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RADIO TEST REPORT

Report ID:
REP010015

Project number:
PRJ0033196

Type of assessment:
Final product testing

Applicant:
BLiNQ Networks, Inc.

Description of product:
LTE Base Station

Model/HVIN:
FW6-B53-00-NA

Product marketing name (PMN):
FW-600

FCC identifier:
FCC ID: ROR0013

ISED certification number:
IC: 10794A-FW600B53

Specifications:

- FCC 47 CFR Part 25
- RSS-170, Issue 4, September 29, 2022

Date of issue: June 15, 2023

Tarek Elkholy, EMC/RF Specialist
Tested by

Tarek Elkholy
Signature

Fahar Abdul Sukkoor, EMC/RF Specialist
Reviewed by

Signature

Lab and test locations

Company name	Nemko Canada Inc.			
Facilities	☐ Ottawa site: 303 River Road Ottawa, Ontario Canada K1V 1H2 Tel: +1 613 737 9680 Fax: +1 613 737 9691	☐ Montréal site: 292 Labrosse Avenue Pointe-Claire, Québec Canada H9R 5L8 Tel: +1 514 694 2684 Fax: +1 514 694 3528	☒ Cambridge site: 1-130 Saltsman Drive Cambridge, Ontario Canada N3E 0B2 Tel: +1 519 650 4811	☐ Almonte site: 1500 Peter Robinson Road West Carleton, Ontario Canada K0A 1L0 Tel: +1 613 256-9117
Test site registration	**Organization**	**Recognition numbers and location**		
	FCC/ISED	CA2040 (Ottawa/Almonte); CA2041 (Montreal); CA0101 (Cambridge)		
Website	www.nemko.com			

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 Nemko Canada's ISO/IEC 17025 accreditation.

Copyright notification

Section 1. Table of contents

Section 2. Report summary

2.1 Test specifications

FCC 47 CFR Part 25	Satellite communications
RSS-170, Issue 4, September 29, 2022	Mobile Earth Stations (MESs) and Ancillary Terrestrial Component (ATC) Equipment Operating in the Mobile-Satellite Service (MSS) Bands

2.2 Test methods

273109 D01 v02r02 (2011)	Equipment Authorization Guidance for Part 25 Transceivers
662911 D01 v02r01 (2013)	Emissions Testing of Transmitters with Multiple Outputs in the Same Band
662911 D02 MIMO with Cross Polarized Antenna v01 (2011)	Emissions testing of transmitters with multiple outputs in the same band (MIMO) with Cross Polarized Antenna
RSS-Gen, Issue 5, April 2018	General Requirements for Compliance of Radio Apparatus
ANSI C63.26 v2015	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services

2.3 Exclusions

None

2.4 Statement of compliance

In the configuration tested, the EUT was found compliant.

Testing was performed against all relevant requirements of the test standard except as noted in section 1.4 below. 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.

2.5 Test report revision history

Table 2.5-1: *Test report revision history*

Revision #	Date of issue	Details of changes made to test report
REP010015	June 15, 2023	Original report issued

Section 3. Engineering considerations

3.1 Modifications incorporated in the EUT for compliance

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

3.2 Technical judgment

The EUT has three sectors. As per customer request, only 1 sector is assessed as all sectors are identical as per customer declaration, both chain 0 & chain 1 were tested.

3.3 Model variant declaration

There were no model variants declared by the applicant.

3.4 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 4. Test conditions

4.1 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 ±5 %, for which the equipment was designed.

Section 5. Information provided by the applicant

5.1 Disclaimer

This section contains information provided by the applicant and has been utilized to support the test plan. Inaccurate information provided by the applicant can affect the validity of the results contained within this test report. Nemko accepts no responsibility for the information contained within this section and the impact it may have on the test plan and resulting measurements.

5.2 Applicant / Manufacturer

Applicant name	BLiNQ Networks, Inc.
Applicant address	140 Renfrew Drive Suite 205, Markham, ON, L3R 6B3, Canada.
Manufacturer name	Same as applicant
Manufacturer address	Same as applicant

5.3 EUT information

Product description	LTE Base Station
Model / HVIN	FW6-B53-00-NA
Serial number	F60C-21290030
Power supply requirements	DC: 48 V from external 100–240 V(AC) power adapter
Product description and theory of operation	The FW-600 is an ultra-high capacity, all integrated multicarrier LTE base station system designed as a response to today's broadband connectivity needs in rural and dense suburban markets. Transceiver radio frequency used for TX covers 2483.5MHz to 2495MHz frequency band. Each transmitter section supports QPSK, 16QAM and 64QAM modulations digitally controlled. The 2x2 MIMO configuration of each transmit chain uses uncorrelated data.
Software version	SW Version 3.1.2_1

5.4 Radio technical information

Frequency band	2483.5–2495.0 MHz, ATC base station
Center Frequency	2489 MHz
RF power Max, Conducted	74.1 mW (18.7 dBm)
Measured BW (MHz), 99% OBW	9.0 MHz
Type of modulation	QPSK, 16-QAM, 64-QAM
Emission classification (F1D, G1D, D1D)	W7D
Antenna information	Alpha wireless AW3003-T0-F Sectorial Antenna Antenna Gain: 18 dBi Azimuth BW: 65 deg Typical cable loss: 1 dB
Stated EIRP	36 dBm

5.5 EUT setup details

5.5.1 Radio exercise details

Operating conditions	The EUT was forced into continuous transmission at both chain 0 and chain 1 of sector 1 (antenna ports A1 and A2) at input power level setting of 19 dBm. One channel with a center frequency of 2489 MHz and bandwidth of 10 MHz was assessed.
Transmitter state	Transmitter set into continuous mode.

5.5.2 EUT setup configuration

Table 5.5-1: *EUT interface ports*

Description	Qty.
DC Power port	1
Antenna ports (3 sectors)	6
Optional SFP port	1

Table 5.5-2: *Support equipment*

Description	Brand name	Model/Part number/Serial number
Power adaptor	Mean Well	MN: HLG-600H-48, SN: RB99055813
Laptop	Dell Latitude	MN: Latitude E6420, DPN: VVF52 A01, SN: 28MCCS1

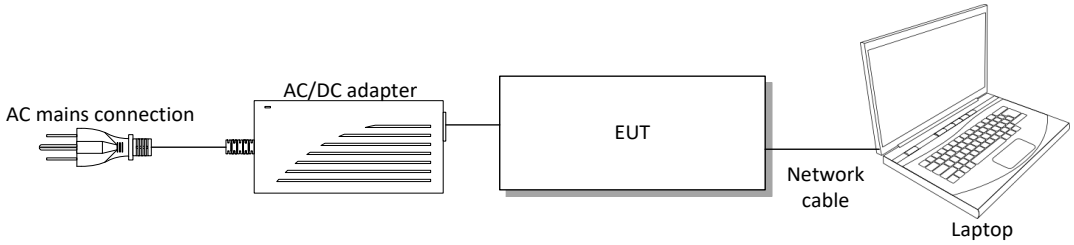


Figure 5.5-1: *Radiated testing block diagram*

Section 6. Summary of test results

6.1 Testing location

Test location (s)	Cambridge

6.2 Testing period

Test start date	April 20, 2023	Test end date	April 25, 2023

6.3 Sample information

Receipt date	April 10, 2023	Nemko sample ID number(s)	PRJ00331960001

6.4 FCC test results

Table 6.4-1: *FCC Part 25 results*

Part	Test description	Verdict
2.1049	Occupied bandwidth	Pass
15.207	AC powerline conducted emission limits	Pass
25.149 (c) (4) (ii)	6 dB bandwidth	Pass
25.149 (c) (4) (iii)	The maximum transmit power and peak EIRP	Pass
25.149 (c) (4) (iv)	The maximum conducted power spectral density	Pass
25.149 (c) (4) (v)	Emissions below 2483.5 MHz	Pass
25.149 (c) (4) (vi)	Emissions above 2495 MHz	Pass
25.202(d)	Frequency tolerance, earth stations	Pass

Notes: None

6.5 ISED test results

Table 6.5-2: *RSS-Gen, Issue 5 test results*

Part	Test description	Verdict
6.7	Occupied bandwidth	Pass
7.3	Receiver radiated emission limits	Not applicable[1]
7.4	Receiver conducted emission limits	Not applicable[1]
8.8	AC power-line conducted emission limits	Pass

Notes: [1] According to sections 5.2 and 5.3 of RSS-Gen, Issue 4 the EUT does not have a stand-alone receiver neither scanner receiver, therefore exempt from receiver requirements.

Table 6.5-3: *RSS-170, Issue 4 test results*

Part	Test description	Verdict
5.2	Frequency bands	Pass
5.3	Frequency stability	Pass
5.4	Transmitter e.i.r.p. for ATC equipment	Pass
5.6	Unwanted emission limits for ATC base station equipment	Pass
5.6.3	Transmitter unwanted emissions for ATC Base Station Equipment operating at 2483.5–2495 MHz band	Pass

Notes: None

Section 7. Test equipment

7.1 Test equipment list

Table 7.1-1: *Equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
3 m EMI test chamber	TDK	SAC-3	FA003012	1 year	January 31, 2024
Flush mount turntable	SUNAR	FM2022	FA003006	—	NCR
Controller	SUNAR	SC110V	FA002976	—	NCR
Antenna mast	SUNAR	TLT2	FA003007	—	NCR
AC Power source	Chroma	0	FA003020	—	NCR
Receiver/spectrum analyzer	Rohde & Schwarz	ESR26	FA002969	1 year	February 10, 2024
Spectrum analyzer	Rohde & Schwarz	FSW43	FA002971	1 year	December 31, 2023
Horn antenna (1–18 GHz)	ETS Lindgren	3117	FA002911	1 year	May 11, 2023
Preamp (1–18 GHz)	ETS Lindgren	124334	FA002956	1 year	March 27, 2024
Bilog antenna (30–2000 MHz)	SUNAR	JB1	FA003010	1 year	June 21, 2023
Horn antenna (18–40 GHz)	EMCO	3116B	FA002948	1 year	March 27, 2024
Preamp 18-40 GHz	None	PA1840	FA003323	1 year	March 27, 2024
50 Ω coax cable	Huber + Suhner	None	FA003047	1 year	January 18, 2024
50 Ω coax cable	Huber + Suhner	None	FA003046	1 year	January 18, 2024
50 Ω coax cable	Huber + Suhner	None	FA003402	1 year	January 18, 2024

Notes: NCR - no calibration required

Table 7.1-2: *Automation software details*

Test description	Manufacturer of Software	Details
Radiated Emissions	Rohde & Schwarz	EMC32, Software for EMC Measurements, Version 10.60.00

Table 7.1-3: *Measurement uncertainty calculations based on equipment list*

Measurement	U_{lab} dB
Radiated disturbance (30 MHz to 1 GHz)	4.27
Radiated disturbance (1 GHz to 6 GHz)	4.74
Radiated disturbance (6 GHz to 18 GHz)	5.04
Radiated spurious emissions ESR26 (18 GHz-26 GHz)	4.47
Radiated spurious emissions FSW43 (18 GHz – 40 GHz)	4.78
RF Output power measurement using Spectrum Analyzer	0.85
RF Output power measurement using Power Meter	0.73
Conducted spurious emissions	1.13
Other antenna port measurements	0.94

Notes: Nemko Canada Inc. has calculated measurement uncertainty and is documented in EMC/MUC/001 “Uncertainty in EMC measurements.” Measurement uncertainty was calculated using the methods described in CISPR 16-4-2 Specification for radio disturbance and immunity measuring apparatus and methods – Part 4-2: Uncertainties, statistics and limit modelling – Measurement instrumentation uncertainty. The expression of Uncertainty in EMC Testing. Measurement uncertainty calculations assume a coverage factor of K=2 with 95% certainty.

Section 8. Testing data

8.1 Occupied Bandwidth

8.1.1 References, definitions and limits

FCC §2.1049
The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission.

RSS-Gen 6.7:
The emission bandwidth (×dB) is defined as the frequency range between two points, one above and one below the carrier frequency, at which the maximum power level of the transmitted emission is attenuated × dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least 3× the resolution bandwidth.
When the occupied bandwidth limit is not stated in the applicable RSS or reference measurement method, the transmitted signal bandwidth shall be reported as the 99% emission bandwidth, as calculated or measured.

8.1.2 Test summary

Verdict	Pass		
Test date	April 24, 2023	Temperature	21 °C
Tested by	Tarek Elkholy	Air pressure	985 mbar
Test location	Cambridge	Relative humidity	42 %

8.1.3 Observations, settings and special notes

Spectrum analyser settings:

Resolution bandwidth:	≥ 1 % of span
Video bandwidth:	≥3 × RBW
Detector mode:	Peak
Trace mode:	Max Hold

8.1.4 Test data

Table 8.1-1: *99 % bandwidth results*

Chain	Modulation	99 % occupied bandwidth, MHz
0	QPSK	9.0
	64-QAM	9.0
1	QPSK	9.0
	64-QAM	9.0

8.1.5 Test data, continued

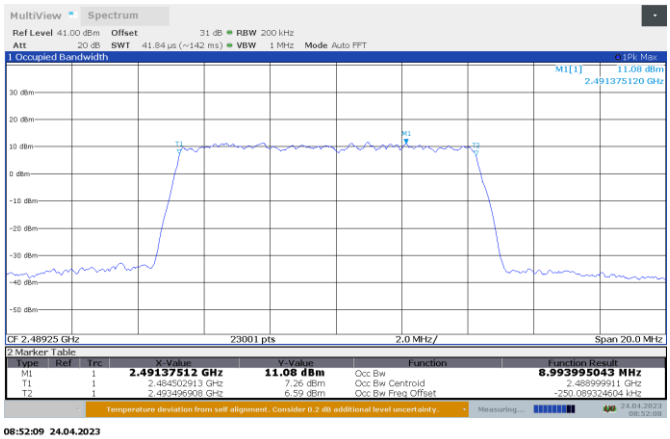


Figure 8.1-1: *Sample plot, 99 % bandwidth on chain 0, QPSK*

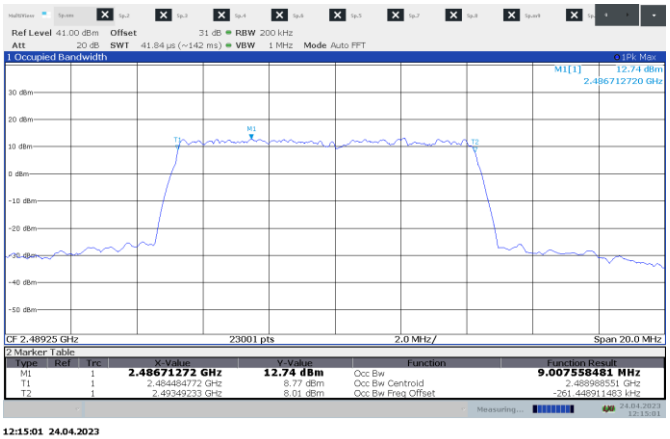


Figure 8.1-2: *Sample plot 99 % bandwidth on chain 1, 64-QAM*

8.2 6 dB bandwidth and 26 dB BW

8.2.1 References, definitions and limits

FCC §25.149 (c) (4) (ii)
The 6 dB bandwidth is at least 500 kHz

FCC §25.149 (c) (4) (vii)
The emission bandwidth of the fundamental emission of a transmitter is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

8.2.2 Test summary

Verdict	Pass		
Test date	April 24, 2023	Temperature	21 °C
Tested by	Tarek Elkholy	Air pressure	985 mbar
Test location	Cambridge	Relative humidity	42 %

8.2.3 Observations, settings and special notes

Measurement performed with reference to ANSI C63.26 section 5.4

Spectrum analyser settings:

Resolution bandwidth:	1 % - 5 % of the anticipated OBW
Video bandwidth:	≥ 3 RBW
Detector mode:	Peak
Trace mode:	Max Hold

8.2.4 Test data

Table 8.2-1: *6 dB bandwidth results*

Chain #	Modulation	6 dB bandwidth, MHz	Minimum limit, MHz	Margin, MHz
0	QPSK	9.07	0.50	8.57
	64-QAM	9.09	0.50	8.59
1	QPSK	9.07	0.50	8.57
	64-QAM	9.09	0.50	8.59

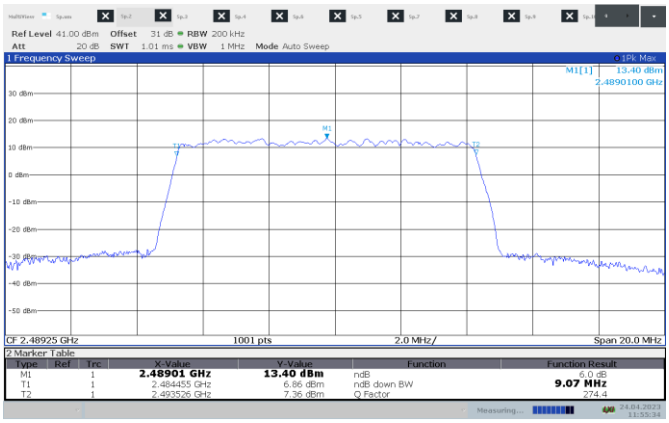


Figure 8.2-1: *Sample plot, 6 dB bandwidth on chain 0, QPSK*

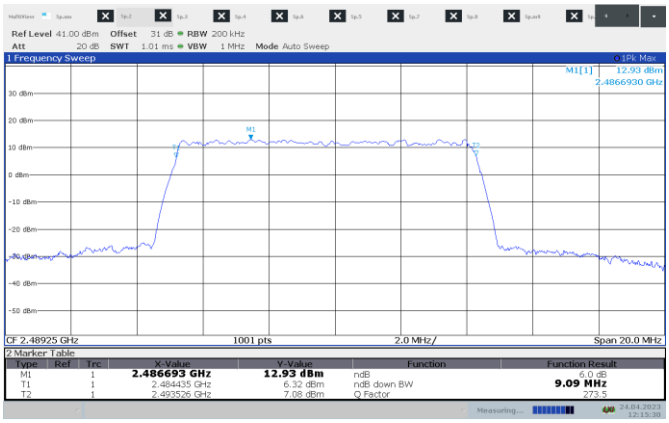


Figure 8.2-2: *Sample plot, 6 dB bandwidth on chain 1, 64-QAMs*

Table 8.2-2: *26 dB bandwidth results*

Chain #	Modulation	26 dB bandwidth, MHz
0	QPSK	9.93
	64-QAM	10.00
1	QPSK	9.95
	64-QAM	10.01

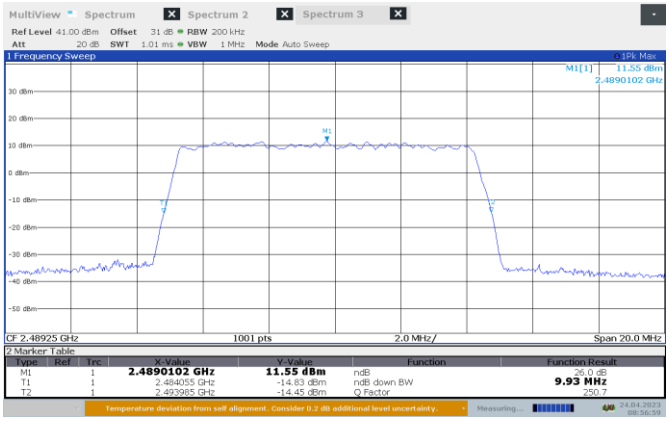


Figure 8.2-3: *Sample plot, 26 dB bandwidth on chain 0, QPSK*

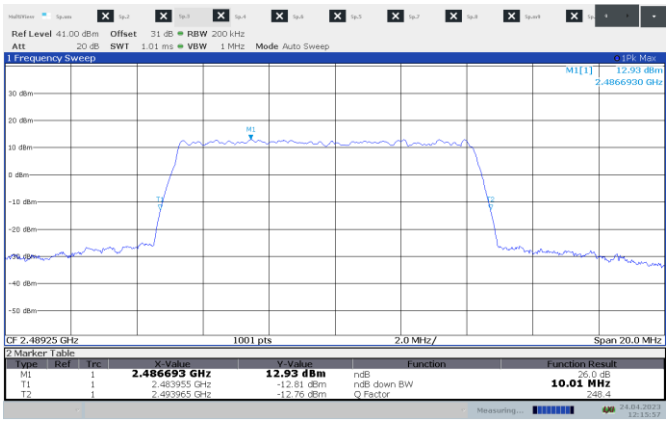


Figure 8.2-4: *Sample plot, 26 dB bandwidth on chain 1, 64-QAM*

8.3 Frequency tolerance, Earth stations

8.3.1 References, definitions and limits

FCC §25.202:

(d) **Frequency tolerance, Earth stations.**
The carrier frequency of each earth station transmitter authorized in these services shall be maintained within 0.001 percent (±10 ppm) of the reference frequency.

FCC 2.1055:

(a) The frequency stability shall be measured with variation of ambient temperature as follows:
(1) From −30°C to +50°C for all equipment except that specified in paragraphs (a)(2) and (3) of this section

(b) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10 °C through the range.

(d) The frequency stability shall be measured with variation of primary supply voltage as follows:
(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

RSS-170, Clause 5.3:

For all other ATC equipment, the carrier frequency shall not drift from the reference frequency in excess of ±2.5 ppm for mobile equipment and ±1.5 ppm for base station equipment.

8.3.2 Test summary

Verdict	Pass		
Test date	April 25, 2023	Temperature	22 °C
Tested by	Tarek Elkholy	Air pressure	985 mbar
Test location	Cambridge	Relative humidity	42 %

8.3.3 Observations, settings and special notes

Frequency stability measurements were performed with reference to ANSI 63.26 section 5.6.3 and section 5.6.5

QPSK modulation was selected to represent the worst case.
The tables show the ISED limits, which are more stringent.

Offset was calculated as per the following formula: $\frac{F_{Measured} - F_{reference}}{F_{reference}} \times 1 \cdot 10^{6}$

Spectrum analyser settings:

Resolution bandwidth:	200 kHz
Video bandwidth:	≥3 × RBW
Detector mode:	Peak
Trace mode:	Max Hold

8.3.4 Test data

Table 8.3-1: *Frequency tolerance measurement result – Chain 0*

Test conditions	Frequency, GHz	Offset, ppm	Limit, ±ppm	Margin, ppm
+50 °C, Nominal	2.48900057	0.2652	1.5	1.23
+40 °C, Nominal	2.48900045	0.2170	1.5	1.28
+30 °C, Nominal	2.48900131	0.5625	1.5	0.94
+20 °C, +15 %	2.48900005	0.0562	1.5	1.44
+20 °C, Nominal	2.48899991		**Reference**	
+20 °C, -15 %	2.48900005	0.0562	1.5	1.44
+10 °C, Nominal	2.48900253	1.0526	1.5	0.45
0 °C, Nominal	2.48900130	0.5665	1.5	0.93
−10 °C, Nominal	2.48900220	0.9120	1.5	0.59
−20 °C, Nominal	2.48899990	0.0080	1.5	1.49
−30 °C, Nominal	2.48899990	0.0000	1.5	1.50

Table 8.3-2: *Frequency tolerance measurement result – Chain 1*

Test conditions	Frequency, GHz	Offset, ppm	Limit, ±ppm	Margin, ppm
+50 °C, Nominal	2.48900350	0.9080	1.5	0.59
+40 °C, Nominal	2.48900154	0.1205	1.5	1.38
+30 °C, Nominal	2.48899985	-0.5585	1.5	0.94
+20 °C, +15 %	2.48900164	0.1607	1.5	1.34
+20 °C, Nominal	2.48900124		**Reference**	
+20 °C, -15 %	2.48900030	-0.3777	1.5	1.12
+10 °C, Nominal	2.48900418	1.1812	1.5	0.32
0 °C, Nominal	2.48900172	0.1928	1.5	1.31
−10 °C, Nominal	2.48899976	-0.5946	1.5	0.91
−20 °C, Nominal	2.48899825	-1.2013	1.5	0.30
−30 °C, Nominal	2.48900049	-0.3013	1.5	1.20

8.4 AC power line conducted emissions limits

8.4.1 References, definitions and limits

FCC §15.207:

(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 µH/50 Ω 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.

ANSI C63.10, Clause 6.2:

If the EUT normally receives power from another device that in turn connects to the public utility ac power lines, measurements shall be made on that device with the EUT in operation to demonstrate that the device continues to comply with the appropriate limits while providing the EUT with power. If the EUT is operated only from internal or dedicated batteries, with no provisions for connection to the public utility ac power lines (600 VAC or less) to operate the EUT (such as an adapter), then ac power-line conducted measurements are not required.
For direct current (dc) powered devices where the ac power adapter is not supplied with the device, an "off-the-shelf" unmodified ac power adapter shall be used. If the device is supposed to be installed in a host (e.g., the device is a module or PC card), then it is tested in a typical compliant host.

RSS-Gen, Clause 8.8:

A radio apparatus that is designed to be connected to the public utility (AC) power line shall ensure that the radio frequency voltage, which 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 table below.
Unless the requirements applicable to a given device state otherwise, for any radio apparatus equipped to operate from the public utility AC power supply either directly or indirectly (such as with a battery charger), the radio frequency voltage of emissions conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in table below. The more stringent limit applies at the frequency range boundaries.

Table 8.4-1: *Conducted emissions limit*

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

Notes: * - The level decreases linearly with the logarithm of the frequency.
** - A linear average detector is required.

8.4.2 Test summary

Verdict	Pass		
Test date	April 25, 2023	Temperature	22 °C
Tested by	Tarek Elkholy	Air pressure	985 mbar
Test location	Cambridge	Relative humidity	42 %

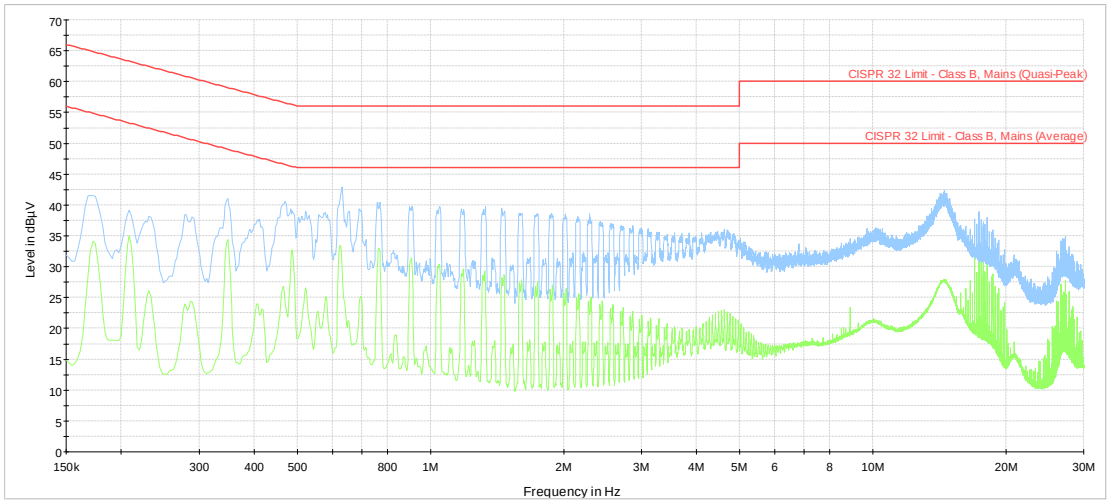
8.4.3 Observations, settings and special notes

Port under test – Coupling device	Adapter AC power input – Artificial Mains Network (AMN)
EUT power input during test	48 V_{DC} (via external 120 V_{AC}, 60 Hz power adapter)
EUT setup configuration	Table top
Measurement details	A preview measurement was generated with the receiver in continuous scan mode. Emissions detected within 10 dB or above the limit were re-measured with the appropriate detector against the correlating limit and recorded as the final measurement.
Additional notes:	– The EUT was set up as tabletop configuration per ANSI C63.10-2013 measurement procedure. – The spectral scan has been corrected with transducer factors (i.e. cable loss, LISN factors, and attenuators) for determination of compliance. Correction factor (dB) = LISN factor IL (dB) + cable loss (dB) + attenuator (dB) – Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

Receiver settings:

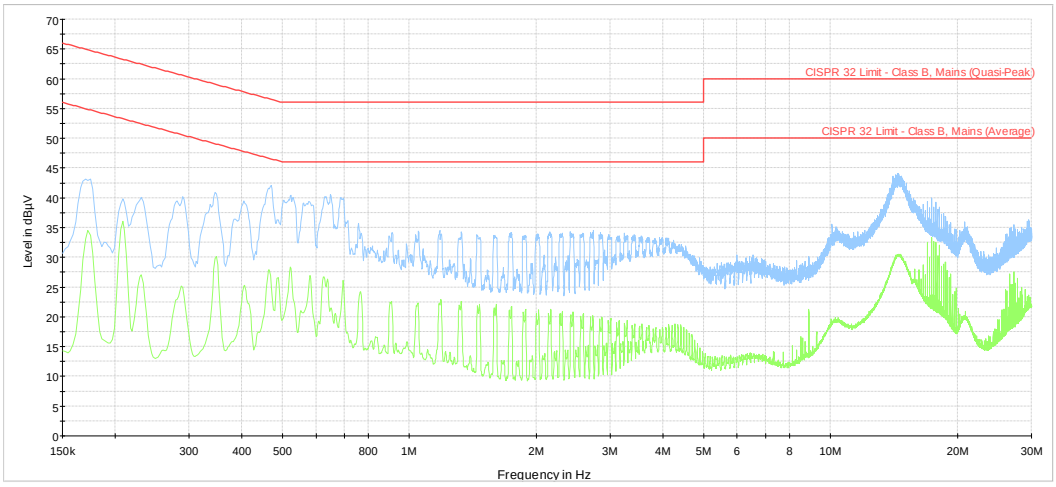
Resolution bandwidth	9 kHz
Video bandwidth	30 kHz
Detector mode	Peak and Average (Preview), Quasi-peak and CAverage (Final)
Trace mode	Max Hold
Measurement time	100 ms (Preview), 160 ms (Final)

8.4.4 Test data



PRJ0033196 CE 0.15-30 MHz, QPSK, Phase, 120 V 60 Hz
Preview Result 2-AVG
Preview Result 1-PK+
CISPR 32 Limit - Class B, Mains (Quasi-Peak)
CISPR 32 Limit - Class B, Mains (Average)

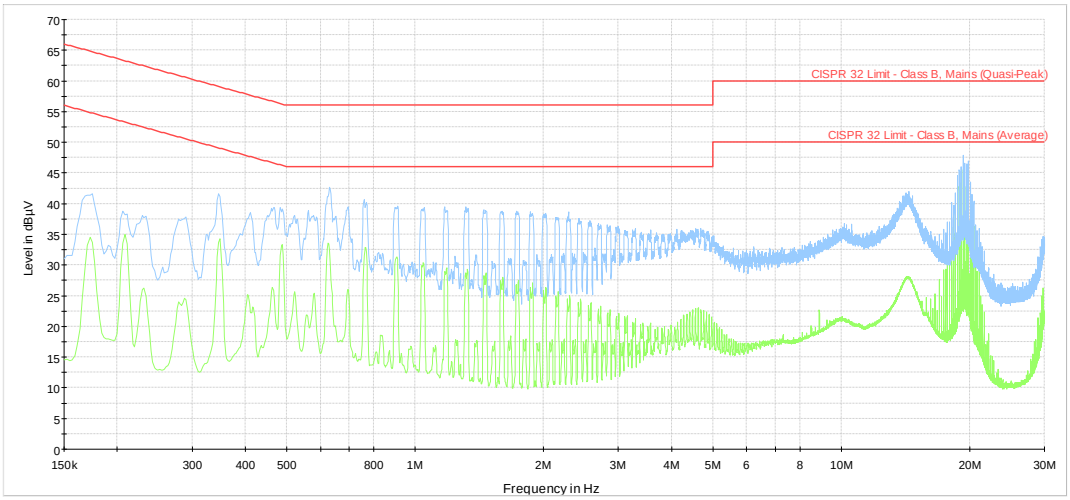
Plot 8.4-1: *Conducted emissions on phase line, QPSK*



PRJ0033196 CE 0.15-30 MHz, QPSK, Neutral, 120 V 60 Hz
Preview Result 2-AVG
Preview Result 1-PK+
CISPR 32 Limit - Class B, Mains (Quasi-Peak)
CISPR 32 Limit - Class B, Mains (Average)

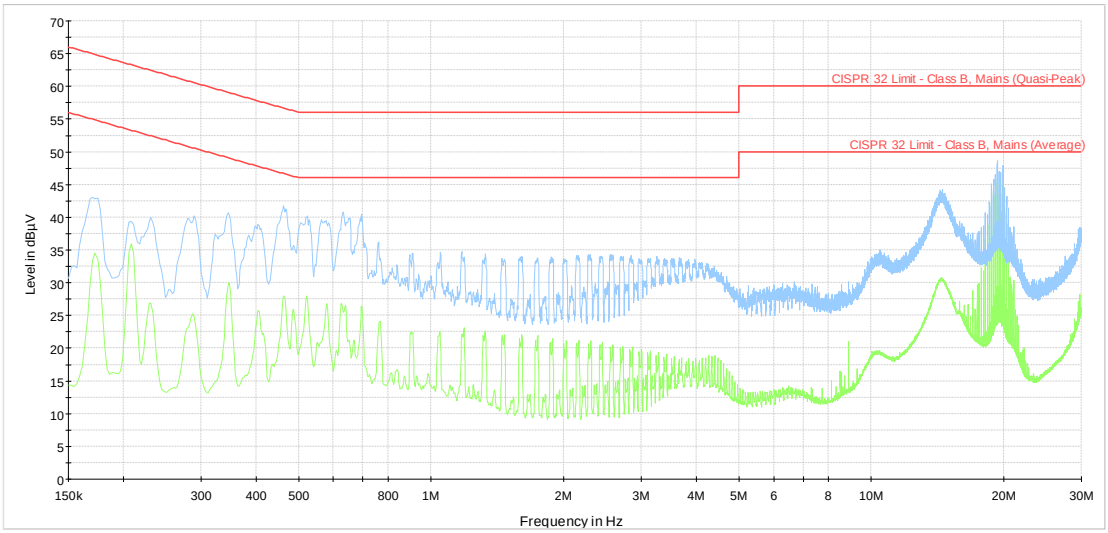
Plot 8.4-2: *Conducted emissions on neutral line, QPSK*

Test data, continued



PRJ0033196 CE 0.15-30 MHz, 64-QAM, Phase, 120 V 60 Hz
Preview Result 2-AVG
Preview Result 1-PK+
CISPR 32 Limit - Class B, Mains (Quasi-Peak)
CISPR 32 Limit - Class B, Mains (Average)

Plot 8.4-3: *Conducted emissions on phase line, 64-QAM*



PRJ0033196 CE 0.15-30 MHz, 64-QAM, Neutral, 120 V 60 Hz
Preview Result 2-AVG
Preview Result 1-PK+
CISPR 32 Limit - Class B, Mains (Quasi-Peak)
CISPR 32 Limit - Class B, Mains (Average)

Plot 8.4-4: *Conducted emissions on neutral line, 64-QAM*

8.5 The maximum transmit power and peak EIRP

8.5.1 References, definitions and limits

FCC §25.149:

(c)(4) Applications for equipment authorization of terrestrial low-power system equipment that will operate in the 2483.5–2495 MHz band shall demonstrate the following:

(iii) The maximum transmit power is no more than 1 W with a peak EIRP of no more than 6 dBW;

RSS-170, Clause 5.4:

The maximum transmitter output power for ATC equipment, measured in terms of average values, shall comply with the limits specified in this section.

The maximum e.i.r.p. of ATC mobile and base station equipment transmitting in the band 2483.5–2495 MHz shall not exceed 6 dBW per channel bandwidth, and the maximum conducted transmitter output power shall not exceed 0 dBW.

8.5.2 Test summary

Verdict	Pass		
Test date	April 24, 2023	Temperature	21 °C
Tested by	Tarek Elkholy	Air pressure	985 mbar
Test location	Cambridge	Relative humidity	42 %

8.5.3 Observations, settings and special notes

The test was performed as per ANSI C63.26 subclause 5.2.4.4.1

Spectrum analyser settings:

Resolution bandwidth	1 % - 5 % of the OBW
Video bandwidth	≥3 × RBW
Frequency span	2 -3 times OBW
Detector mode	RMS
Trace mode	Power averaging

Combined average output power for MIMO 2 × 2 application was calculated as follows: $P_{combined} = 10 \times log_{10}\left(\left(10^{P_{ch0}/10}\right) + \left(10^{P_{ch1}/10}\right)\right)$

As per KDB 662911 D02, Combined power was used to demonstrate compliance against the conducted limits, The antennas are cross-polarized so each chain output is used individually to show compliance against EIRP limits.

8.5.4 Test data

Table 8.5-1: *Output power and EIRP results (antenna port measurement)*

Modulation	Conducted output power chain 0, dBm	Conducted output power chain 1, dBm	Combined output power, dBm	Output power limit, dBm	Output power margin, dB	Peak antenna gain*, dBi	EIRP, Chain 0, dBm	EIRP, Chain 1, dBm	EIRP limit, dBm	EIRP margin, dB
QPSK	18.6	18.7	21.7	30.0	8.3	17.0	35.6	35.7	36.0	0.3
64-QAM	18.7	18.7	21.7	30.0	8.3	17.0	35.7	35.7	36.0	0.3

Note: * Antenna gain is 18 dBi and cable loss is 1 dB, therefore total the system gain is 17 dBi.
EIRP [dBm] = Conducted output power [dBm] + Antenna gain [dBi]
The antennas are cross-polarized antennas, accordingly EIRP is compared individually against the EIRP limit as per the KDB 662911 D02.

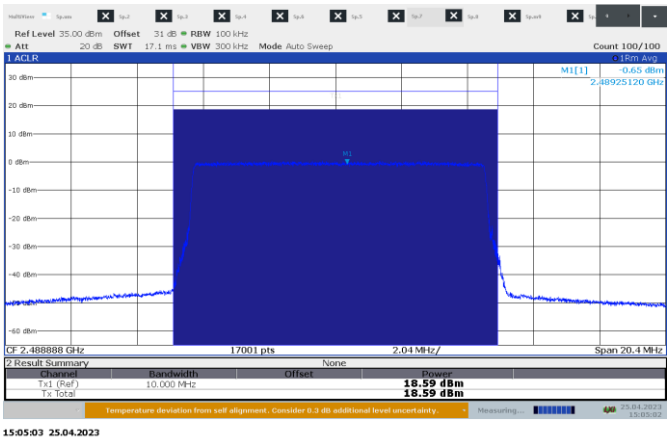


Figure 8.5-1: *Sample plot, Output power on chain 0, QPSK*

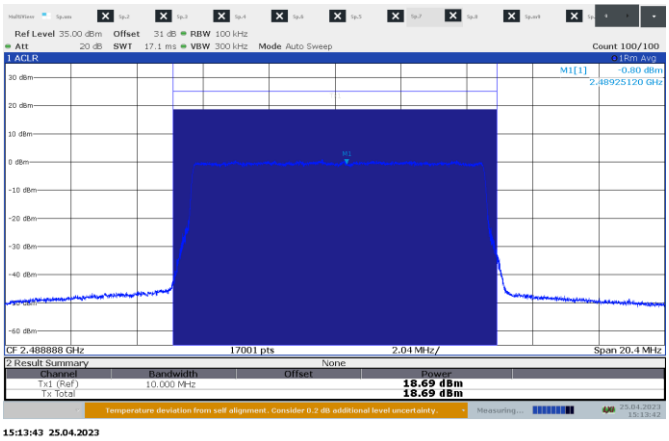


Figure 8.5-2: *Sample plot, Output power on chain 1, 64-QAM*

8.6 The maximum power spectral density

8.6.1 References, definitions and limits

FCC §25.149:

(c)

(4) Applications for equipment authorization of terrestrial low-power system equipment that will operate in the 2483.5–2495 MHz band shall demonstrate the following:

(iv) The maximum power spectral density conducted to the antenna is not greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission:

8.6.2 Test summary

Verdict	Pass		
Test date	April 24, 2023	Temperature	21 °C
Tested by	Tarek Elkholy	Air pressure	985 mbar
Test location	Cambridge	Relative humidity	42 %

8.6.3 Observations, settings and special notes

Power spectral density test was performed as per ANSI C63.10 subclause 5.2.4.5

Spectrum analyser settings:

Resolution bandwidth:	3 kHz
Video bandwidth:	≥3 × RBW
Frequency span:	2 -3 times OBW
Detector mode:	RMS
Trace mode:	Power averaging
Averaging sweeps number:	100

8.6.4 Test data

Table 8.6-1: *PSD results (antenna port measurement)*

Modulation	PSD, chain 0, dBm/3 kHz	PSD, chain 1, dBm/3 kHz	Combined PSD, dBm/3 kHz	PSD limit, dBm/3 kHz	Margin, dB
QPSK	-15.0	-14.5	-11.7	8.00	19.7
64-QAM	-14.1	-13.7	-10.9	8.00	18.9

Note: Combined PSD for MIMO 2 × 2 application was calculated as follows: $PSD_{combined} = 10 \times log_{10}\left(\left(10^{PSD_{ch0}/10}\right) + \left(10^{PSD_{ch1}/10}\right)\right)$

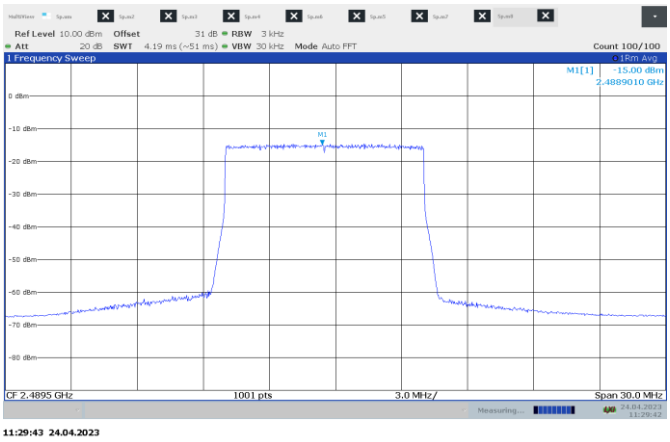


Figure 8.6-1: *Sample plot, PSD on Chain 0, QPSK*

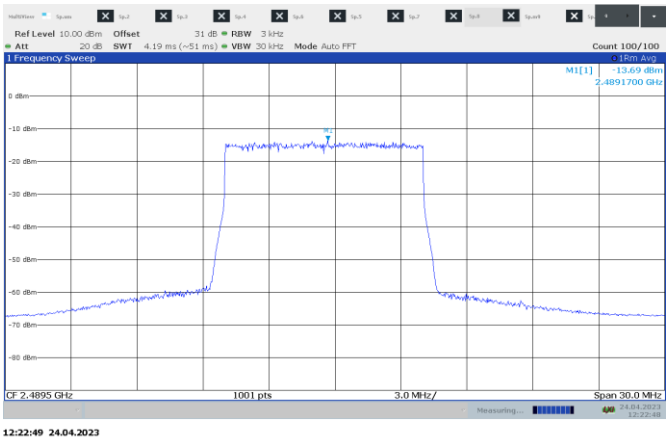


Figure 8.6-2: *Sample plot, PSD on chain 1, 64-QAM*

8.7 Unwanted emission limits for ATC base station equipment

8.7.1 References, definitions and limits

FCC §25.149:

(c)

(4) Applications for equipment authorization of terrestrial low-power system equipment that will operate in the 2483.5–2495 MHz band shall demonstrate the following.

(v) Emissions below 2483.5 MHz are attenuated below the transmitter power (P) measured in watts by a factor of at least 40 + 10 log (P) dB at the channel edge at 2483.5 MHz, 43 + 10 log (P) dB at 5 MHz from the channel edge, and 55 + 10 log (P) dB at X MHz from the channel edge where X is the greater of 6 MHz or the actual emission bandwidth.

(vi) Emissions above 2495 MHz are attenuated below the transmitter power (P) measured in watts by a factor of at least 43 + 10 log (P) dB on all frequencies between the channel edge at 2495 MHz and X MHz from this channel edge and 55 + 10 log (P) dB on all frequencies more than X MHz from this channel edge, where X is the greater of 6 MHz or the actual emission bandwidth;

(vii) Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately above and adjacent to the 2495 MHz a resolution bandwidth of at least 1 percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. If 1 percent of the emission bandwidth of the fundamental emission is less than 1 MHz, the power measured must be integrated over the required measurement bandwidth of 1 MHz. A resolution bandwidth narrower than 1 MHz is permitted to improve measurement accuracy, provided the measured power is integrated over the full required measurement bandwidth (i.e., 1 MHz). The emission bandwidth of the fundamental emission of a transmitter is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power. When an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in this section; and

Note to paragraph (c)(4):
Systems meeting the requirements set forth in this section are deemed to have also met the requirements of § 25.254(a) through (d). No further demonstration is needed for these systems with respect to § 25.254(a)–(d).

RSS-170,

Clause 5.6

This section sets out the unwanted emission limits for equipment covered under this standard. For ATC equipment operating in the bands 2000-2020 MHz and 2483.5-2495 MHz, compliance with the unwanted emission limits shall be determined using a measurement bandwidth of 1 MHz or greater. However, in the 1 MHz band immediately outside and adjacent to the equipment's operating frequency block, a resolution bandwidth of at least 1% of the occupied bandwidth may be used.

Clause 5.6.3:

For ATC base station equipment transmitting in the band 2483.5–2495 MHz, the e.i.r.p. density of unwanted emissions, measured in terms of average values, shall not exceed the limits specified in table 3, for emissions below 2483.5 MHz, and table 4, for emissions above 2495 MHz, where X is the greater of 6 MHz or the occupied bandwidth.

Table 3: *Unwanted emission limits below 2483.5 MHz*

Offset from the block edge (MHz)	Unwanted emission limits (dBm/MHz)
< 5	-10
5–X	-13
> X	-25

Table 4: *Unwanted emission limits above 2495 MHz*

Offset from the block edge (MHz)	Unwanted emission limits (dBm/MHz)
≤ X	-13
> X	-25

8.7.2 Test summary

Verdict	Pass		
Test date	April 21, 2023	Temperature	21 °C
Tested by	Tarek Elkholy	Air pressure	985 mbar
Test location	Cambridge	Relative humidity	42 %

8.7.3 Observations, settings and special notes

The test was performed as per ANSI C63.26 subclause 5.7.3
Cabinet radiated spurious emissions tests were performed, antenna ports were terminated using 50-ohm terminations.

Spectrum analyser settings for conducted spurious emissions measurements 30 MHz – 1 GHz:

Resolution bandwidth	100 kHz
Video bandwidth	300 kHz
Detector mode	Peak
Trace mode	Max Hold

scaled method can be used adding correction factor of [10 Log (Reference RBW / Used RBW)]

Spectrum analyser settings for conducted spurious emissions measurements 1 GHz – 25 GHz:

Resolution bandwidth	1 MHz
Video bandwidth	3 MHz
Detector mode	RMS
Trace mode	Max Hold

Spectrum analyser settings for conducted spurious emissions measurements immediately outside and adjacent to the equipment's operating frequency block:

Resolution bandwidth	100 kHz
Video bandwidth	300 kHz
Detector mode	RMS
Trace mode	Max Hold

8.7.4 Test data

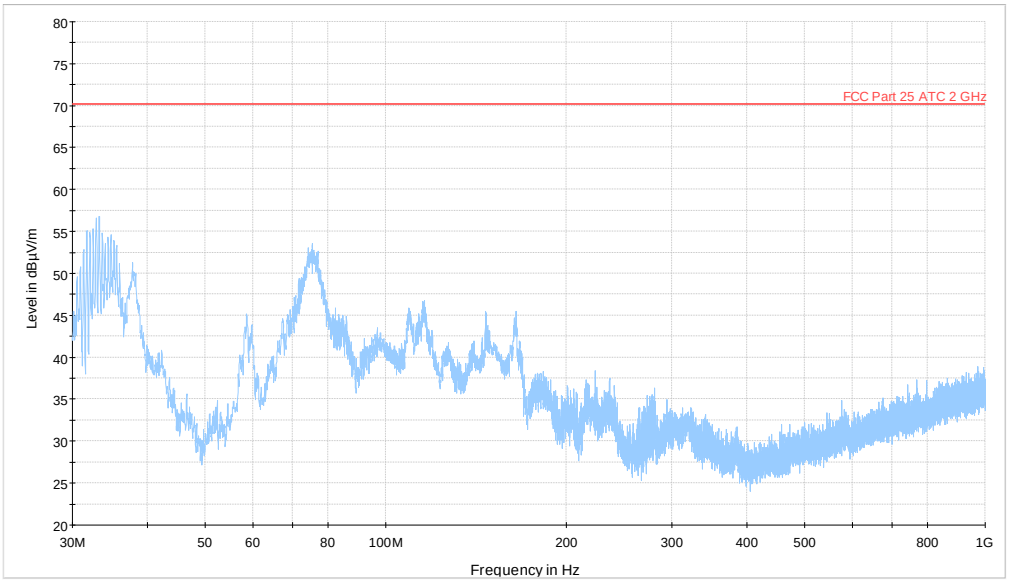


Figure 8.7-1: *Radiated cabinet spurious emissions below 1 GHz, QPSK*

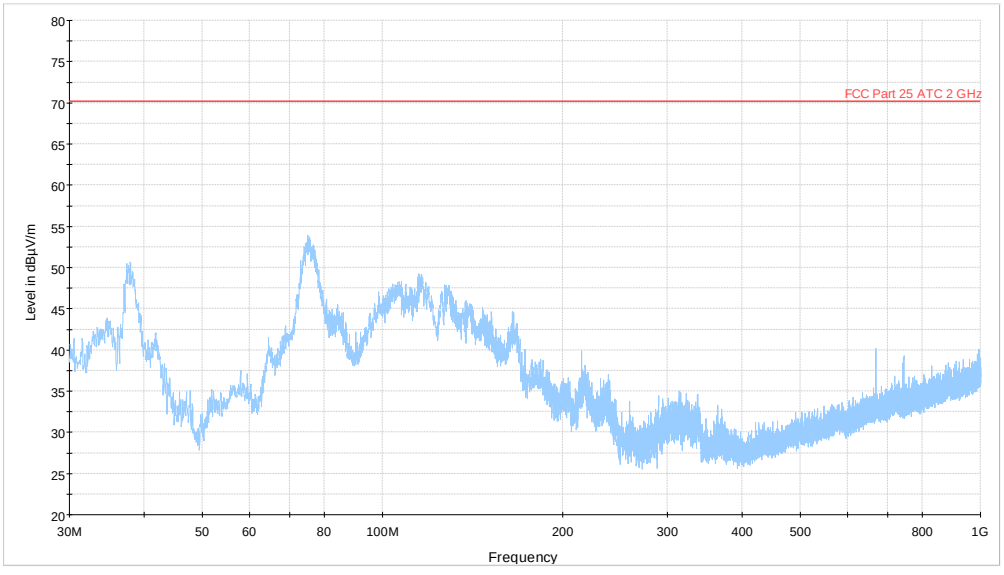
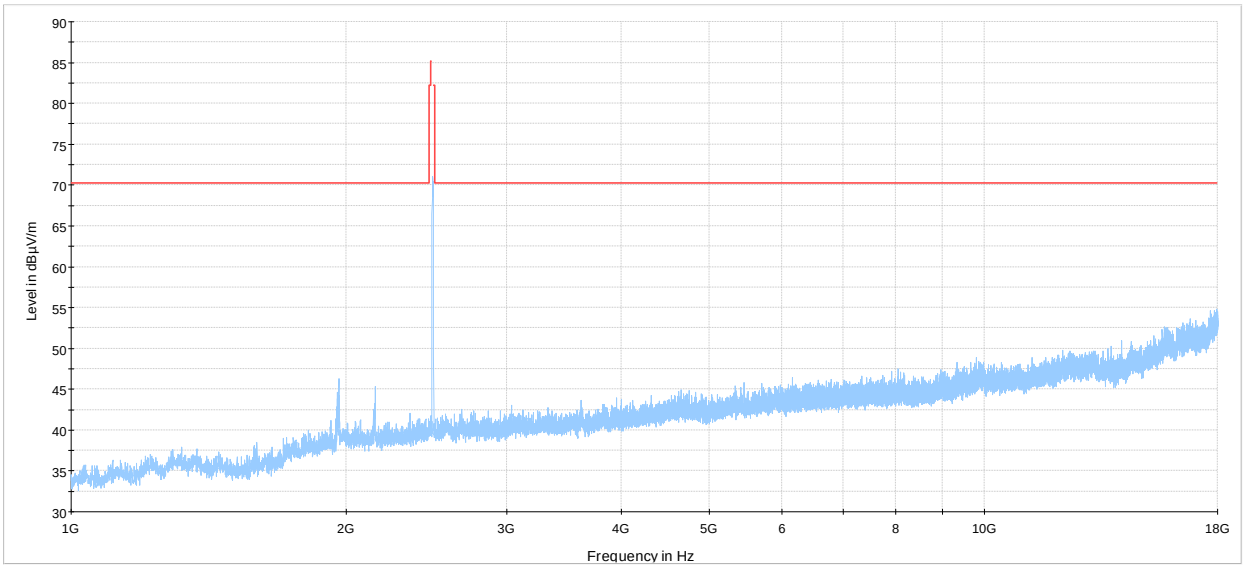


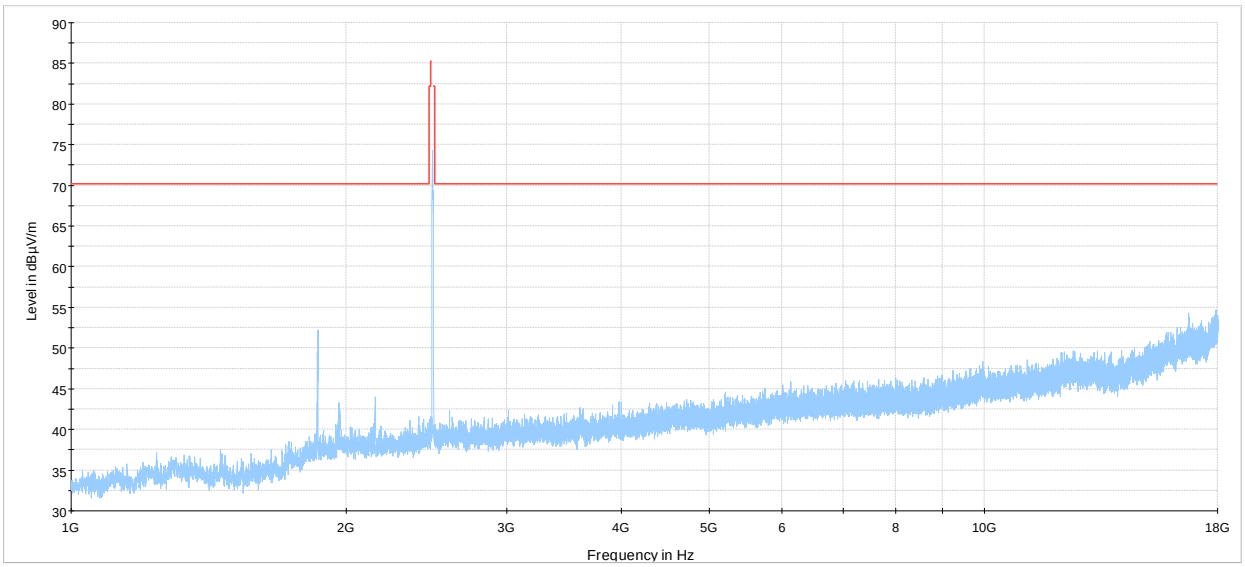
Figure 8.7-2: *Radiated cabinet spurious emissions below 1 GHz, 64-QAM*

Test data, continued



PRJ0033196 RE 1-18 GHz, QPSK
Preview Result 1-PK+
FCC Part 25 ATC 2 GHz

Figure 8.7-3: *Radiated cabinet spurious emissions 1-18 GHz, QPSK*



PRJ0033196 RE 1-18 GHz, 64-QAM
Preview Result 1-PK+
FCC Part 25 ATC 2 GHz

Figure 8.7-4: *Radiated cabinet spurious emissions 1-18 GHz, 64-QAM*

Test data, continued

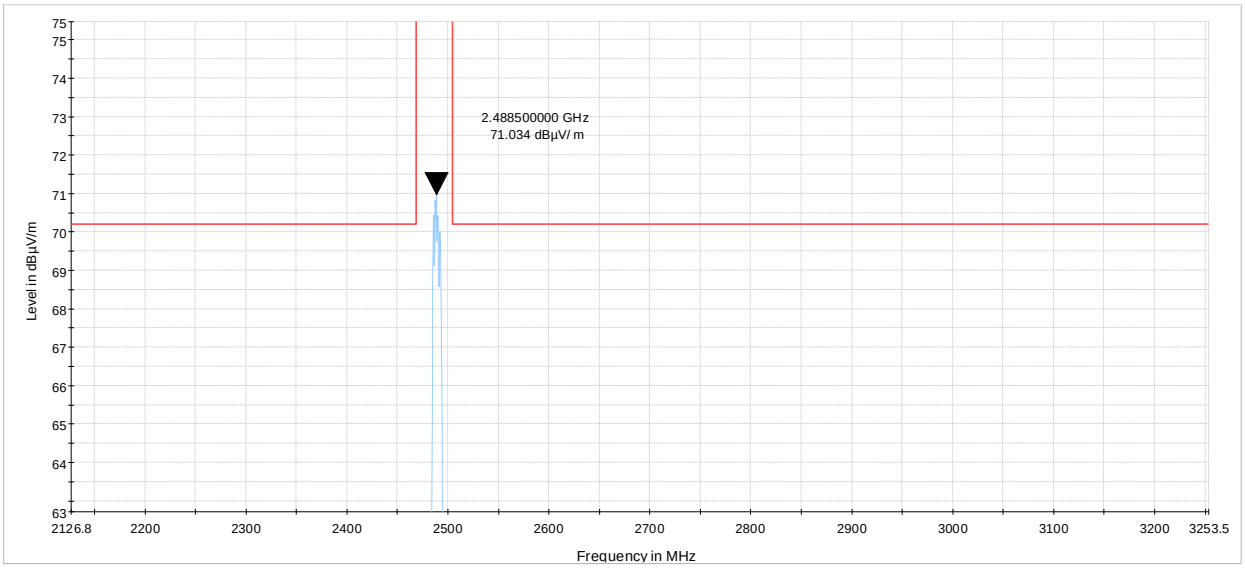


Figure 8.7-5: *Radiated cabinet spurious emissions 1-18 GHz, QPSK, zoom in*

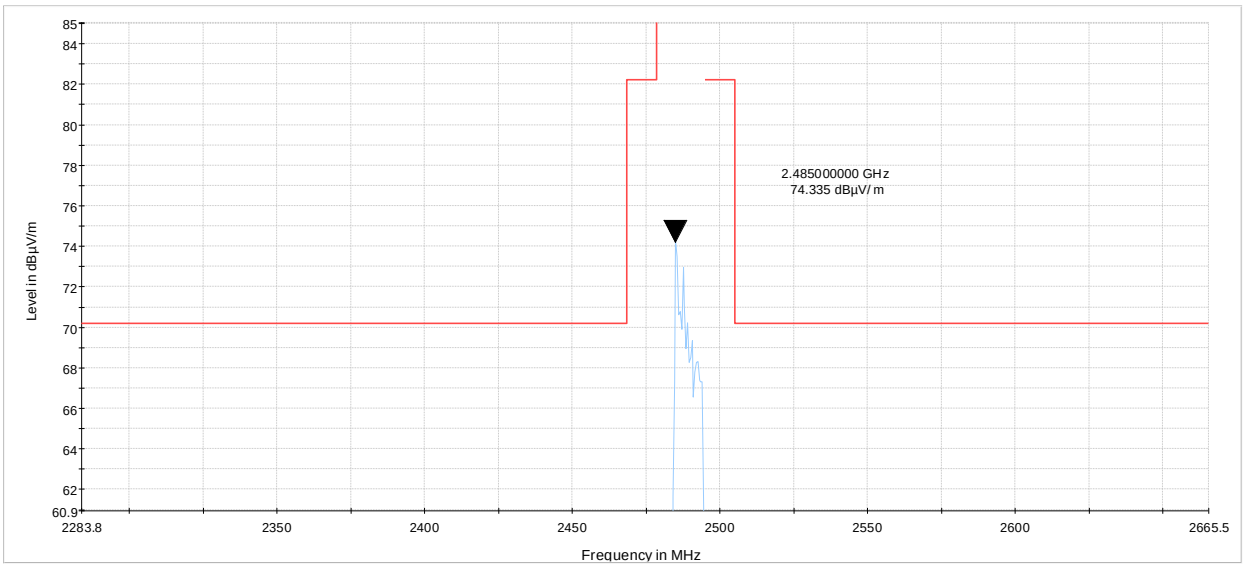


Figure 8.7-6: *Radiated cabinet spurious emissions 1-18 GHz, 64-QAM, zoom in*

Test data, continued

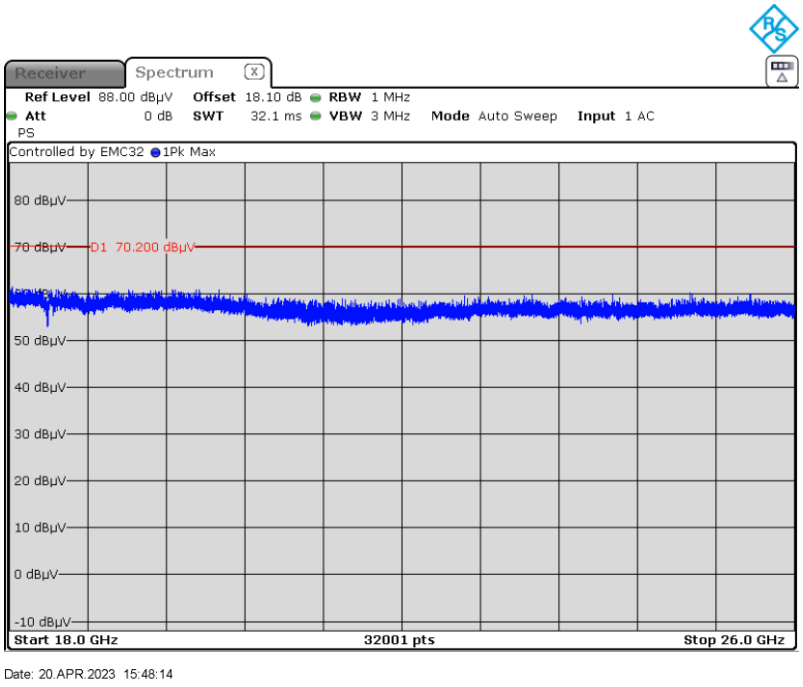


Figure 8.7-7: *Radiated cabinet spurious emissions 18-25 GHz, QPSK*

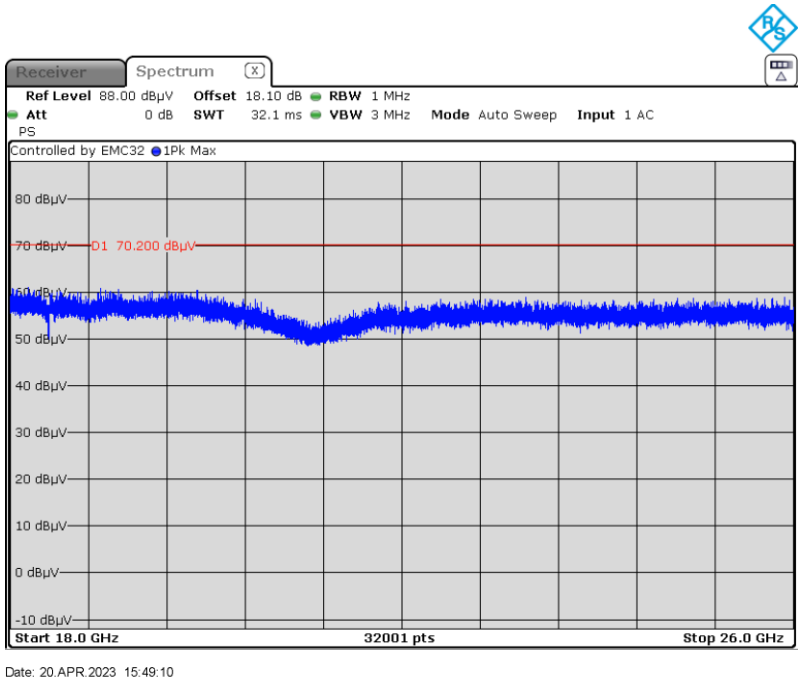
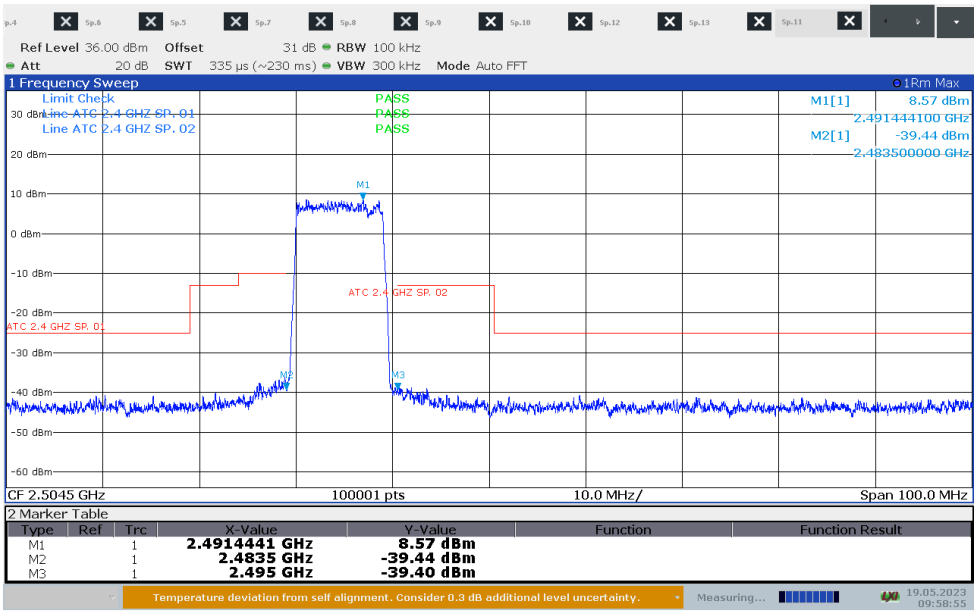


Figure 8.7-8: *Radiated cabinet spurious emissions 18-25 GHz, 64-QAM*

Test data, continued

09:45:14 19.05.2023

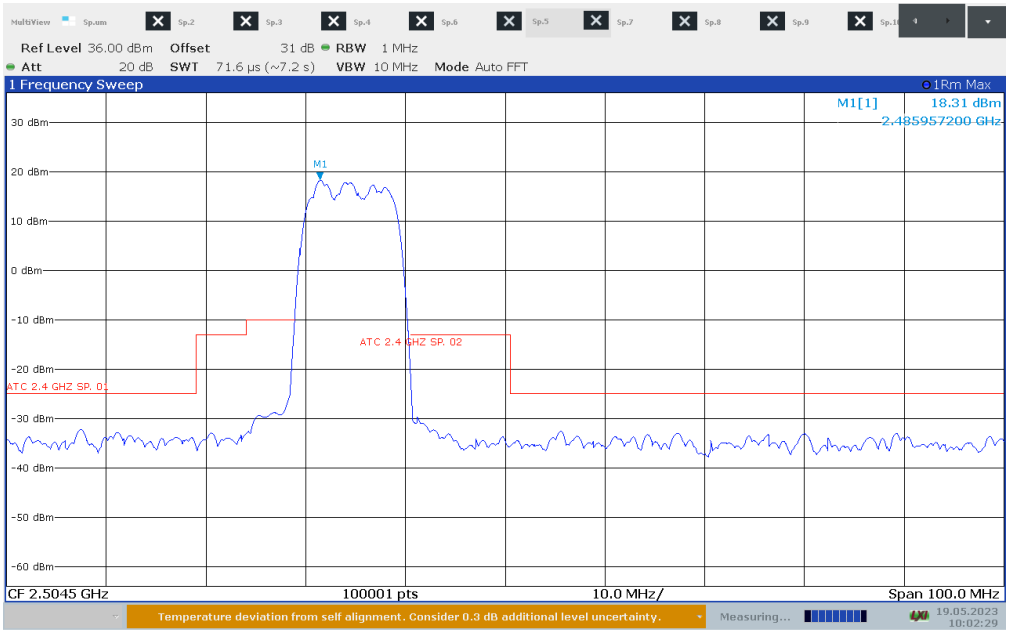
Figure 8.7-9: *Conducted Unwanted emission limit, chain 0, QPSK*



09:58:55 19.05.2023

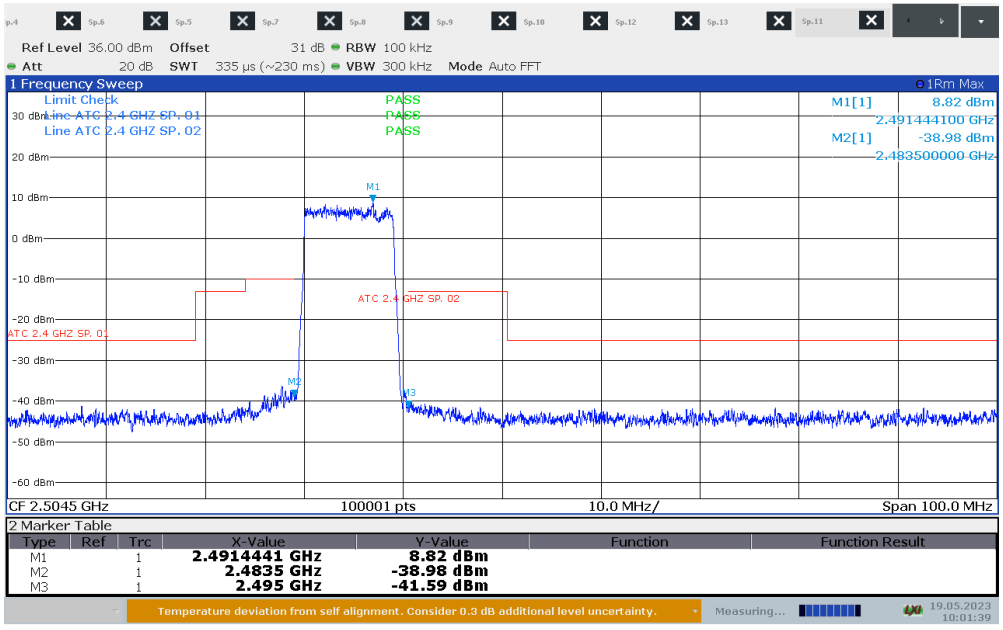
Figure 8.7-10: *Unwanted emission limit, chain 0, QPSK, outside operating frequency block*

Test data, continued



10:02:30 19.05.2023

Figure 8.7-11: *Unwanted emission limit, chain 1, QPSK*



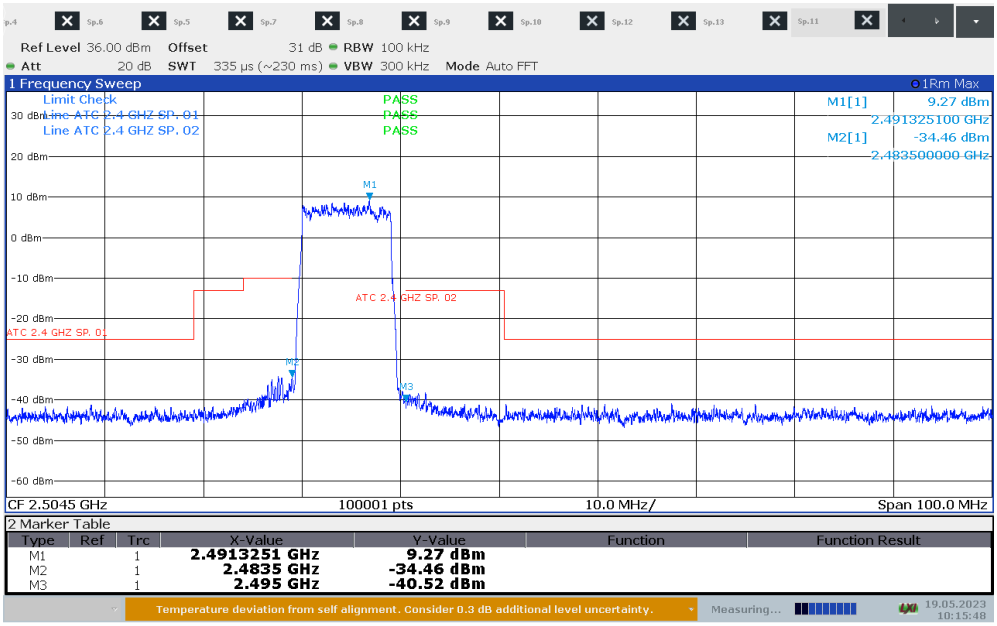
10:01:40 19.05.2023

Figure 8.7-12: *Unwanted emission limit, chain 1, QPSK, outside operating frequency block*

Test data, continued

09:45:14 19.05.2023

Figure 8.7-13: *Conducted Unwanted emission limit, chain 0, 64-QAM*



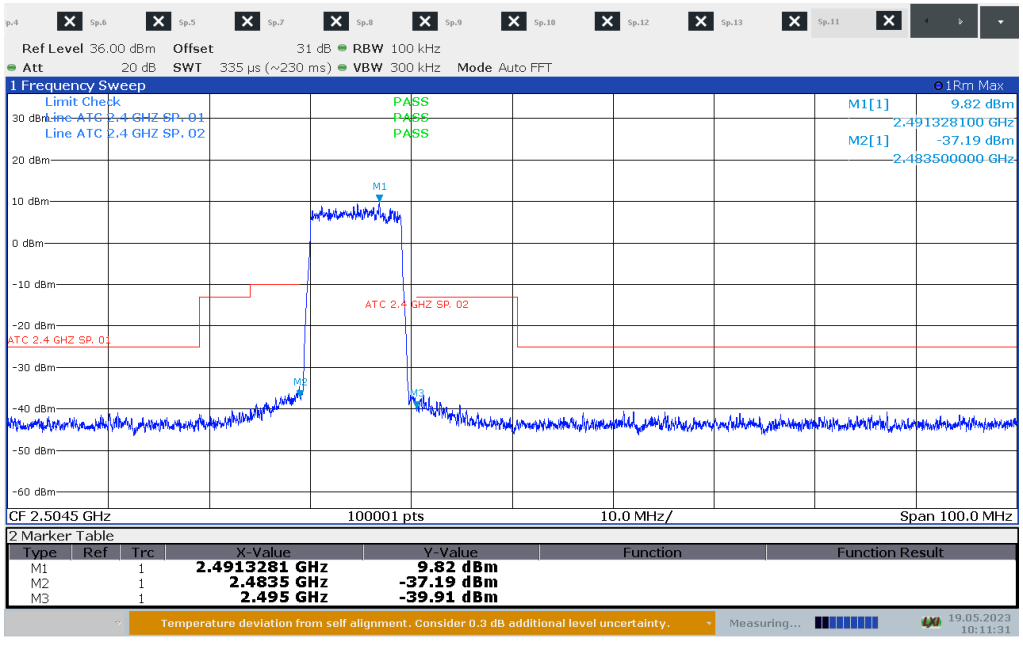
10:15:48 19.05.2023

Figure 8.7-14: *Unwanted emission limit, chain 0, 64-QAM, outside operating frequency block*

Test data, continued

10:12:45 19.05.2023

Figure 8.7-15: *Unwanted emission limit, chain 1, 64-QAM*

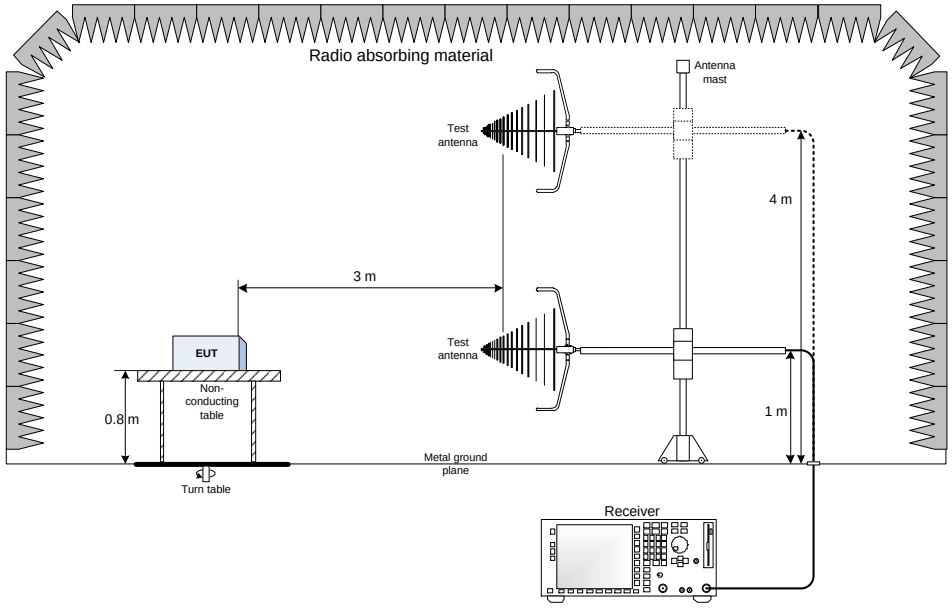


10:11:32 19.05.2023

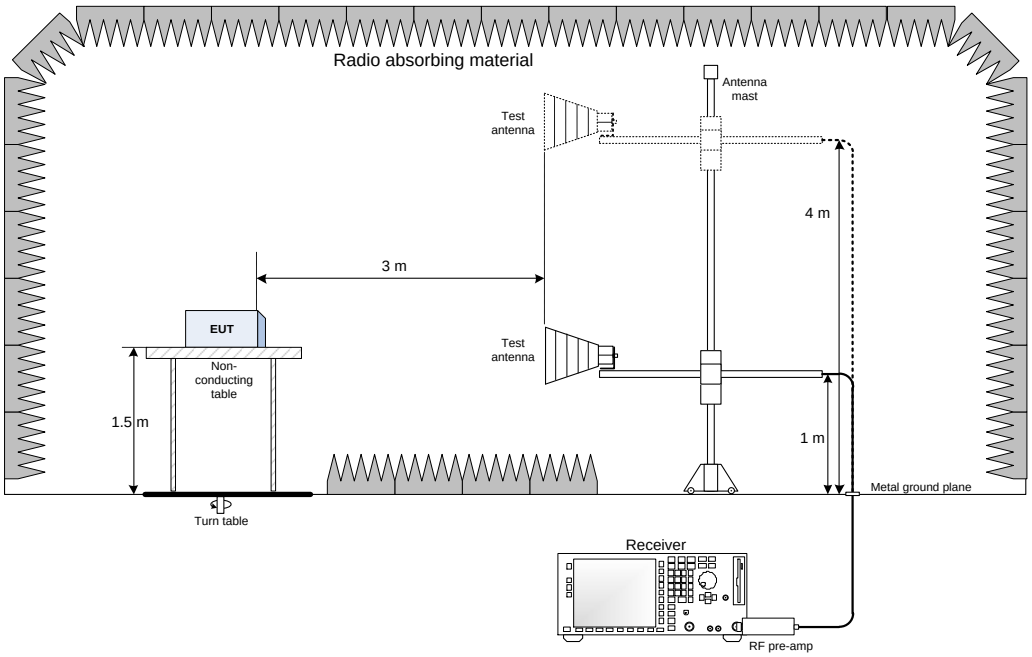
Figure 8.7-16: *Unwanted emission limit, chain 1, 64-QAM, outside operating frequency block*

Section 9. Test setup diagrams

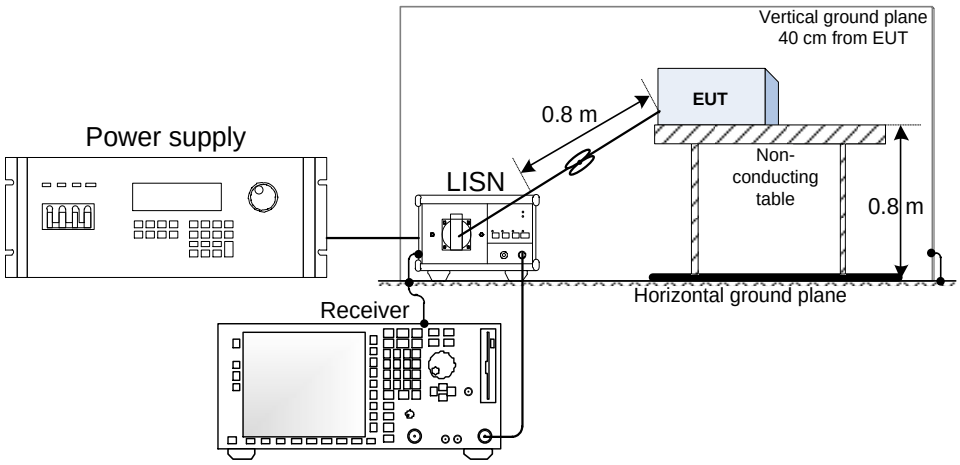
9.1 Radiated emissions set-up for frequencies below 1 GHz



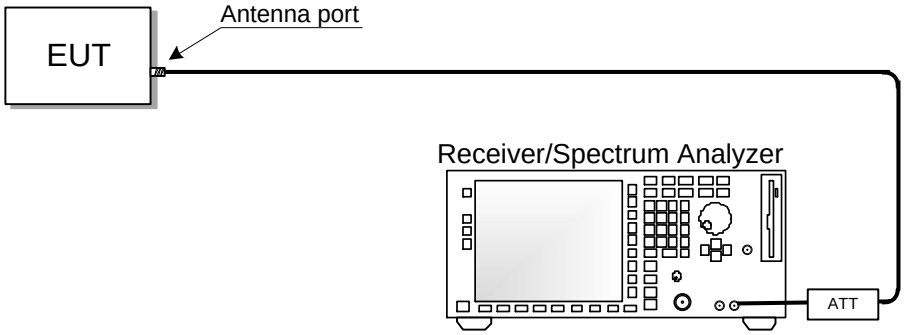
9.2 Radiated emissions set-up for frequencies above 1 GHz



9.3 AC mains conducted emissions set-up



9.4 Antenna port set-up



End of the test report