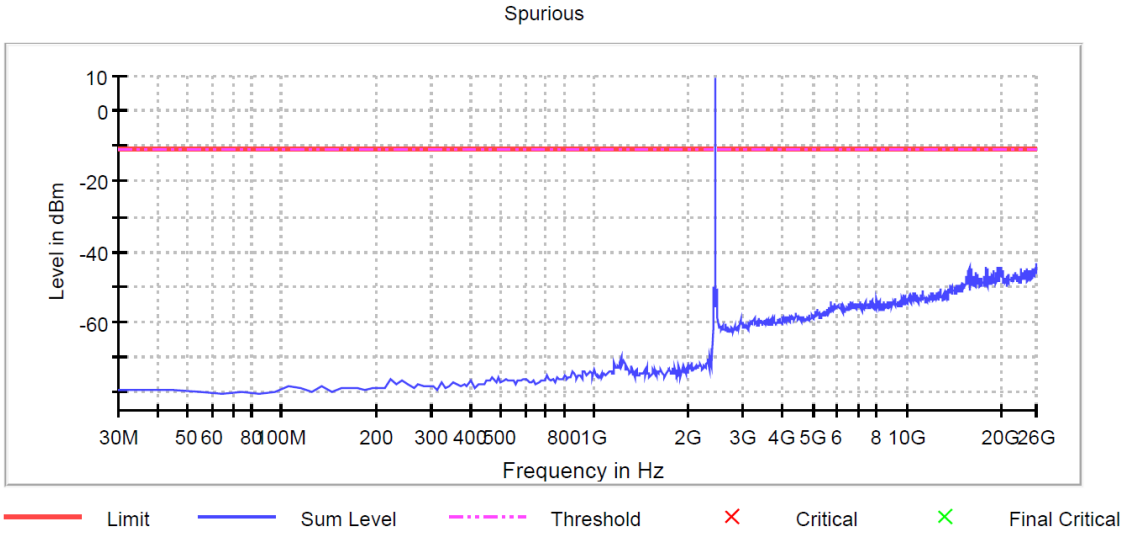


Figure 28: Conducted spurious emissions 30 MHz – 26 GHz MID channel

Table 22: Pre measurements, conducted spurious emissions MID channel

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)
25905.054505	-43.1	32.5	-10.7
25935.037293	-43.6	33.0	-10.7
25825.100404	-44.2	33.5	-10.7
25855.083192	-44.2	33.6	-10.7
25885.065980	-44.3	33.7	-10.7
15810.849235	-44.4	33.7	-10.7
19778.571504	-44.4	33.7	-10.7
17849.678814	-44.4	33.8	-10.7
20158.353485	-44.5	33.8	-10.7
25815.106141	-44.5	33.8	-10.7
19518.720676	-44.5	33.9	-10.7
25315.393009	-44.6	33.9	-10.7
25525.272524	-44.6	34.0	-10.7
25875.071717	-44.7	34.1	-10.7
25895.060242	-44.7	34.1	-10.7

Table 23: Final measurements, conducted spurious emissions MID channel

No final measurements were made; no emissions near the limit.

Conducted spurious emissions results HIGH channel

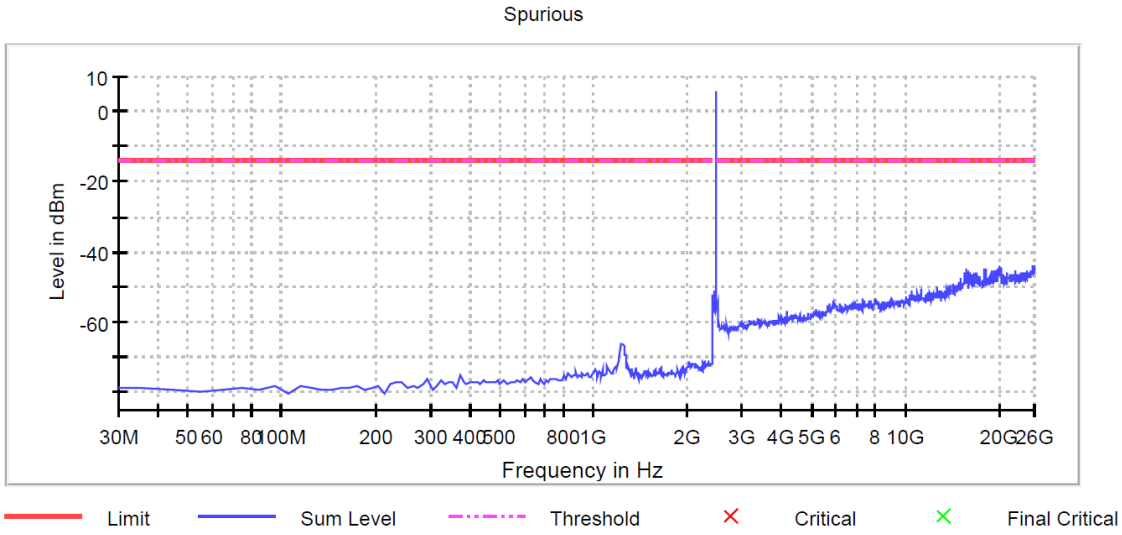


Figure 29: Conducted spurious emissions 30 MHz – 26 GHz HIGH channel

Table 24: Pre measurements, conducted spurious emissions HIGH channel

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)
25835.094666	-43.6	29.6	-13.9
25725.157777	-43.9	29.9	-13.9
25885.065980	-43.9	29.9	-13.9
25845.088929	-44.0	30.0	-13.9
25875.071717	-44.1	30.1	-13.9
20198.330535	-44.1	30.2	-13.9
25925.043030	-44.2	30.3	-13.9
25955.025818	-44.3	30.4	-13.9
25905.054505	-44.5	30.6	-13.9
25825.100404	-44.5	30.6	-13.9
25935.037293	-44.6	30.6	-13.9
25775.129091	-44.6	30.7	-13.9
25915.048768	-44.6	30.7	-13.9
25865.077454	-44.7	30.8	-13.9
25805.111878	-44.7	30.8	-13.9

Table 25: Final measurements, conducted spurious emissions HIGH channel

No final measurements were made; no emissions near the limit.

Table 26: Measurement settings, band edge

Setting	Instrument Value	Target Value
Start Frequency	2.40000 GHz	2.40000 GHz
Stop Frequency	2.48350 GHz	2.48350 GHz
Span	83.500 MHz	83.500 MHz
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	1670	~ 1670
Sweeptime	94.727 µs	AUTO
Reference Level	10.000 dBm	10.000 dBm
Attenuation	30.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Max Stable Difference	0.44 dB	0.50 dB

Table 27: Measurement settings, spurious emissions

Setting	Instrument Value	Target Value
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	238	~ 238
Sweeptime	23.700 ms	AUTO
Reference Level	-20.000 dBm	-30.000 dBm
Attenuation	10.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	3	3
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Max Stable Difference	0.00 dB	0.50 dB

6 dB Bandwidth of the Channel

Standard:	ANSI C63.10-2013
Tested by:	HEM
Date:	11 January 2021
Temperature:	21.9 °C
Humidity:	25.5 %RH
Barometric pressure:	21.9 °C

FCC Rule: 15.247(a)(2)
RSS-247 5.2(a)

Results:

Table 28: 6 dB bandwidth test results

Channel	6 dB BW [kHz]	Minimum limit [kHz]
Low	2019.802	500
Mid	1980.198	
High	1980.198	

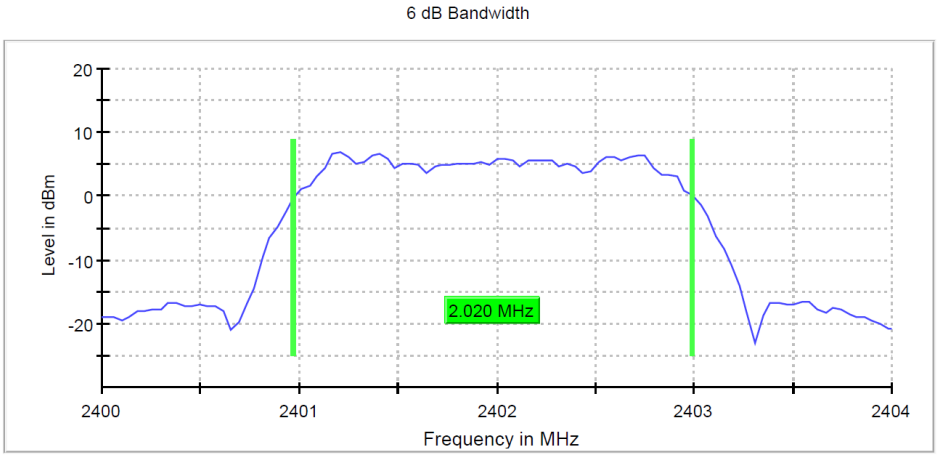


Figure 30: 6 dB bandwidth, channel LOW

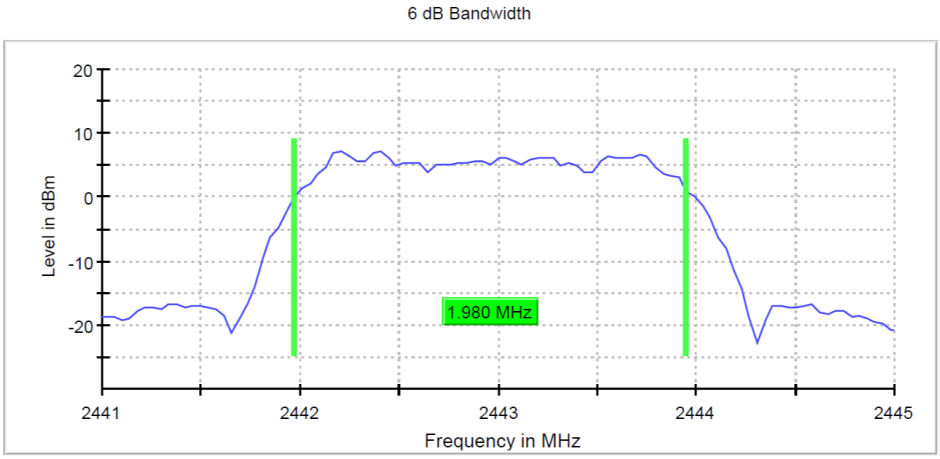


Figure 31: 6 dB bandwidth, channel MID

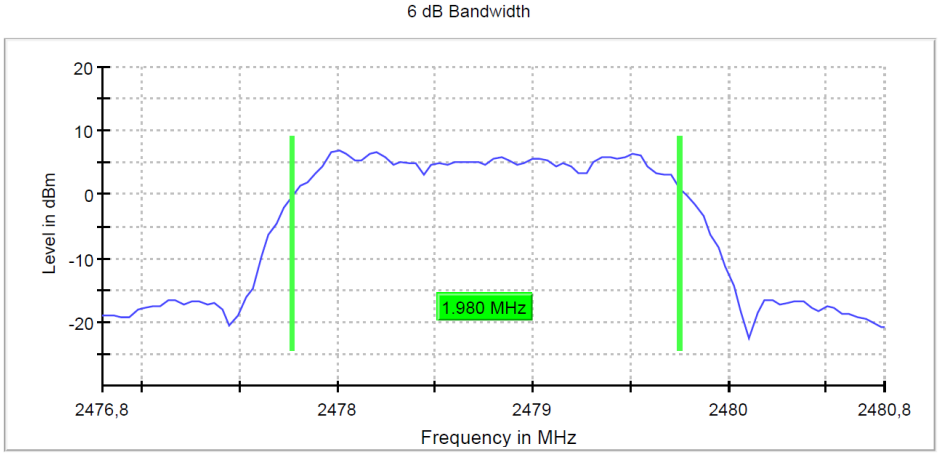


Figure 32: 6 dB bandwidth, channel HIGH

Table 29: Measurement settings, 6 dB bandwidth

Setting	Instrument Value	Target Value
Span	**4.000 MHz**	**4.000 MHz**
RBW	**100.000 kHz**	**~ 100.000 kHz**
VBW	**300.000 kHz**	**~ 300.000 kHz**
SweepPoints	**101**	**~ 80**
Sweeptime	**18.938 µs**	**AUTO**
Reference Level	**0.000 dBm**	**0.000 dBm**
Attenuation	**20.000 dB**	**AUTO**
Detector	**MaxPeak**	**MaxPeak**
SweepCount	**100**	**100**
Filter	**3 dB**	**3 dB**
Trace Mode	**Max Hold**	**Max Hold**
Sweeptype	**FFT**	**AUTO**
Preamp	**off**	**off**
Stablemode	**Trace**	**Trace**
Stablevalue	**0.50 dB**	**0.50 dB**
Max Stable Difference	**0.11 dB**	**0.50 dB**

Power Spectral Density

Standard:	ANSI C63.10-2013
Tested by:	HEM
Date:	11 January 2021
Temperature:	21.9 °C
Humidity:	25.5 %RH
Barometric pressure:	1005.1 mbar

FCC Rule: 15.247(e)
RSS-247 5.2(b)

Results:

Table 30: Power spectral density test results

Channel	PSD dBm/10 kHz	Maximum limit [dBm/3 kHz]
Low	-0.995	+8.00
Mid	-0.544	
High	-1.030	

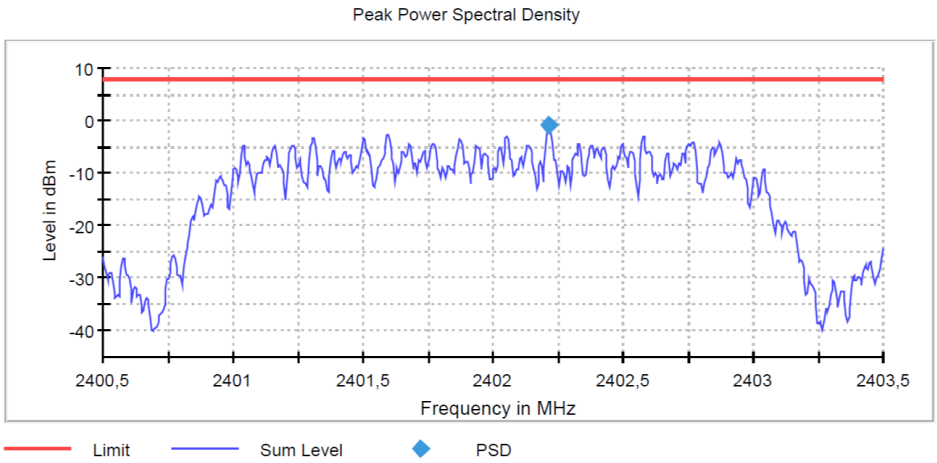


Figure 33: Power spectral density, channel LOW

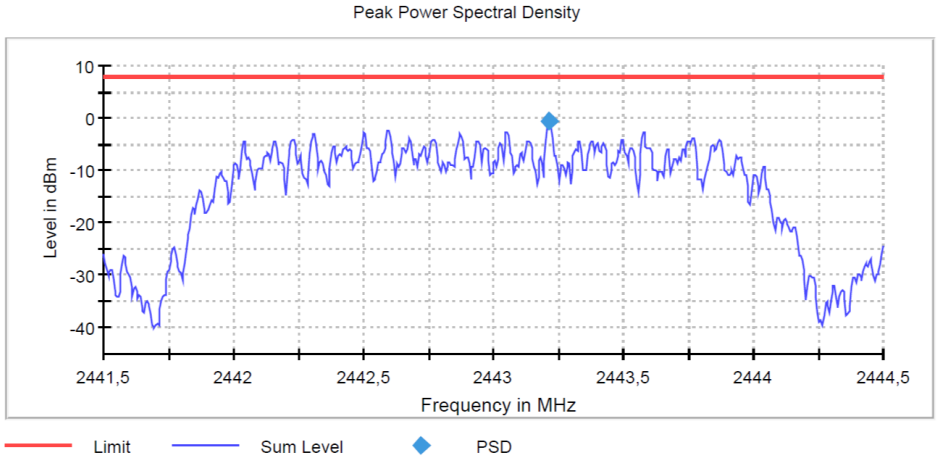


Figure 34: Power spectral density, channel MID

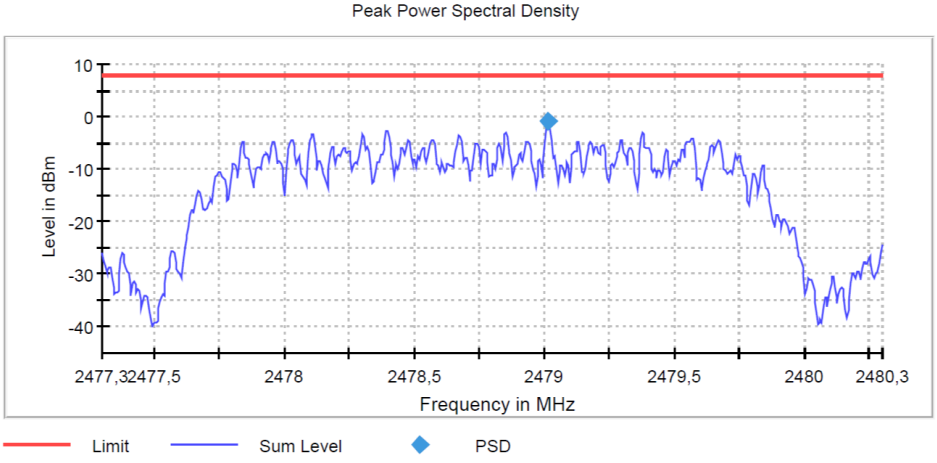


Figure 35: Power spectral density, channel HIGH

Table 31: Measurement settings, Power spectral density

Setting	Instrument Value	Target Value
Span	**3.000 MHz**	**3.000 MHz**
RBW	**10.000 kHz**	**<= 10.000 kHz**
VBW	**30.000 kHz**	**>= 30.000 kHz**
SweepPoints	**600**	**~ 600**
Sweeptime	**3.000 ms**	**AUTO**
Reference Level	**0.000 dBm**	**0.000 dBm**
Attenuation	**20.000 dB**	**AUTO**
Detector	**MaxPeak**	**MaxPeak**
SweepCount	**100**	**100**
Filter	**3 dB**	**3 dB**
Trace Mode	**Max Hold**	**Max Hold**
Sweeptype	**Sweep**	**Sweep**
Preamp	**off**	**off**
Stablemode	**Trace**	**Trace**
Stablevalue	**0.50 dB**	**0.50 dB**
Max Stable Difference	**0.36 dB**	**0.50 dB**

99% Occupied Bandwidth

Standard: RSS-GEN
Tested by: HEM
Date: 11 January 2021
Temperature: 21.9 °C
Humidity: 25.5 %RH
Barometric pressure: 1005.1 mbar

RSS-GEN 6.7

Results

Table 32: 99% occupied bandwidth test results

Channel	99 % BW [MHz]	Limit
Low	2.200000	-
Mid	2.190000	-
High	2.190000	-

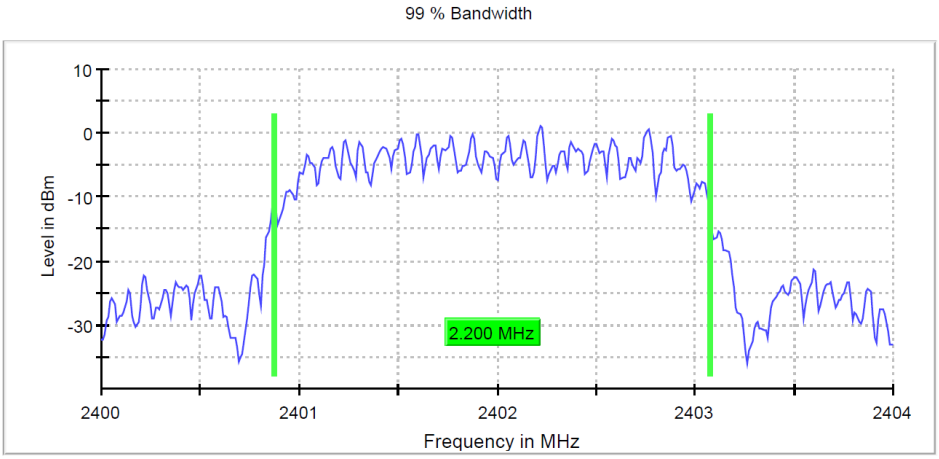


Figure 36: 99% OBW, channel LOW

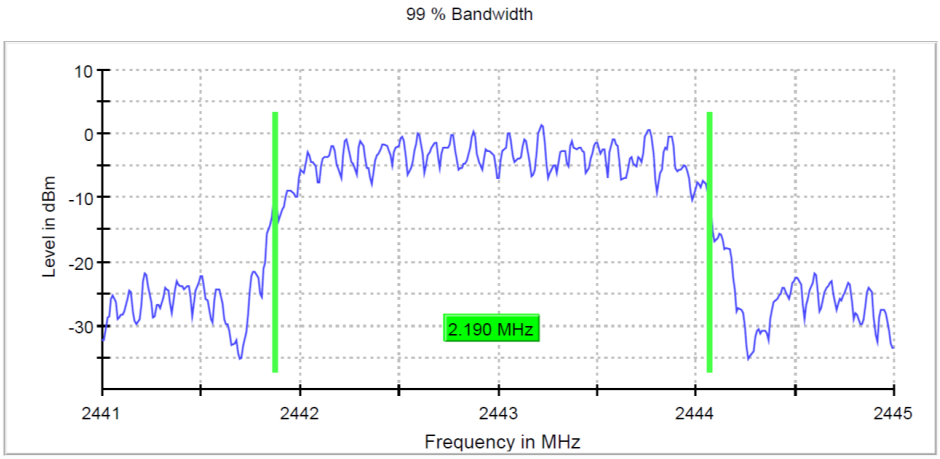


Figure 37: 99% OBW, channel MID

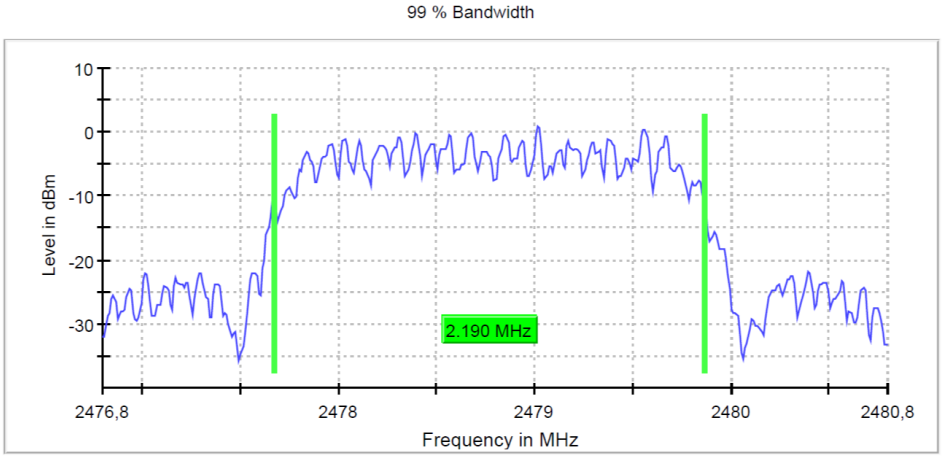


Figure 38: 99% OBW, channel HIGH

Table 33: Measurements settings, 99% occupied bandwidth

Setting	Instrument Value	Target Value
Span	**4.000 MHz**	**4.000 MHz**
RBW	**20.000 kHz**	**>= 20.000 kHz**
VBW	**100.000 kHz**	**>= 60.000 kHz**
SweepPoints	**400**	**~ 400**
Sweeptime	**94.824 µs**	**AUTO**
Reference Level	**0.000 dBm**	**0.000 dBm**
Attenuation	**20.000 dB**	**AUTO**
Detector	**MaxPeak**	**MaxPeak**
SweepCount	**100**	**100**
Filter	**3 dB**	**3 dB**
Trace Mode	**Max Hold**	**Max Hold**
Sweeptype	**FFT**	**AUTO**
Preamp	**off**	**off**
Stablemode	**Trace**	**Trace**
Stablevalue	**0.30 dB**	**0.30 dB**
Max Stable Difference	**0.21 dB**	**0.30 dB**

TEST EQUIPMENT

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
ANTENNA	EMCO	3160-09, emi 18-26.5GHz	inv. 7294	2020-02-20	2021-02-20
ANTENNA	EMCO	3117, emi 1-18GHz	inv. 7293	2020-03-11	2022-03-11
ANTENNA	ROHDE & SCHWARZ	HFH2-Z2 , 335.4711.52	inv. 8013	2020-10-28	2022-10-28
ANTENNA	SCHWARZBECK	VULB 9168	inv. 8911	2020-11-04	2022-11-04
ANTENNA MAST	MATURO	TAM 4.0E	inv. 10181	NCR	NCR
ATTENUATOR	PASTERNACK	10 dB, DC-40 GHz	sn:A1	2019-04-01	2021-04-01
ATTENUATOR	PASTERNACK	PE 7004-4 (4dB)	inv. 10126	2019-04-01	2021-04-01
EMI TEST RECEIVER	ROHDE & SCHWARZ	ESW26	inv. 10679	2020-07-20	2021-07-20
FILTER	WAINWRIGHT	HP, WHKX4.0/18G-10SS	inv:10403	2019-04-01	2021-04-01
LISN	ROHDE & SCHWARZ	ENV216	inv. 9611	2020-03-03	2021-03-03
LISN	ROHDE & SCHWARZ	ESH3-Z5	inv. 8019	2020-05-19	2021-05-19
MAST & TURNTABLE CONTROLLER	MATURO	NCD	inv. 10183	NCR	NCR
OSP BASE UNIT	ROHDE & SCHWARZ	OSP120	inv:10882	2019-02-28	2021-02-28
OSP-B157W 8 PORT	ROHDE & SCHWARZ	OSP-B157W8	inv:10883	2019-02-06	2021-02-06
OSP-B157WX	ROHDE & SCHWARZ	OSP-B157WX	inv:10884	2019-02-13	2021-02-13
POWER SUPPLY	CALIFORNIA INSTR.	5001 iX Series II	inv. 7826	NCR	NCR
RF PREAMPLIFIER	CIAO	CA118-3123	inv. 10278	2020-10-09	2021-10-09
RF PREAMPLIFIER	CIAO	CA1840-5019	inv. 10593	2020-10-09	2021-10-09
SPECTRUM ANALYZER	ROHDE & SCHWARZ	FSV40	inv:10881	2020-06-10	2021-09-06
TEST SOFTWARE	ROHDE & SCHWARZ	EMC-32	-	-	-
TURNTABLE	MATURO	DS430 UPGRADED	inv. 10182	NCR	NCR

NCR = No calibration required

END OF REPORT