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Test report

358850-1R1TRFWL

Date of issue: August 30, 2018

Applicant:
eSmart Tech Inc.

Product:
Hardware Cryptocurrency Wallet

Model: FLX One

Model variant: N/A

FCC ID: 2AQRU-0018

IC Registration number: 24159-0018

Specifications:

◆ **FCC Part 15 Subpart C §15.249**

Operation in the 902–928 MHz, 2400–2483.5 MHz, 5725–5875 MHz and 24.0–24.25 GHz

◆ **IC RSS-210 Issue 9 August 2016, Annex B**

License-Exempt Radio Apparatus: Category I Equipment, Devices Operating in Frequency Bands for any Application, Bands 902-928 MHz, 2400-2483.5 MHz and 5725-5875 MHz

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358850-1R1TRFWL(FCC Part 15.249 RSS-210)

NVLAP[®]
NVLAP Code
200116-0

Test location

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FCC Site Number	Test Firm Registration Number: 392943 Designation Number: US5058
ISED Test Site	2040B-3

Tested by:	Nikolay Shtin, Sr. Wireless Engineer
Reviewed by:	Juan Manuel Gonzalez, EMC/Wireless Business Development Manager
Date:	August 30, 2018
Signature:	

Limits of responsibility

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

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

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Table of Contents

Section 1 Report summary.....	4
1.1 Applicant and manufacturer	4
1.2 Test specifications	4
1.3 Test methods.....	4
1.4 Statement of compliance.....	4
1.5 Exclusions.....	4
1.6 Test report revision history	4
Section 2 Summary of test results.....	5
2.1 FCC Part 15 Subpart C – general requirements, test results	5
2.2 FCC Part 15 Subpart C – Intentional Radiators, test results	5
2.3 IC RSS-GEN, Issue 3, test results.....	5
2.4 RSS-210, Issue 9, test results	5
Section 3 Equipment under test (EUT) details	6
3.1 Sample information	6
3.2 EUT information	6
3.3 Technical information.....	6
3.4 Product description and theory of operation	6
3.5 EUT exercise details	6
3.6 EUT setup Figure.....	7
3.7 EUT sub assemblies	7
Section 4 Engineering considerations	8
4.1 Modifications incorporated in the EUT	8
4.2 Technical judgment.....	8
4.3 Deviations from laboratory tests procedures	8
Section 5 Test conditions.....	9
5.1 Atmospheric conditions	9
5.2 Power supply range	9
Section 6 Measurement uncertainty	10
6.1 Uncertainty of measurement	10
Section 7 Test equipment.....	11
7.1 Test equipment list.....	11
Section 8 Testing data.....	12
8.1 FCC 15.207 (a) - Conducted limits	12
8.2 Clause 15.215(c) Emission bandwidth RSS Gen 6.6 Occupied bandwidth	15
8.3 Clause 15.249(a) RSS 210 B.10(a) Field strength of emissions not in restricted bands.....	18
8.4 Clause 15.249(d) RSS 210 B.10(b) Spurious emissions (except for harmonics).....	22
Section 9 Block Figures of test set-ups.....	28
9.1 Radiated emissions set-up – Below 1GHz.....	28
9.2 Radiated emissions set-up – Above 1GHz	29
9.3 Conducted emissions set-up	29

Section 1 Report summary

1.1 Applicant and manufacturer

Company name	eSmart Tech Inc.
Address	16835 W Bernardo Dr., Suite 205
City	San Diego
Province/State	CA
Postal/Zip code	92127
Country	USA

1.2 Test specifications

FCC 47 CFR Part 15, Subpart C, Clause 15.249	Operation in the 902–928 MHz, 2400–2483.5 MHz, 5725–5875 MHz and 24.0–24.25 GHz
RSS-210, Issue 9 Annex B	Licence-Exempt Radio Apparatus: Category I Equipment, Devices Operating in Frequency Bands for any Application, Bands 902-928 MHz, 2400-2483.5 MHz and 5725-5875 MHz

1.3 Test methods

ANSI C63.10-2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
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1.4 Statement of compliance

In the configuration tested, the EUT was found compliant.

Testing was completed against all relevant requirements of the test standard. Results obtained indicate that the product under test complies in full with the requirements tested. The test results relate only to the items tested.

See "Summary of test results" for full details.

1.5 Exclusions

None

1.6 Test report revision history

Revision #	Details of changes made to test report
TRF	Original report issued
1R1TRF	Average field strength and respective compliance margins were added to the Table 8.3-3 (page 20)

Section 2 Summary of test results

2.1 FCC Part 15 Subpart C – general requirements, test results

Part	Test description	Verdict
§15.207(a)	Conducted limits	Pass
§15.31(e)	Variation of power source	Pass
§15.215(c)	20 dB bandwidth	Pass

Note: No considerable emissions power variation were observed while the supply voltage was varied between 85% and 115% of the nominal rated supply voltage.

2.2 FCC Part 15 Subpart C – Intentional Radiators, test results

Part	Test description	Verdict
§15.249(a)	Radiated emissions not in restricted bands	Pass
§15.249(b)	Fixed Point-to-Point operation in the 24.0–24.25 GHz band	Not applicable
§15.249(d)	Spurious emissions (except harmonics)	Pass

Notes: [None](#)

2.3 IC RSS-GEN, Issue 3, test results

Part	Test description	Verdict
§6.6	Occupied bandwidth	Pass
§8.8	AC power lines conducted emission limits	Pass
§7.1.2	Receiver radiated emission limits	Not applicable*

*Not applicable. EUT has no Stand-Alone receiver port.

2.4 RSS-210, Issue 9, test results

Part	Test description	Verdict
§B.10a	Radiated emissions (The field strength of fundamental and harmonic emissions)	Pass
§B.10b	Spurious emissions (except harmonics)	Pass

Notes: [None](#)

Section 3 Equipment under test (EUT) details

3.1 Sample information

Receipt date	August 8, 2018
Nemko sample ID number	358850

3.2 EUT information

Product name	Hardware Cryptocurrency Wallet
Model	FLX One
Model variant	N/A
Serial number	N/A

3.3 Technical information

Operating band	2400–2483.5 MHz
Operating frequency	2402-2480 MHz
Modulation type	GFSK
Occupied bandwidth (20dB)	1.140MHz
Occupied bandwidth (99%)	0.9675MHz
EIRP	81.75dBuV/m or -13.48dBm or 0.045mW (@2402MHz Channel) *see notes below for calculation details
Emission designator	F1D
Power requirements	+5VDC (Battery powered or from USB voltage)
Antenna information	The EUT uses a unique antenna coupling/ non-detachable antenna to the intentional radiator.
Notes	<p>* $eirp = pt \times gt = (E \times d)^2 / 30$</p> <p>where:</p> <ul style="list-style-type: none"> • pt = transmitter output power in watts, • gt = numeric gain of the transmitting antenna (unitless), • E = electric field strength in V/m, • d = measurement distance in meters (m). <p>And</p> <p>$V / m = 10^{((dBuV/m) - 120) / 20}$</p>

3.4 Product description and theory of operation

The Equipment Under Test (EUT) was a eSmart Tech Inc. FLX One Hardware Cryptocurrency Wallet. The EUT incorporates a low power BLE radio operating in the 2402-2480 MHz ISM band.

3.5 EUT exercise details

EUT was set to fixed channel test mode transmitting modulated signal at maximum power.

3.6 EUT setup Figure

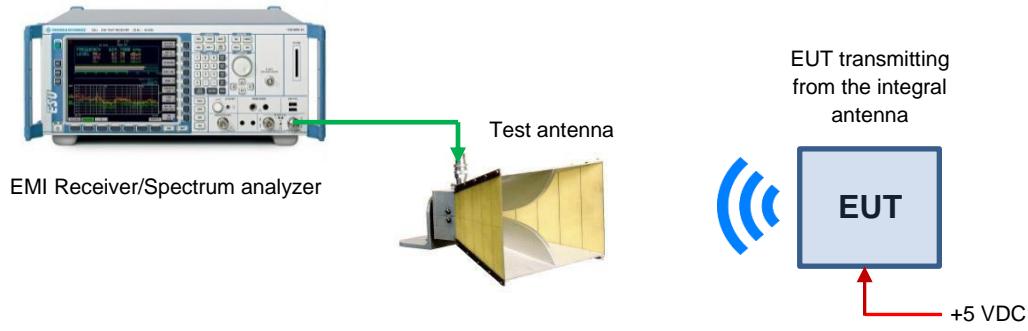


Figure 3.6-1: Setup Figure

3.7 EUT sub assemblies

Table 3.7-1: EUT sub assemblies

Description	Brand name	Model/Part number	Serial number
AC Adapter	Inertek	N/A	N/A
Hardware Cryptocurrency Wallet	eSmart Tech Inc.	FLX One	N/A

Section 4 Engineering considerations

4.1 Modifications incorporated in the EUT

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

4.2 Technical judgment

[None](#)

4.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 5 Test conditions

5.1 Atmospheric conditions

Temperature	15–30 °C
Relative humidity	20–75 %
Air pressure	860–1060 mbar

When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

5.2 Power supply range

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

Section 6 Measurement uncertainty

6.1 Uncertainty of measurement

Measurement uncertainty budgets for the tests are detailed below. Measurement uncertainty calculations assume a coverage factor of $K = 2$ with 95% certainty.

Test name	Measurement uncertainty, dB
All antenna port measurements	0.55
Conducted spurious emissions	1.13
Radiated spurious emissions	3.78
AC power line conducted emissions	3.55

Section 7 Test equipment

7.1 Test equipment list

Table 7.1-1: Radiated disturbance equipment list

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
EMC Test Receiver	Rohde & Schwarz	ESU 40	E1131	1 yr.	8/18/2018
Antenna, Bilog	Schaffner-Chase	CBL6111B	1763	1 yr.	11/28/2018
Antenna, Horn (1-18 GHz)	ETS Lindgren	3117	1139	1 yr.	1/26/2019
Antenna, Horn (18-26 GHz)	SAGE Millimeter	SAR-2309-42-S2	E1143	2 yr.	3/13/2020
Signal Generator	Rohde & Schwarz	SMW200A	E1156	2 yr.	4/10/2020
Band-reject filter	Micro-Tronics	BRM50702-02	E1142	N/A	Verified with E1131

Notes: None

Table 7.1-2: Conducted disturbance at mains port equipment list

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
EMI Test Receiver 9kHz to 7GHz	Rohde & Schwarz	ESCI 7	E1026	5/23/2017	5/23/2019
Two Line V-Network	Rohde & Schwarz	ENV216	E1019	6/27/2017	6/27/2019

Notes: None

Table 7.1-3: Test software details

Manufacturer of Software	Details
R&S	EMC32 V10.00.00

Notes: None

Section 8 Testing data

8.1 FCC 15.207 (a) - Conducted limits.

8.1.1 References

Title 47 → Chapter I → Subchapter A → Part 15 → Subpart C → §15.207 / ANSI C63.10: 2013

(a) Except as shown in paragraphs (b) and (c) of this section, 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 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

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

b) The limit shown in paragraph (a) of this section shall not apply to carrier current systems operating as intentional radiators on frequencies below 30 MHz. In lieu thereof, these carrier current systems shall be subject to the following standards:

- (1) For carrier current system containing their fundamental emission within the frequency band 535-1705 kHz and intended to be received using a standard AM broadcast receiver: no limit on conducted emissions.
- (2) For all other carrier current systems: 1000 μ V within the frequency band 535-1705 kHz, as measured using a 50 μ H/50 ohms LISN.
- (3) Carrier current systems operating below 30 MHz are also subject to the radiated emission limits in §15.205, §15.209, §15.221, §15.223, or §15.227, as appropriate.

(c) Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines. Devices that include, or make provisions for, the use of battery chargers which permit operating while charging, AC adapters or battery eliminators or that connect to the AC power lines indirectly, obtaining their power through another device which is connected to the AC power lines, shall be tested to demonstrate compliance with the conducted limits.

8.1.2 Conducted Emissions Test summary

Verdict	Pass	Temperature	23 °C
Test date	July 11, 2018	Air pressure	1000 mbar
Test engineer	Nikolay Shtin	Relative humidity	41
Test location	Ground Plane		

8.1.3 Notes

None

8.1.4 Setup details

Port under test	AC Mains Input of the support AC adapter
EUT setup configuration	Table top
Measurement details	A preview measurement was generated with the receiver in continuous scan mode. Emissions detected within 6 dB or above limit were re-measured with the appropriate detector against the correlating limit and recorded as the final measurement.

Receiver settings:

Resolution bandwidth	9 kHz
Video bandwidth	30 kHz
Detector mode	<ul style="list-style-type: none">– Peak and Average (Preview measurement)– Quasi-peak and CAverage (Final measurement)
Trace mode	Max Hold
Measurement time	<ul style="list-style-type: none">– 100 ms (Peak and Average preview measurement)– 1000 ms (Quasi-peak final measurement)– 160 ms (CAverage final measurement)

8.1.5 Conducted Emissions Test data

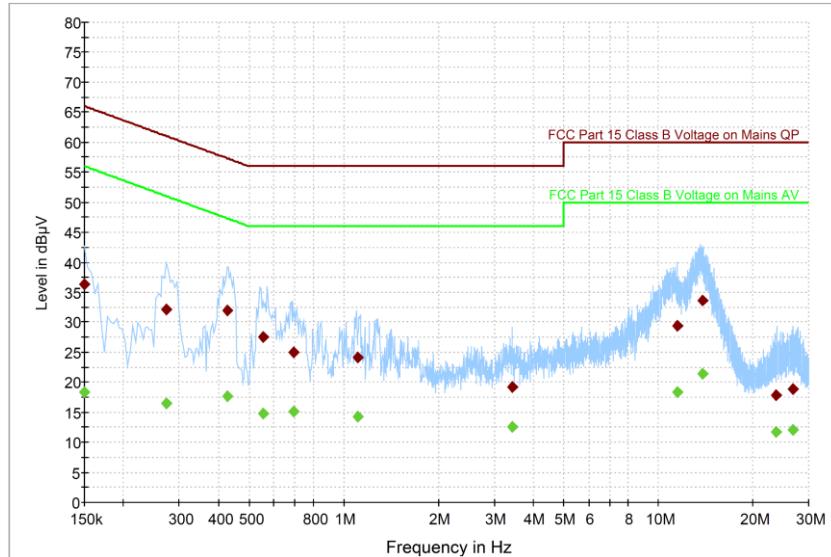


Figure 8.1.1: Conducted spurious emissions, 150 kHz-30 MHz

Note: The spectral plot has been corrected with transducer factors. (i.e. cable loss, LISN factors, and attenuators)

Table 8.1-1 Conducted disturbance at AC mains results (Quasi-Peak and Average)

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.150000	36.40	---	66.00	29.60	5000.0	9.000	N	ON	19.5
0.150000	---	18.36	56.00	37.64	5000.0	9.000	N	ON	19.5
0.272500	---	16.53	51.04	34.51	5000.0	9.000	N	ON	19.5
0.272500	32.13	---	61.04	28.91	5000.0	9.000	N	ON	19.5
0.428500	31.91	---	57.28	25.37	5000.0	9.000	L1	ON	19.5
0.428500	---	17.71	47.28	29.57	5000.0	9.000	L1	ON	19.5
0.555500	27.59	---	56.00	28.41	5000.0	9.000	L1	ON	19.5
0.555500	---	14.86	46.00	31.14	5000.0	9.000	L1	ON	19.5
0.692500	24.96	---	56.00	31.04	5000.0	9.000	N	ON	19.5
0.692500	---	15.20	46.00	30.80	5000.0	9.000	N	ON	19.5
1.104500	24.07	---	56.00	31.93	5000.0	9.000	L1	ON	19.5
1.104500	---	14.30	46.00	31.70	5000.0	9.000	L1	ON	19.5
3.428500	---	12.62	46.00	33.38	5000.0	9.000	L1	ON	19.5
3.428500	19.18	---	56.00	36.82	5000.0	9.000	L1	ON	19.5
11.464500	29.37	---	60.00	30.63	5000.0	9.000	N	ON	19.6
11.464500	---	18.34	50.00	31.66	5000.0	9.000	N	ON	19.6
13.768500	---	21.37	50.00	28.63	5000.0	9.000	L1	ON	19.7
13.768500	33.55	---	60.00	26.45	5000.0	9.000	L1	ON	19.7
23.716500	17.82	---	60.00	42.18	5000.0	9.000	N	ON	19.9
23.716500	---	11.67	50.00	38.33	5000.0	9.000	N	ON	19.9
26.636500	18.79	---	60.00	41.21	5000.0	9.000	L1	ON	19.8
26.636500	---	12.02	50.00	37.98	5000.0	9.000	L1	ON	19.8

Notes:

¹ Result (dBμV) = receiver/spectrum analyzer value (dBμV) + correction factor (dB)

² Correction factor (dB) = LISN factor IL (dB) + cable loss (dB) + attenuator (dB)

³ The maximum measured value observed over a period of 15 seconds was recorded.

Sample calculation: 63.5 dBμV (result) = 44 dBμV (receiver reading) + 19.5 dB (Correction factor)

8.2 Clause 15.215(c) Emission bandwidth RSS Gen 6.6 Occupied bandwidth

Definitions and limits

Part 15.215(c)

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80 % of the permitted band in order to minimize the possibility of out-of-band operation.

RSS-Gen Clause 6.6 Occupied bandwidth

When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99 percent emission bandwidth, as calculated or measured.

The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1 percent of the selected span as is possible without being below 1 percent. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used since a peak or, peak hold, may produce a wider bandwidth than actual.

The trace data points are recovered and are directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 percent of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is recorded.

The span between the two recorded frequencies is the occupied bandwidth.

Test summary

Test date:	August 8, 2018	Temperature:	20 °C
Test engineer:	Nikolay Shtin	Air pressure:	1006 mbar
Verdict:	Pass	Relative humidity:	40 %

Observations/special notes

None

Test data

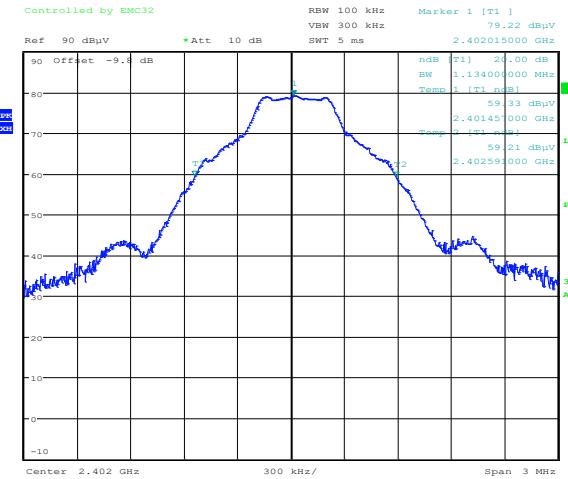


Figure 8.2-1: 20 dB Bandwidth, Low CH



Figure 8.2-2: 20 dB Bandwidth, Mid CH



Figure 8.2-3: 20 dB Bandwidth, High CH

Table 8.2-1: 20 dB bandwidth results

Frequency (MHz)	20dB bandwidth (MHz)
2402	1.134
2440	1.134
2480	1.140

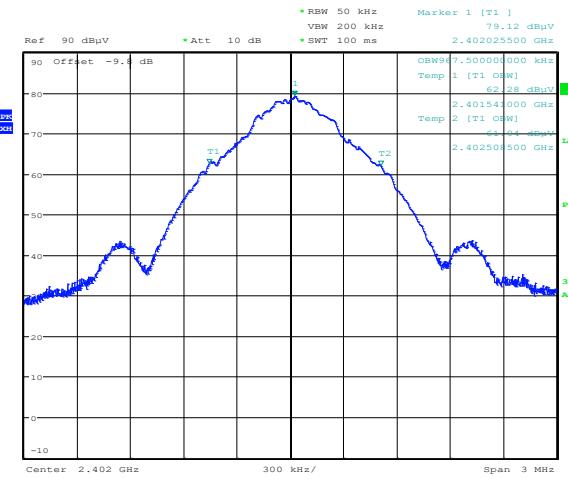


Figure 8.2-4: 99% OBW, Low CH

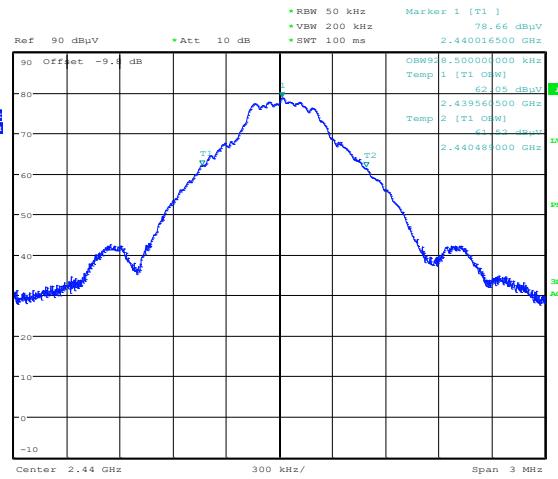


Figure 8.2-5: 99% OBW, Mid CH

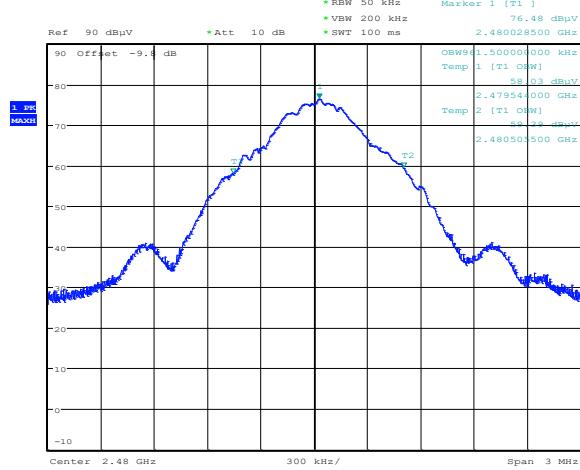


Figure 8.2-6: 99% OBW, High CH

Table 8.2-2: 99% bandwidth results

Frequency (MHz)	99 % bandwidth (MHz)
2402	0.9675
2440	0.9285
2480	0.9615

8.3 Clause 15.249(a) RSS 210 B.10(a) Field strength of emissions not in restricted bands

Definitions and limits

In addition to the provisions of §15.205 and RSS-Gen the field strength of emissions from intentional radiators operated under this section shall not exceed the following:

Table 8.3-1: Field strength limits

Fundamental frequency (MHz)	Field strength of fundamental (mV/m)	Field strength of fundamental (dB μ V/m)	Field strength of spurious emissions (μ V/m)	Field strength of spurious emissions (dB μ V/m)
902–928	50	94	500	54
2400–2483.5	50	94	500	54
5725–5875	50	94	500	54
24.0–24.25	250	108	2500	68

(e) As shown in §15.35(b), for frequencies above 1000 MHz, the field strength limits in paragraphs (a) and (b) of this section are based on average limits.

However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For point-to-point operation under paragraph (b) of this section, the peak field strength shall not exceed 2500 millivolts/meter (128 dB μ V/m) at 3 meters along the antenna azimuth.

Test summary

Test date:	August 10, 2018	Temperature:	20 °C
Test engineer:	Nikolay Shtin	Air pressure:	1006 mbar
Verdict:	Pass	Relative humidity:	42 %

Observations/special notes

Table 8.3-2: §15.209 RSS Gen 8.9 – Radiated emission limits

Frequency (MHz)	Field strength (μ V/m)	Field strength (dB μ V/m)	Measurement distance (m)
0.009–0.490	2400/F	67.6–20 \times log ₁₀ (F)	300
0.490–1.705	24000/F	87.6–20 \times log ₁₀ (F)	30
1.705–30.0	30	29.5	30
30–88	100	40.0	3
88–216	150	43.5	3
216–960	200	46.0	3
above 960	500	54.0	3

- The spectrum was searched from 30 MHz to the 10th harmonic.
- The EUT was measured on three orthogonal axes.
- All measurements were performed at a distance of 3 m.
- All measurements were performed:
 - within 30–1000 MHz range: using a quasi-peak detector with 120 kHz/300 kHz RBW/VBW,
 - above 1 GHz: using peak detector with 1 MHz/3 MHz RBW/VBW for peak results
 - and using a duty cycle/average factor for average results calculations.

Test data, continued

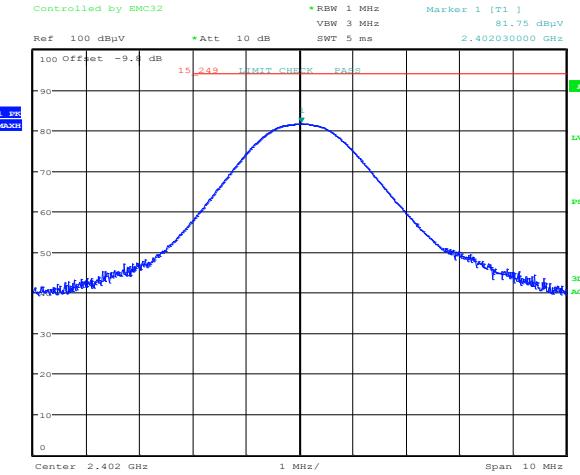


Figure 8.3-1: Fundamental emissions, Low CH

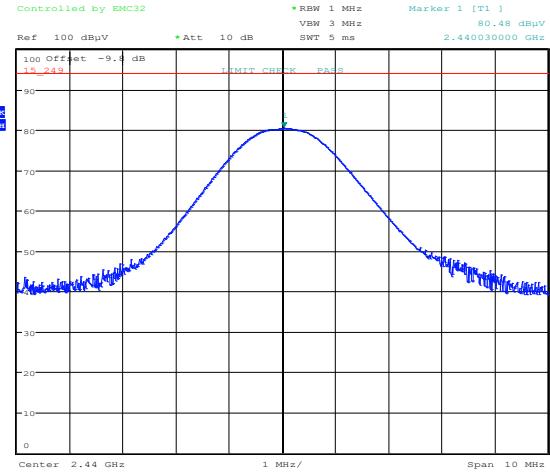


Figure 8.3-2: Fundamental emissions, Mid CH

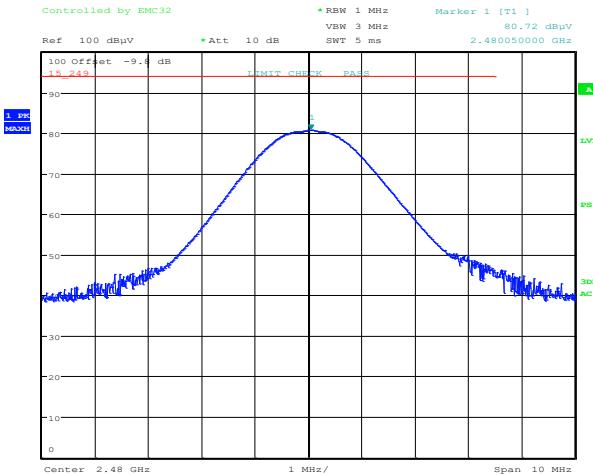


Figure 8.3-3: Fundamental emissions, High CH

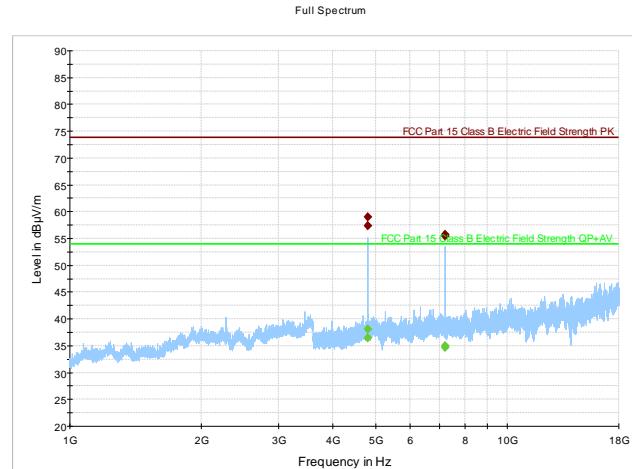


Figure 8.3-4: 2nd and 3rd harmonic emissions, Low CH

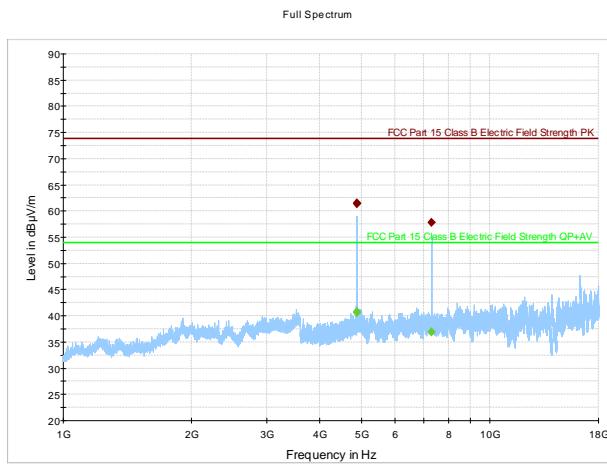


Figure 8.3-5: 2nd and 3rd harmonic emissions, Mid CH

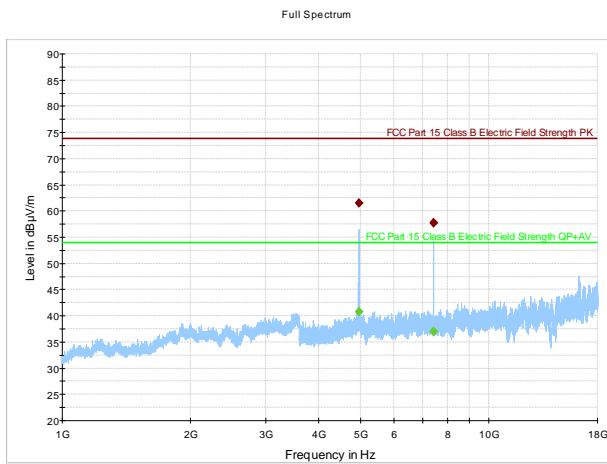


Figure 8.3-6: 2nd and 3rd harmonic emissions, High CH

The spectral plot is a summation of a vertical and horizontal scan. The spectral scan has been corrected with transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators) for determination of compliance. Limits have been adjusted to reflect 3 m requirements.

A preview measurement was generated with receiver in continuous scan or sweep mode while the EUT was rotated and antenna adjusted to maximize radiated emission. Emissions detected within 6 dB or above limit were re-measured with the appropriate detector against the correlating limit and recorded as the final measurement.

Table 8.3-3: Field strength measurement results (fundamental emissions)

Frequency, (MHz)	Polarization, V/H	Peak Field strength, (dBµV/m)	Peak limit, (dBµV/m)	Margin, (dB)	Avg. Field strength (dBµV/m)	Avg. limit (dBµV/m)	Margin (dB)
2.402	H	81.75 ¹	114.0	32.25	60.95 ²	94.0	33.05
2.440	H	80.48 ¹	114.0	33.52	59.68 ²	94.0	34.32
2.480	H	80.72 ¹	114.0	33.28	59.92 ²	94.0	34.08

Note: ¹Field strength includes correction factor of antenna, cable loss, amplifier, and attenuators where applicable.

²Average data are from Peak data with Duty Cycle correction factor applied. Sample computation:

$$\begin{aligned}
 \text{2402 MHz (Low Channel)} &= 81.75 \text{ dB}\mu\text{V/m (Peak)} \\
 &= 81.75 \text{ dB}\mu\text{V/m} - 20.8 \text{ (DCCF)} \\
 &= 60.95 \text{ (Average)}
 \end{aligned}$$

Table 8.3-4: Field strength measurement results for 2nd and 3rd harmonics (Low Channel)

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
4804.006667	58.94	---	73.90	14.96	5000.0	1000.000	127.8	H	102.0
4804.006667	---	38.14	53.90	15.76	5000.0	1000.000	127.8	H	102.0
4804.433333	---	36.51	53.90	17.39	5000.0	1000.000	126.7	H	102.0
4804.433333	57.31	---	73.90	16.59	5000.0	1000.000	126.7	H	102.0
7205.566667	55.44	---	73.90	18.46	5000.0	1000.000	191.1	V	272.0
7205.566667	---	34.64	53.90	19.26	5000.0	1000.000	191.1	V	272.0
7206.300000	---	34.93	53.90	18.97	5000.0	1000.000	220.0	V	300.0
7206.300000	55.73	---	73.90	18.17	5000.0	1000.000	220.0	V	300.0

Table 8.3-5: Field strength measurement results 2nd and 3rd harmonics (Mid Channel)

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
4880.200000	---	40.69	53.90	13.21	5000.0	1000.000	118.6	H	100.0

4880.200000	61.49	---	73.90	12.41	5000.0	1000.000	118.6	H	100.0
4880.366667	---	40.57	53.90	13.33	5000.0	1000.000	121.3	H	94.0
4880.366667	61.37	---	73.90	12.53	5000.0	1000.000	121.3	H	94.0
7319.400000	57.78	---	73.90	16.12	5000.0	1000.000	156.5	H	252.0
7319.400000	---	36.98	53.90	16.92	5000.0	1000.000	156.5	H	252.0

Table 8.3-6: Field strength measurement results 2nd and 3rd harmonics (High Channel)

Frequency (MHz)	MaxPeak (dB μ V/m)	Average (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
4959.633333	---	40.73	53.90	13.17	5000.0	1000.000	122.3	H	102.0
4959.633333	61.53	---	73.90	12.37	5000.0	1000.000	122.3	H	102.0
4960.266667	---	40.69	53.90	13.21	5000.0	1000.000	121.2	H	102.0
4960.266667	61.49	---	73.90	12.41	5000.0	1000.000	121.2	H	102.0
7439.600000	57.89	---	73.90	16.01	5000.0	1000.000	154.5	H	214.0
7439.600000	---	37.09	53.90	16.81	5000.0	1000.000	154.5	H	214.0
7440.566667	57.70	---	73.90	16.20	5000.0	1000.000	153.6	H	214.0
7440.566667	---	36.90	53.90	17.00	5000.0	1000.000	153.6	H	214.0

Note: Average data are from Peak data with Duty Cycle correction factor applied. Sample computation:

$$\begin{aligned}
 4959.6333 \text{ MHz (High Channel)} &= 61.53 \text{ dB}\mu\text{V/m (Peak)} \\
 &= 61.53 \text{ dB}\mu\text{V/m} - 20.8 \text{ (DCCF)} \\
 &= 40.73 \text{ (Average)}
 \end{aligned}$$

Duty Cycle Correction Factor Calculation

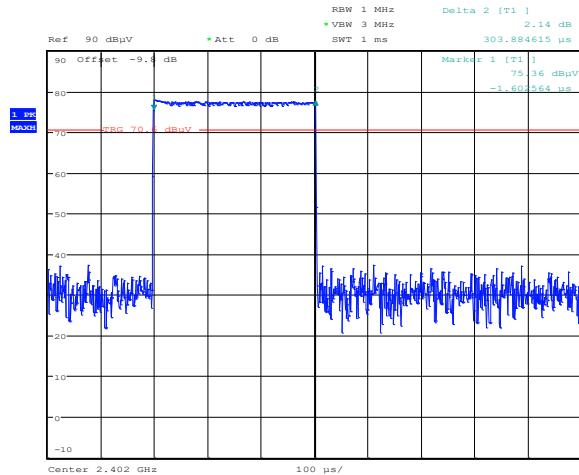


Figure 8.3-7: 1ms sweep (representative channel)

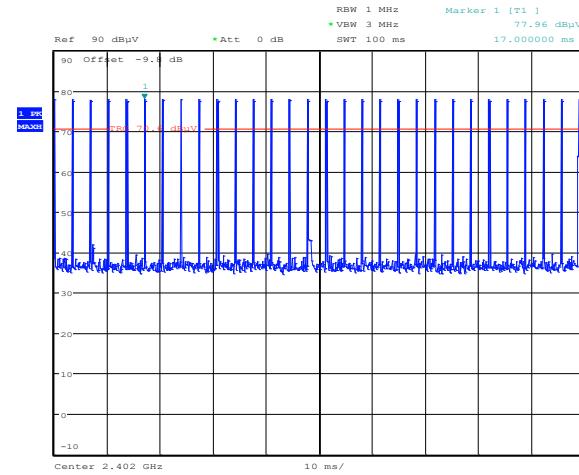


Figure 8.3-8: 100ms sweep (representative channel)

Duty Cycle Calculation:

$$\begin{aligned}
 &= 0.303 \text{ ms "On" time per 1 ms sweep} \\
 &= 0.303 \text{ ms} \times 30 / 100 \text{ "On" time per 100 ms sweep}
 \end{aligned}$$

Duty Cycle Correction Factor (DCCF)

$$\begin{aligned}
 &= 20 \log (0.0909) \\
 &= \mathbf{-20.8 \text{ dB}}
 \end{aligned}$$

8.4 Clause 15.249(d) RSS 210 B.10(b) Spurious emissions (except for harmonics)

Definitions and limits

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

Table 8.4-1: Field strength limits

Frequency (MHz)	Field strength		Measurement distance (m)
	(μ V/m)	(dB μ V/m)	
0.009–0.490	2400/F	67.6–20 \times log ₁₀ (F)	300
0.490–1.705	24000/F	87.6–20 \times log ₁₀ (F)	30
1.705–30.0	30	29.5	30
30–88	100	40.0	3
88–216	150	43.5	3
216–960	200	46.0	3
above 960	500	54.0	3

Notes:

- F = fundamental frequency in kHz
- In the emission table above, the tighter limit applies at the band edges.
- For frequencies above 1 GHz the limit on peak RF emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test.

Test summary

Test date:	August 10, 2018	Temperature:	21 °C
Test engineer:	Nikolay Shtin	Air pressure:	1005 mbar
Verdict:	Pass	Relative humidity:	42 %

Observations/special notes

- The spectrum was searched from 30 MHz to the 10th harmonic.
- The EUT was measured on three orthogonal axes.
- All measurements were performed at a distance of 3 m.
- All measurements were performed:
- within 30–1000 MHz range: using a quasi-peak detector with 120 kHz/300 kHz RBW/VBW,
- above 1 GHz: using peak detector with 1 MHz/3 MHz RBW/VBW for peak results
- and using average detector with 1 MHz/3 MHz RBW/VBW for average results.

Test data

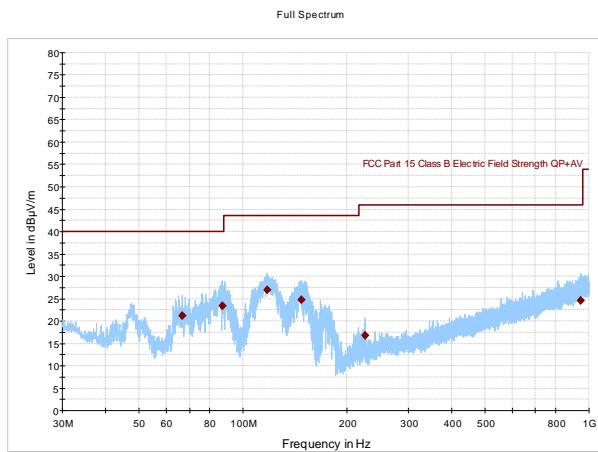


Figure 8.4-1: Radiated spurious emissions, Low channel, 30-1000MHz

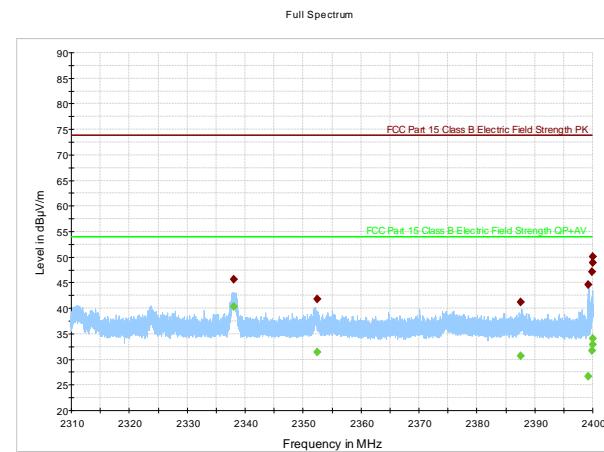


Figure 8.4-2: Radiated spurious emissions, Band-edge and immediate Restricted band 2.31-2.39 GHz, Low channel

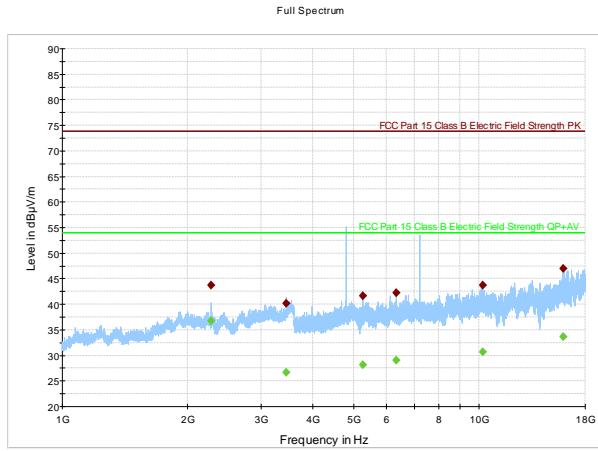


Figure 8.4-3: Radiated spurious emissions, Low channel, 1-18GHz

Table 8.4-2: Radiated field strength measurement results for low channel 2402 MHz

Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
66.597500	21.24	40.00	18.76	5000.0	120.000	186.6	V	325.0
86.970000	23.37	40.00	16.63	5000.0	120.000	115.1	V	313.0
117.643000	26.99	43.50	16.51	5000.0	120.000	100.0	V	337.0
147.047500	24.67	43.50	18.83	5000.0	120.000	124.2	V	342.0
224.950000	16.74	46.00	29.26	5000.0	120.000	124.9	V	250.0
945.834500	24.64	46.00	21.36	5000.0	120.000	345.4	V	33.0

Frequency (MHz)	MaxPeak (dB μ V/m)	Average (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
2337.998000	45.58	---	73.90	28.32	5000.0	1000.000	299.5	H	34.0
2337.998000	---	40.34	53.90	13.56	5000.0	1000.000	299.5	H	34.0
2352.414000	41.75	---	73.90	32.15	5000.0	1000.000	194.7	H	126.0
2352.414000	---	31.43	53.90	22.47	5000.0	1000.000	194.7	H	126.0
2387.609000	41.21	---	73.90	32.69	5000.0	1000.000	111.2	H	42.0
2387.609000	---	30.64	53.90	23.26	5000.0	1000.000	111.2	H	42.0
2399.165000	---	26.73	53.90	27.17	5000.0	1000.000	139.5	H	24.0
2399.165000	44.66	---	73.90	29.24	5000.0	1000.000	139.5	H	24.0
2399.894000	---	31.71	53.90	22.19	5000.0	1000.000	185.5	H	34.0
2399.894000	47.11	---	73.90	26.79	5000.0	1000.000	185.5	H	34.0
2399.993000	48.86	---	73.90	25.04	5000.0	1000.000	111.2	H	31.0
2399.993000	---	32.91	53.90	20.99	5000.0	1000.000	111.2	H	31.0
2400.000000	---	34.05	53.90	19.85	5000.0	1000.000	197.3	H	94.0
2400.000000	50.08	---	73.90	23.82	5000.0	1000.000	197.3	H	94.0

Frequency (MHz)	MaxPeak (dB μ V/m)	Average (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
2274.266667	---	36.80	53.90	17.10	5000.0	1000.000	215.5	H	42.0
2274.266667	43.78	---	73.90	30.13	5000.0	1000.000	215.5	H	42.0
3443.266667	---	26.72	53.90	27.18	5000.0	1000.000	253.8	V	0.0
3443.266667	40.21	---	73.90	33.69	5000.0	1000.000	253.8	V	0.0
6344.833333	---	29.00	53.90	24.90	5000.0	1000.000	126.7	H	102.0
6344.833333	42.21	---	73.90	31.69	5000.0	1000.000	126.7	H	102.0
5262.566667	41.60	---	73.90	32.30	5000.0	1000.000	191.1	V	272.0
5262.566667	---	28.10	53.90	25.80	5000.0	1000.000	191.1	V	272.0
10214.133333	---	30.69	53.90	23.21	5000.0	1000.000	302.5	H	332.0
10214.133333	43.79	---	73.90	30.11	5000.0	1000.000	302.5	H	332.0
15970.566667	---	33.71	53.90	20.19	5000.0	1000.000	148.0	H	358.0
15970.566667	46.97	---	73.90	26.93	5000.0	1000.000	148.0	H	358.0

Note: No considerable EUT emissions above 18 GHz were observed.

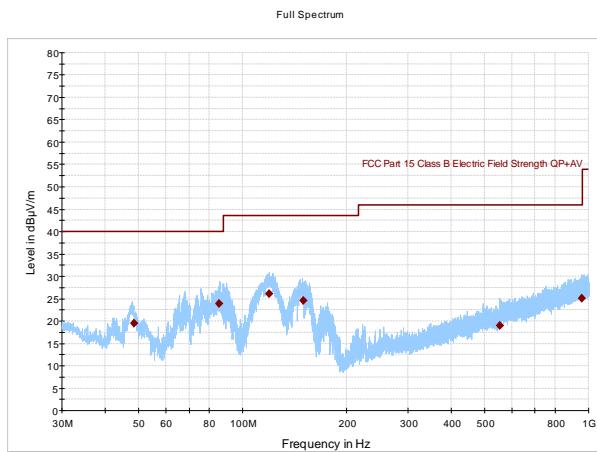


Figure 8.4-4: Radiated spurious emissions, Mid channel, 30-1000MHz

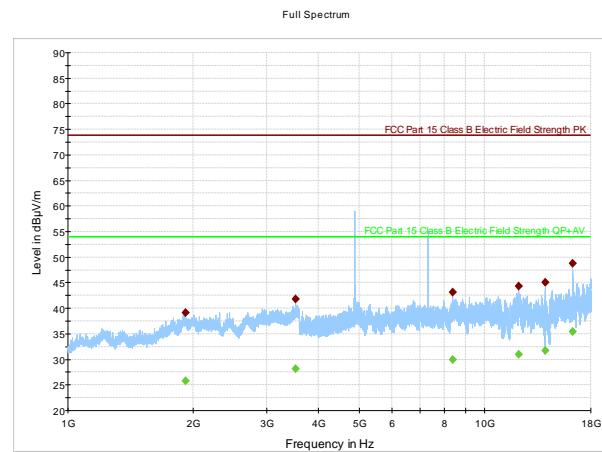


Figure 8.4-5: Radiated spurious emissions, Mid channel, 1-18GHz

Table 8.4-3: Radiated field strength measurement results for Mid channel 2440 MHz

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
48.382000	19.50	40.00	20.50	5000.0	120.000	111.4	V	231.0
85.529000	23.81	40.00	16.19	5000.0	120.000	121.3	V	296.0
119.017000	26.17	43.50	17.33	5000.0	120.000	119.0	V	315.0
149.767500	24.58	43.50	18.92	5000.0	120.000	100.0	V	102.0
554.804500	18.91	46.00	27.09	5000.0	120.000	248.6	H	0.0
957.342000	25.09	46.00	20.91	5000.0	120.000	142.4	V	352.0

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
1917.200000	39.11	---	73.90	34.79	5000.0	1000.000	392.8	H	132.0
1917.200000	---	25.83	53.90	28.07	5000.0	1000.000	392.8	H	132.0
3518.800000	---	28.20	53.90	25.70	5000.0	1000.000	141.3	H	102.0
3518.800000	41.82	---	73.90	32.08	5000.0	1000.000	141.3	H	102.0
8376.500000	43.14	---	73.90	30.76	5000.0	1000.000	214.5	V	211.0
8376.500000	---	29.97	53.90	23.93	5000.0	1000.000	214.5	V	211.0
12059.833333	---	30.96	53.90	22.94	5000.0	1000.000	402.7	V	262.0
12059.833333	44.31	---	73.90	29.59	5000.0	1000.000	402.7	V	262.0
14007.600000	45.09	---	73.90	28.81	5000.0	1000.000	387.4	H	251.0
14007.600000	---	31.72	53.90	22.18	5000.0	1000.000	387.4	H	251.0
16302.900000	---	35.43	53.90	18.47	5000.0	1000.000	395.4	V	193.0
16302.900000	48.82	---	73.90	25.08	5000.0	1000.000	395.4	V	193.0

Note: No considerable EUT emissions above 18 GHz were observed.

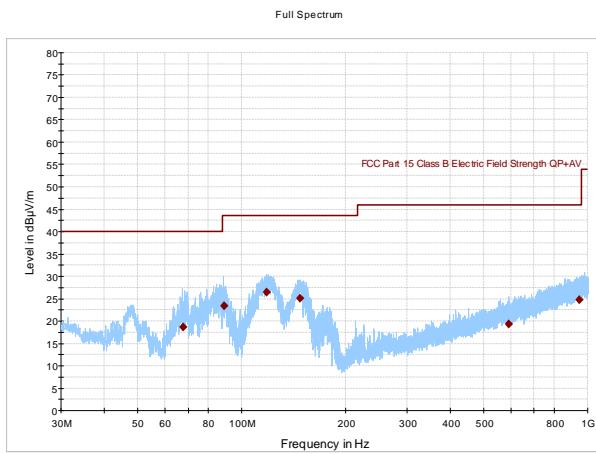


Figure 8.4-6: Radiated spurious emissions, High channel, 30-1000MHz

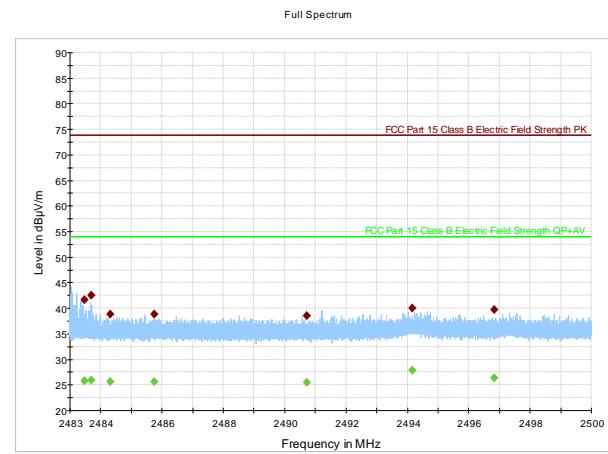


Figure 8.4-7: Radiated spurious emissions, High channel, Upper immediate Restricted Band 2483.5MHz-2500MHz

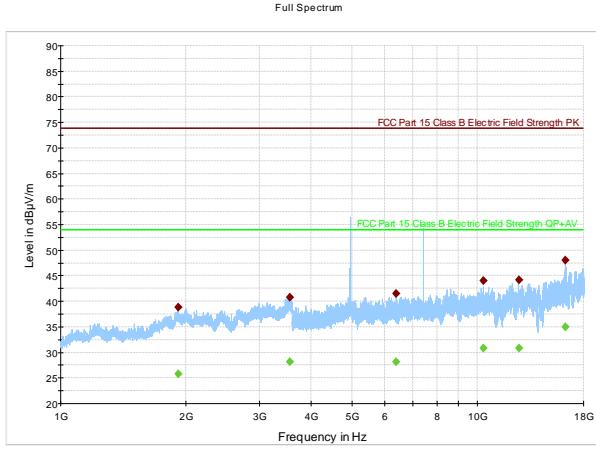


Figure 8.4-8: Radiated spurious emissions, High channel, 1-18GHz

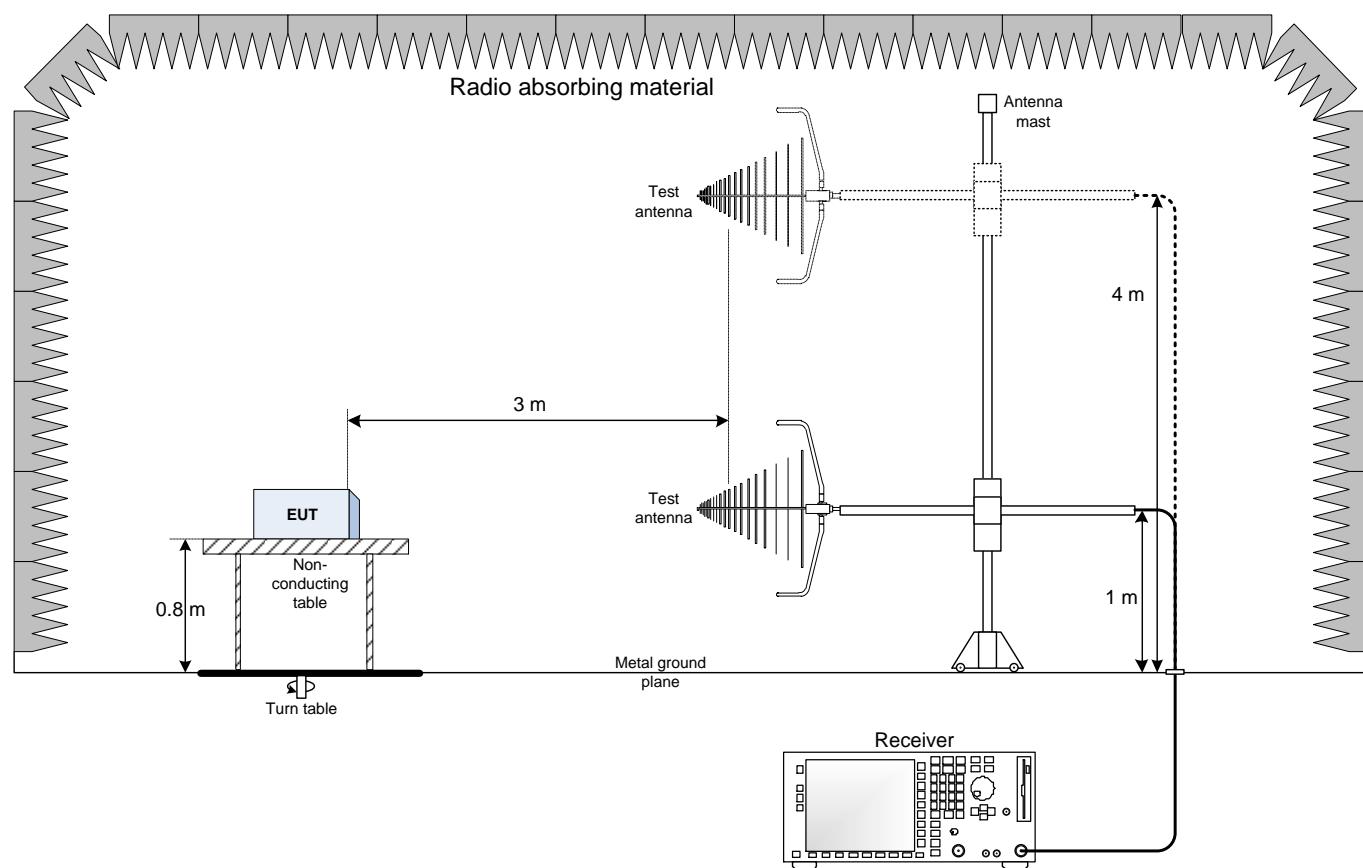
Table 8.4-4: Radiated field strength measurement results for High channel 2480 MHz

Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
67.753500	18.72	40.00	21.28	5000.0	120.000	118.4	V	93.0
88.828000	23.34	43.50	20.16	5000.0	120.000	115.4	V	56.0
117.716000	26.47	43.50	17.03	5000.0	120.000	132.0	V	176.0
147.310500	25.02	43.50	18.48	5000.0	120.000	111.3	V	0.0
591.476500	19.29	46.00	26.71	5000.0	120.000	323.7	V	292.0
947.021500	24.67	46.00	21.33	5000.0	120.000	333.4	H	205.0

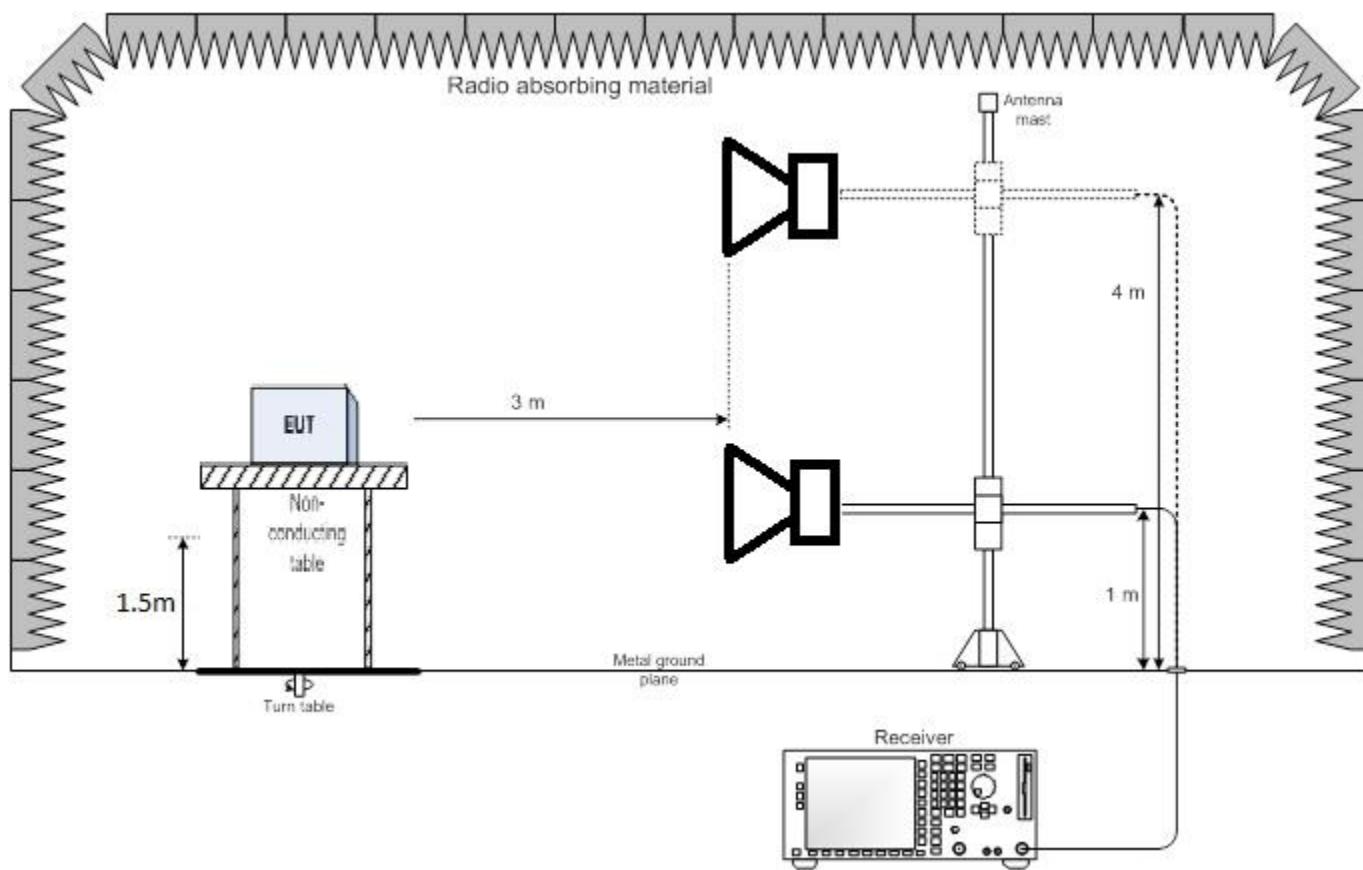
Frequency (MHz)	MaxPeak (dB μ V/m)	Average (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
2483.477500	---	25.84	53.90	28.06	5000.0	1000.000	270.8	H	54.0
2483.477500	41.65	---	73.90	32.25	5000.0	1000.000	270.8	H	54.0
2483.693967	42.50	---	73.90	31.40	5000.0	1000.000	176.1	H	42.0
2483.693967	---	25.95	53.90	27.95	5000.0	1000.000	176.1	H	42.0
2484.300733	---	25.64	53.90	28.26	5000.0	1000.000	264.6	H	184.0
2484.300733	38.76	---	73.90	35.14	5000.0	1000.000	264.6	H	184.0
2485.755367	---	25.61	53.90	28.29	5000.0	1000.000	393.0	V	108.0
2485.755367	38.90	---	73.90	35.00	5000.0	1000.000	393.0	V	108.0
2490.710433	---	25.52	53.90	28.38	5000.0	1000.000	125.5	H	343.0
2490.710433	38.59	---	73.90	35.31	5000.0	1000.000	125.5	H	343.0
2494.152933	---	27.90	53.90	26.00	5000.0	1000.000	311.6	H	25.0
2494.152933	39.96	---	73.90	33.94	5000.0	1000.000	311.6	H	25.0
2496.827600	39.78	---	73.90	34.12	5000.0	1000.000	170.2	H	145.0
2496.827600	---	26.40	53.90	27.50	5000.0	1000.000	170.2	H	145.0

Frequency (MHz)	MaxPeak (dB μ V/m)	Average (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
1917.200000	38.87	---	73.90	35.03	5000.0	1000.000	255.8	H	42.0
1917.200000	---	25.85	53.90	28.05	5000.0	1000.000	255.8	H	42.0
3548.300000	40.81	---	73.90	33.09	5000.0	1000.000	337.0	V	339.0
3548.300000	---	28.12	53.90	25.78	5000.0	1000.000	337.0	V	339.0
6387.300000	41.46	---	73.90	32.44	5000.0	1000.000	345.7	V	64.0
6387.300000	---	28.22	53.90	25.68	5000.0	1000.000	345.7	V	64.0
10336.733333	44.05	---	73.90	29.85	5000.0	1000.000	230.0	V	162.0
10336.733333	---	30.84	53.90	23.06	5000.0	1000.000	230.0	V	162.0
12575.133333	---	30.88	53.90	23.02	5000.0	1000.000	324.3	H	0.0
12575.133333	44.18	---	73.90	29.72	5000.0	1000.000	324.3	H	0.0
16306.433333	---	35.00	53.90	18.90	5000.0	1000.000	340.1	V	132.0
16306.433333	48.04	---	73.90	25.86	5000.0	1000.000	340.1	V	132.0

Note: No considerable EUT emissions above 18 GHz were observed.

Section 9 Block Figures of test set-ups**9.1 Radiated emissions set-up – Below 1GHz**

9.2 Radiated emissions set-up – Above 1GHz



9.3 Conducted emissions set-up

