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RADIO TEST REPORT – 446890-3TRFWL

Type of assessment:

Final product testing

Applicant:

Blinq Wireless, Inc.

Product:

Base station

Model:

FW6-B48-46-NA

FCC ID:

ROR0011

Specification:

FCC 47 CFR Part 15 Subpart E, §15.407

Date of issue: January 21, 2022

Fahar Abdul Sukkoor, Wireless/EMC Specialist
Tested by


Signature

Andrey Adelberg, Senior EMC/RF Specialist
Reviewed by


Signature

Lab locations

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Test site identifier	**Organization**	**Ottawa/Almonte**	**Montreal**	**Cambridge**
	FCC:	CA2040	CA2041	CA0101
	ISED:	2040A-4	2040G-5	24676
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

Table of Contents

Section 1 Report summary

1.1 Test specifications

FCC 47 CFR Part 15, Subpart E, Clause 15.407	Unlicensed National Information Infrastructure Devises operating in the 5.15–5.35 GHz, 5.47–5.725 GHz, 5.725–5.85 GHz, and 5.925–7.125 GHz bands.

1.2 Test methods

789033 D02 General U-NII Test Procedures New Rules v02r01 (December 14, 2017)	Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E
662911 D01 Multiple Transmitter Output v02r01 (October 31, 2013)	Emissions Testing of Transmitters with Multiple Outputs in the Same Band
662911 D02 MIMO with Cross Polarized Antenna v01 (October 25, 2011)	Emissions testing of transmitters with multiple outputs in the same band (MIMO) with Cross Polarized Antenna
ANSI C63.10 v2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

1.3 Exclusions

None

1.4 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 1.3 above. 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 Test report revision history

Table 1.5-1: *Test report revision history*

Revision #	Date of issue	Details of changes made to test report
TRF	January 21, 2022	Original report issued

Section 2 Engineering considerations

2.1 Modifications incorporated in the EUT for compliance

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

2.2 Technical judgment

This EUT is designed and produced with six carriers numbered 0 to 5 where carriers 3 to 5 are exact replica of carriers 0 to 2 respectively in electrical ,mechanical design and manufacturing process. Due to this similarity all conducted measurements were performed only on carriers 0 to 2

Output power and PSD measurements for antenna (Brand: MTI, Model:MT-404083/ND, Peak Gain = 19 dBi) in section 8.7, are extracted from Nemko test report NEX 425119-3TRFWL

2.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 3 Test conditions

3.1 Atmospheric conditions

Temperature	15 °C – 35 °C
Relative humidity	20 % – 75 %
Air pressure	86 kPa (860 mbar) – 106 kPa (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.

3.2 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 ±5 %, for which the equipment was designed.

Section 4 Measurement uncertainty

4.1 Uncertainty of measurement

UKAS Lab 34 and TIA-603-B have been used as guidance for measurement uncertainty reasonable estimations with regards to previous experience and validation of data. Nemko Canada, Inc. follows these test methods in order to satisfy ISO/IEC 17025 requirements for estimation of uncertainty of measurement for wireless products.

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

Table 4.1-1: *Measurement uncertainty calculations*

Test name	Measurement uncertainty, ±dB
All antenna port measurements	0.55
Occupied bandwidth	4.45
Conducted spurious emissions	1.13
Radiated spurious emissions	3.78
AC power line conducted emissions	3.55

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/Manufacture

Applicant name	Blinq Wireless, Inc.
Applicant address	140 Renfrew Dr Suite 205 Markham ON L3R6B3 Canada
Manufacture name	Same as applicant
Manufacture address	Same as applicant

5.3 EUT information

Product	Base station
Model	FW6-B48-46-NA
Serial number	F60D-21250001
Power supply requirements	DC: 48 V from external 100–240 V(AC) power adapter
Software details	BLiNQ_FW600_3.1.1_48507
Product description and theory of operation	The BLiNQ FW-600 system is a tri-sector and tri-carrier Long-Term Evolution (LTE) Evolved Node B (eNB) with the capability to operate in the following bands: 42, 43, 46 and 48 (Citizens Broadband Radio Service (CBRS)). With a distinctive feature set and integration level, the FW-600 brings an ideal solution to an “install anywhere” micro-base transceiver station (micro-BTS) that fully serves private networks, fixed wireless access and mobility use cases. This specific model incorporates dual FW600 system functionality with total of six sectors.

5.4 Radio technical information

Device type	☒	Outdoor access point
	☐	Indoor access point
	☐	Fixed point-to-point access point
	☐	Client device
	☐	Device installed in vehicles
Frequency band	5725–5850 MHz (U-NII-3)	
Type of modulation	OFDM (QPSK to 64-QAM)	
Antenna information	Option 1: 2 × 2 MIMO - Antenna gain: 22.1 dBi Brand name: CCI Products, Model: MBM12F-HJ5B Option 2: 2 × 2 MIMO - Antenna gain: 19.0 dBi Brand name: MTI, Model:MT-404083/ND Antennas are uncorrelated and cross polarized.	

Channel Bandwidth	10 MHz	20 MHz
Frequency Min (MHz)	5730	5735
Frequency Max (MHz)	5845	5840
RF power Max (W), Conducted	0.0780 (18.92 dBm)	0.0785 (18.95 dBm)
Measured BW (MHz), 99% OBW	8.95	17.88
Emission classification	8M95W7D	17M9W7D
Transmitter spurious (conducted), dBµV/m	97.37 @ 5725 MHz	89.00 @ 5725 MHz

5.5 EUT setup details

5.5.1 Radio exercise details

Operating conditions	The EUT was controlled from laptop via ethernet using ssh application. Power settings areas below:

Power settings for antenna - Brand: CCI Products, Model: MBM12F-HJ5B, Antenna gain: 22.1 dBi

Carrier Configuration		1CC		2CC	
BW (MHz)		10	20	10	20
Aggregated BW (MHz)		10	20	20	40
Carrier 0	Power set per BW	10dBm	12dBm	10dBm	12dBm
Carrier 2	Power set per BW	10dBm	12dBm	10dBm	12dBm
Carrier 3	Power set per BW	10dBm	12dBm	10dBm	12dBm
Carrier 5	Power set per BW	10dBm	12dBm	10dBm	12dBm

Note:

1. 4dB power backoff needed for any carrier center frequency set above 5130MHz when operating 20MHz BW.
2. 2dB power backoff needed for any carrier center frequency set above 5130MHz when operating 10MHz BW.
3. For 2CC operations power levels specified are per carrier. Power settings referred to each MIMO channel.

Power settings for antenna - Brand: MTI Model:MT-404083/ND Antenna gain: 19.0 dBi

Carrier Configuration		1CC		2CC	
BW (MHz)		10	20	10	20
Aggregated BW (MHz)		10	20	20	40
Carrier 0	Power set per BW	16dBm	16dBm	16dBm	16dBm
Carrier 2	Power set per BW	16dBm	16dBm	16dBm	16dBm
Carrier 3	Power set per BW	16dBm	16dBm	16dBm	16dBm
Carrier 5	Power set per BW	16dBm	16dBm	16dBm	16dBm

Notes:

1. 2 dB power backoff needed for any carrier center frequency set above 5830MHz.
2. For 2CC operations power levels specified are per carrier. Power settings referred to each MIMO channel.

Transmitter state	Transmitter set into continuous mode.

Radio exercise details, continued

Table 5.5-1: *EUT interface ports*

Description	Qty.
DC Power port	1
Ethernet port	1

Table 5.5-2: *Support equipment*

Description	Brand name	Model/Part number	Serial number
Power adaptor	Mean Well	HLG-600H-48	RB99055874
Laptop	Dell Latitude	E6440	FA002914

Table 5.5-3: *Inter-connection cables*

Cable description	From	To	Length (m)
DC Power port	EUT	Power adaptor	>3
AC power port	Power adaptor	AC mains	>3
Ethernet cable	EUT	laptop	>3

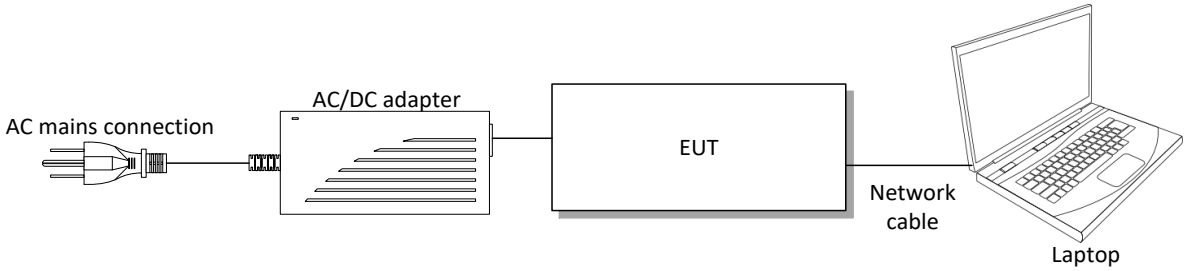


Figure 5.5-1: *Setup block diagram*

Section 6 Summary of test results

6.1 Testing location

Test location (s)	Cambridge

6.2 Testing period

Test start date	October 25, 2021	Test end date	October 29, 2021

6.3 Sample information

Receipt date	September 2, 2021	Nemko sample ID number(s)	1

6.4 FCC Part 15 Subpart A and C, general requirements test results

Table 6.4-1: *FCC general requirements results*

Part	Test description	Verdict
§15.207(a)	Conducted limits	Pass
§15.31I	Variation of power source	Pass
§15.31(m)	Number of tested frequencies	Pass
§15.203	Antenna requirement	Pass

Notes: None

6.5 FCC Part §15.407 test results

Table 6.5-1: *FCC §15.407 requirements results*

Part	Test description	Verdict
§15.403	Emission bandwidth	Pass
§15.407(a)(3)	Power and density limits within 5.725–5.85 GHz band	Pass
§15.407(b)(4)	Undesirable emission limits for 5.725–5.85 GHz band	Pass
§15.407(b)(8)	AC power line conducted limits	Pass
§15.407(e)	Minimum 6 dB bandwidth of U-NII devices within the 5.725–5.85 GHz band	Pass
§15.407(g)	Frequency stability	Pass
§15.407(h)(1)[1]	Transmit power control (TPC)	Not applicable
§15.407(h)(2)[1]	Dynamic Frequency Selection (DFS)	Not applicable
§15.407(k)	Automated frequency coordination (AFC) system	Not applicable

Notes [1]DFS and TPC requirements are only applicable to 5.25–5.35 GHz and 5.47–5.725 GHz bands

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	Apr 12/22
Flush mount turntable	SUNAR	FM2022	FA003006	—	NCR
Controller	SUNAR	SC110V	FA002976	—	NCR
Antenna mast	SUNAR	TLT2	FA003007	—	NCR
Receiver/spectrum analyzer	Rohde & Schwarz	ESR26	FA002969	1 year	Nov 12/21
Spectrum analyzer	Rohde & Schwarz	FSW43	FA002971	1 year	Nov 13/21
Temperature chamber	Espec	EPX-4H	FA003033	1 year	VOU
Radiated Emissions cable set	Huber + Suhner Inc	—	FA003047	—	NCR
Radiated Emissions cable set	Huber + Suhner Inc	—	FA003044	—	NCR
Preamp (1–18 GHz)	ETS-Lindgren	124334	FA002956	1 year	Apr 05/22
Bilog antenna (20–2000 MHz)	Sun AR	JB1	FA003009	1 year	Feb 02/22
Horn antenna (1–18 GHz)	Electro-Metrics	3115	FA000649	1 year	May 10/22
Horn antenna (18–40 GHz)	ETS Lindgren	3116	FA002948	1 year	Jan 22/22
Two-line v-network	Rohde & Schwarz	ENV216	FA002964	1 year	Nov 30/21
50 Ω coax cable	Rohde & Schwarz	None	FA003074	1 year	Dec 17/21

Notes: NCR - no calibration required, VOU - verify on use

Section 8 Testing data

8.1 Variation of power source

8.1.1 References, definitions and limits

FCC §15.31 (e):

For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

8.1.2 Test summary

Verdict	Pass		
Tested by	Fahar Abdul Sukkoor	Test date	October 25, 2021

8.1.3 Observations, settings and special notes

The testing was performed as per ANSI C63.10 Section 5.13.

a) Where the device is intended to be powered from an external power adapter, the voltage variations shall be applied to the input of the adapter provided with the device at the time of sale. If the device is not marketed or sold with a specific adapter, then a typical power adapter shall be used.
b) For devices, where operating at a supply voltage deviating ±15% from the nominal rated value may cause damages or loss of intended function, test to minimum and maximum allowable voltage per manufacturer's specification and document in the report.
c) For devices with wide range of rated supply voltage, test at 15% below the lowest and 15% above the highest declared nominal rated supply voltage.
d) For devices obtaining power from an input/output (I/O) port (USB, firewire, etc.), a test jig is necessary to apply voltage variation to the device from a support power supply, while maintaining the functionalities of the device.

For battery-operated equipment, the equipment tests shall be performed using a variable power supply.

8.1.4 Test data

EUT Power requirements:	☐ AC	☒ DC	☐ Battery
If EUT is an AC or a DC powered, was the noticeable output power variation observed?	☐ YES	☒ NO	☐ N/A
If EUT is battery operated, was the testing performed using fresh batteries?	☐ YES	☐ NO	☒ N/A
If EUT is rechargeable battery operated, was the testing performed using fully charged batteries?	☐ YES	☐ NO	☒ N/A

8.2 Number of frequencies

8.2.1 References, definitions and limits

FCC §15.31:

(m) Measurements on intentional radiators or receivers shall be performed and, if required, reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in the following table.

Table 8.2-1: *Frequency Range of Operation*

Frequency range over which the device operates (in each band)	Number of test frequencies required	Location of measurement frequency inside the operating frequency range
1 MHz or less	1	Center (middle of the band)
1–10 MHz	2	1 near high end, 1 near low end
Greater than 10 MHz	3	1 near high end, 1 near center and 1 near low end

Notes: "near" means as close as possible to or at the centre / low end / high end of the frequency range over which the device operates.

8.2.2 Test summary

Verdict	Pass		
Tested by	Fahar Abdul Sukkoor	Test date	October 25, 2021

8.2.3 Observations, settings and special notes

ANSI C63.10, Clause 5.6.2.1:

The number of channels tested can be reduced by measuring the center channel bandwidth first and then applying the following relaxations as appropriate:

a) For each operating mode, if the measured channel bandwidth on the middle channel is at least 150% of the minimum permitted bandwidth, then it is not necessary to measure the bandwidth on the high and low channels.

b) For multiple-input multiple-output (MIMO) systems, if the measured channel bandwidth on testing the middle channel exceeds the minimum permitted bandwidth by more than 50% on one transmit chain, then it is not necessary to repeat testing on the other chains.

c) If the measured channel bandwidth on the middle channel is less than 50% of the maximum permitted bandwidth, then it is not necessary to measure the bandwidth on the high and low channels.

ANSI C63.10, Clause 5.6.2.2:

For devices with multiple operating modes, measurements on the middle channel can be used to determine the worst-case mode(s). The worst-case modes are as follows:

a) Band edge requirements—Measurements on the mode with the widest bandwidth can be used to cover the same channel (center frequency) on modes with narrower bandwidth that have the same or lower output power for each modulation family (e.g., OFDM and direct sequence spread spectrum).

b) Spurious emissions—Measure the mode with the highest output power and the mode with the highest output power spectral density for each modulation family (e.g., OFDM and direct sequence spread spectrum).

c) In-band PSD—Measurements on the mode with the narrowest bandwidth can be used to cover all modes within the same modulation family of an equal or lower output power provided the result is less than 50% of the limit.

8.2.4 Test data

Table 8.2-2: *Test channels selection 10 MHz*

Start of Frequency range, MHz	End of Frequency range, MHz	Frequency range bandwidth, MHz	Low channel, MHz	Mid channel, MHz	High channel, MHz
5725	5850	125	5730	5800	5845

Table 8.2-3: *Test channels selection 20 MHz*

Start of Frequency range, MHz	End of Frequency range, MHz	Frequency range bandwidth, MHz	Low channel, MHz	Mid channel, MHz	High channel, MHz
5725	5850	125	5735	5800	5840

8.3 Antenna requirement

8.3.1 References, definitions and limits

FCC §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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

RSS-Gen, Clause 6.8:

The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.

For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report.

8.3.2 Test summary

Verdict	Pass		
Tested by	Fahar Abdul Sukkoor	Test date	October 25, 2021

8.3.3 Observations, settings and special notes

All antenna configurations listed below are used in 2 × 2 MIMO configuration

8.3.4 Test data

Must the EUT be professionally installed?	☒ YES	☐ NO	
Does the EUT have detachable antenna(s)?	☒ YES	☐ NO	
If detachable, is the antenna connector(s) non-standard?	☐ YES	☒ NO	☒ N/A

Table 8.3-1: *Antenna information*

Antenna type	Manufacturer	Maximum gain
External Antenna	CCI Products	22.1 dBi
External Antenna	MTI	19.0 dBi

8.4 AC power line conducted emissions limits

8.4.1 References, definitions and limits

FCC §15.407(b):

(8) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in § 15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in § 15.207.

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.

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		
Tested by	Fahar Abdul Sukkoor	Test date	October 25, 2021

8.4.3 Observations, settings and special notes

Port under test – Coupling device	AC power port– Artificial Mains Network (AMN)
EUT power input during test	48 VDC (via external 100–240 VAC, 50/60 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.

Conducted AC line emissions test was performed as per ANSI C63.10, Clause 6.2. Spectrum analyser 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

Table 8.4-2: *Conducted emissions results on phase line*

Frequency, MHz	Quasi-Peak result, dBµV	Quasi-Peak limit, dBµV	Quasi-Peak margin, dB	Correction factor, dB
8.65	50.8	60.0	9.2	15.7

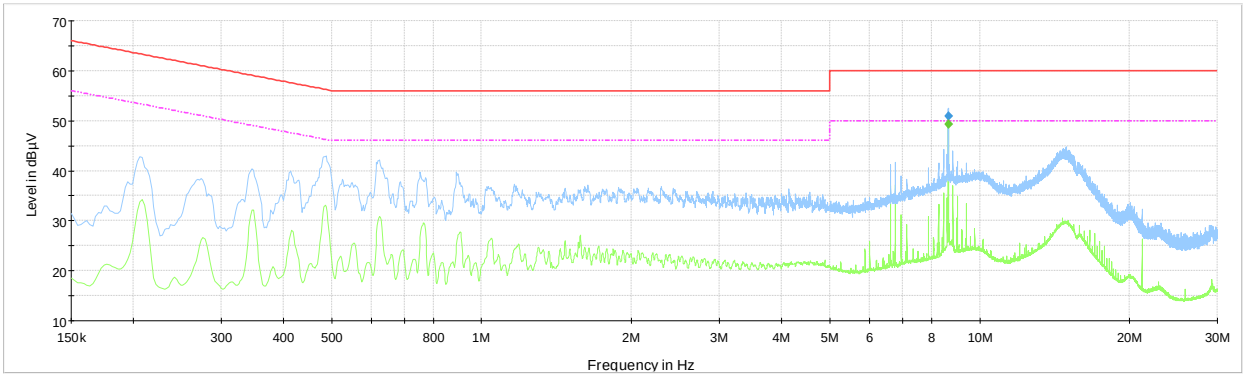
Frequency, MHz	Average result, dBµV	Average limit, dBµV	Average margin, dB	Correction factor, dB
8.65	49.3	50.0	0.7	15.7

Table 8.4-3: *Conducted emissions results on neutral line*

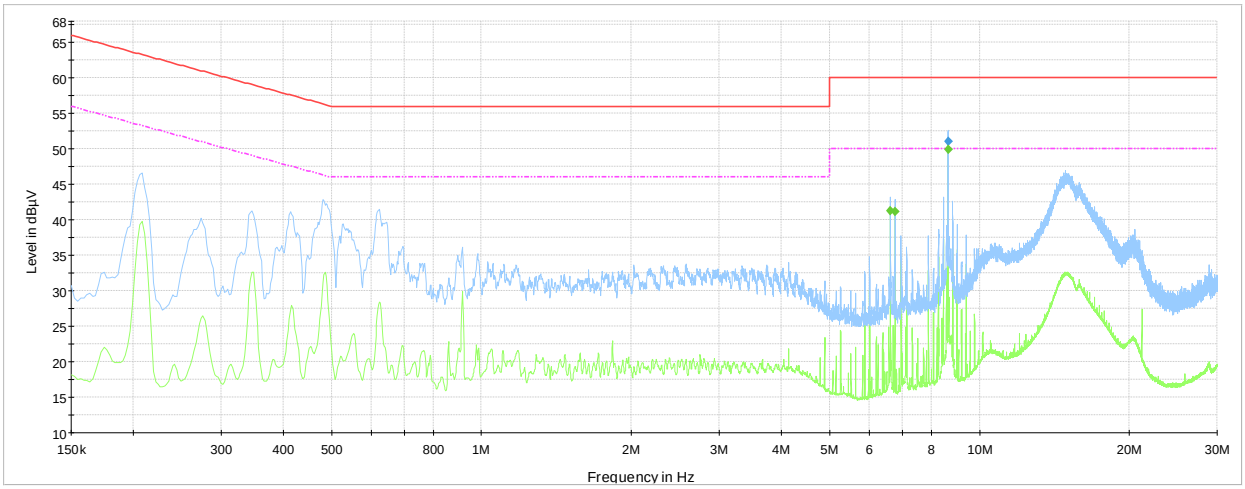
Frequency, MHz	Quasi-Peak result, dBµV	Quasi-Peak limit, dBµV	Quasi-Peak margin, dB	Correction factor, dB
8.65	51.0	60.0	9.0	15.7

Frequency, MHz	Average result, dBµV	Average limit, dBµV	Average margin, dB	Correction factor, dB
6.62	41.3	50.0	8.7	15.7
6.77	41.2	50.0	8.8	15.7
8.65	49.9	50.0	0.1	15.7

Test data, continued



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



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

8.5 Emission bandwidth and 6 dB BW

8.5.1 References, definitions and limits

FCC §15.403:

For purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Determination of the emissions bandwidth is based on the use of measurement instrumentation employing a peak detector function with an instrument resolution bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

FCC §15.407:

(e) Within the 5.725–5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

8.5.2 Test summary

Verdict	Pass		
Tested by	Fahar Abdul Sukkoor	Test date	October 25, 2021

8.5.3 Observations, settings and special notes

The emission bandwidth was tested per ANSI C63.10, Clause 12.4 and KDB 789033 D02, Clause II(C)(1). Spectrum analyser settings:

Resolution bandwidth	approximately 1% of the emission bandwidth
Video bandwidth	> RBW
Detector mode	Peak
Trace mode	Max Hold

The 6 dB bandwidth was tested per ANSI C63.10, Clause 11.8 and KDB 789033 D02, Clause II(C)(2). Spectrum analyser settings:

Resolution bandwidth	approximately 1% of the emission bandwidth
Video bandwidth	≥3 × RBW
Detector mode	Peak
Trace mode	Max Hold

8.5.4 Test data

Table 8.5-1: *26 dB bandwidth 10 MHz results*

Sector	Modulation	Frequency, MHz	26 dB bandwidth at ch0, MHz	6 dB bandwidth at ch0, MHz	26 dB bandwidth at ch1, MHz	6 dB bandwidth at ch1, MHz
0	QPSK	5730	9.63	9.00	9.44	8.99
		5800	9.66	9.00	9.60	9.01
		5845	9.64	9.00	9.67	8.96
	64 QAM	5730	9.61	8.99	9.63	9.00
		5800	9.66	8.98	9.56	8.87
		5845	9.44	8.90	9.52	9.00
2	QPSK	5730	9.65	9.00	9.57	9.00
		5800	9.39	9.01	9.44	8.99
		5845	9.55	9.01	9.58	9.54
	64QAM	5730	9.62	9.00	9.60	8.99
		5800	9.52	8.99	9.62	9.01
		5845	9.61	9.00	9.62	8.99

Test data, continued

Table 8.5-2: *26 dB bandwidth 20 MHz results*

Sector	Modulation	Frequency, MHz	26 dB bandwidth at ch0, MHz	6 dB bandwidth at ch0, MHz	26 dB bandwidth at ch1, MHz	6 dB bandwidth at ch1, MHz
0	QPSK	5735	19.52	17.98	19.26	17.96
		5800	18.87	17.96	18.90	17.95
		5840	19.04	17.95	19.22	17.97
	64 QAM	5735	18.69	17.89	18.84	17.93
		5800	18.67	17.94	18.77	17.97
		5840	18.80	17.96	18.88	17.98
2	QPSK	5735	18.86	17.97	18.75	17.96
		5800	18.65	17.98	18.72	17.98
		5840	18.98	17.96	18.77	17.96
	64QAM	5735	18.58	18.03	18.67	17.91
		5800	18.58	17.90	18.53	17.94
		5840	18.61	17.94	18.59	17.96

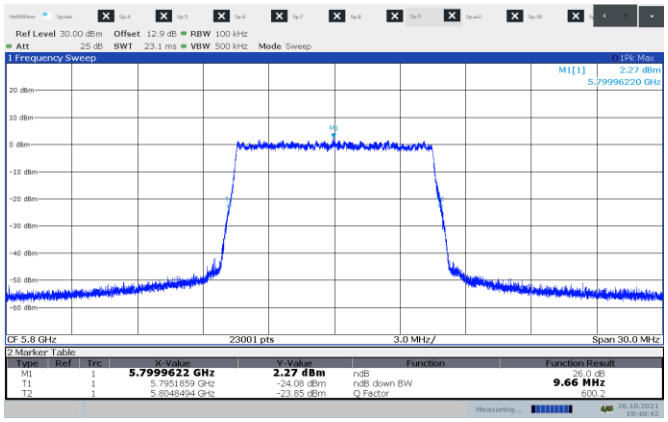


Figure 8.5-1: *26 dB bandwidth 10 MHz, sample plot*

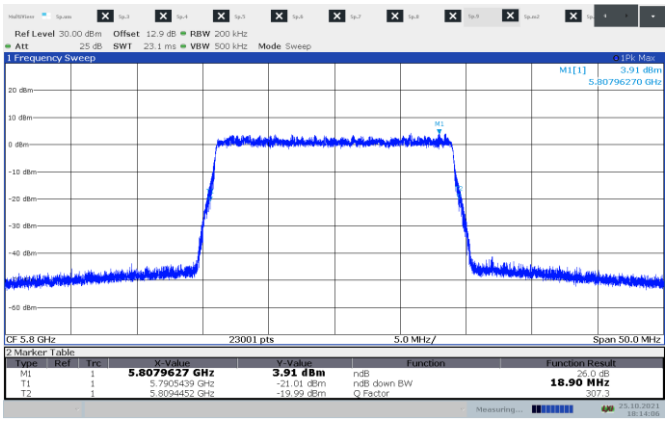


Figure 8.5-2: *26 dB bandwidth 20 MHz, sample plot*

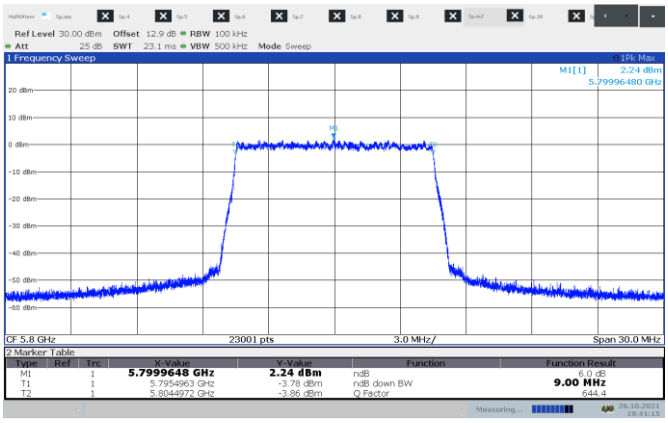


Figure 8.5-3: *6 dB bandwidth 10 MHz, sample plot*

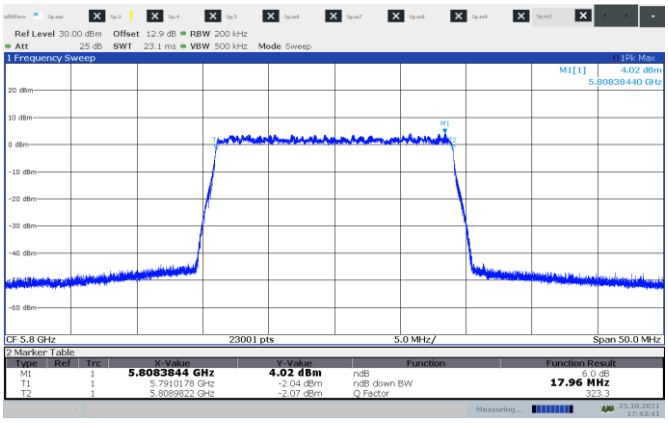


Figure 8.5-4: *6 dB bandwidth 20 MHz, sample plot*

8.6 Occupied bandwidth

8.6.1 References, definitions and limits

ANSI C63.10-2013, Clause 6.9.3:

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission.

8.6.2 Test summary

Verdict	Pass		
Tested by	Fahar Abdul Sukkoor	Test date	October 25, 2021

8.6.3 Observations, settings and special notes

The emission bandwidth was tested per ANSI C63.10, Clause 6.9.3 and KDB 789033 D02, Clause II(D). Spectrum analyser settings:

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

8.6.4 Test data

Table 8.6-1: *99% bandwidth 10 MHz results*

Sector	Modulation	Frequency, MHz	99% bandwidth at ch0, MHz	99% bandwidth at ch1, MHz
0	QPSK	5730	8.95	8.95
		5800	8.95	8.94
		5845	8.95	8.94
	64 QAM	5730	8.95	8.95
		5800	8.95	8.95
		5845	8.93	8.95
2	QPSK	5730	8.94	8.94
		5800	8.94	8.94
		5845	8.95	8.95
	64QAM	5730	8.95	8.95
		5800	8.95	8.95
		5845	8.95	8.95

Test data, continued

Table 8.6-2: *99% bandwidth 20 MHz results*

Sector	Modulation	Frequency, MHz	99% bandwidth at ch0, MHz	99% bandwidth at ch1, MHz
0	QPSK	5735	17.86	17.85
		5800	17.85	17.86
		5840	17.86	17.85
	64 QAM	5735	17.87	17.87
		5800	17.85	17.87
		5840	17.87	17.85
2	QPSK	5735	17.86	17.85
		5800	17.85	17.86
		5840	17.86	17.85
	64QAM	5735	17.88	17.88
		5800	17.87	17.88
		5840	17.87	17.86

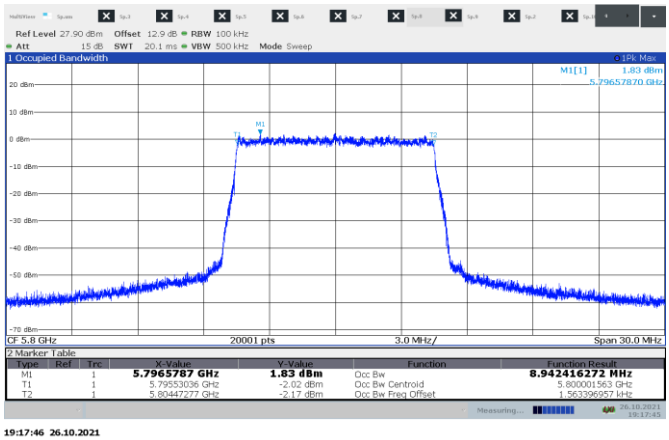


Figure 8.6-1: *99% bandwidth 10 MHz, sample plot*

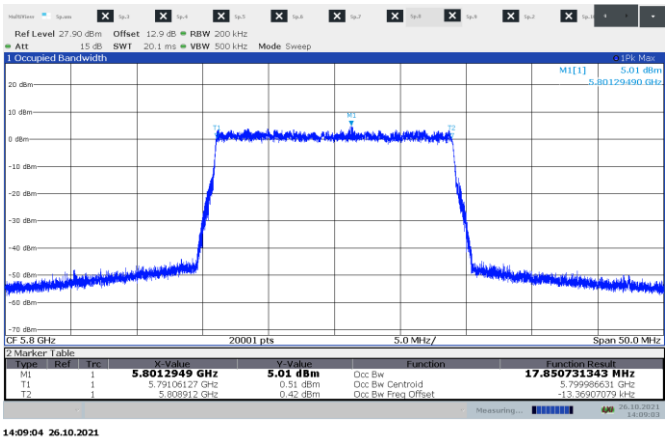


Figure 8.6-2: *99% bandwidth 20 MHz, sample plot*

8.7 Transmitter output power and e.i.r.p. requirements for 5725–5850 MHz band

8.7.1 References, definitions and limits

FCC §15.407:

(a) Power limits:

(3) For the band 5.725–5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(11) The maximum conducted output power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage.

(12) Power spectral density measurement. The maximum power spectral density is measured as either a conducted emission by direct connection of a calibrated test instrument to the equipment under test or a radiated measurement. Measurements in the 5.725–5.85 GHz band are made over a reference bandwidth of 500 kHz or the 26 dB emission bandwidth of the device, whichever is less. Measurements in all other bands are made over a bandwidth of 1 MHz or the 26 dB emission bandwidth of the device, whichever is less. A narrower resolution bandwidth can be used, provided that the measured power is integrated over the full reference bandwidth.

8.7.2 Test summary

Verdict	Pass		
Tested by	Fahar Abdul Sukkoor	Test date	October 25, 2021

8.7.3 Observations, settings and special notes

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

EIRP was calculated as follows: $EIRP = P_{combined} + antenna\ gain$

Combined PPSD was calculated as follows: $PPSD_{combined} = 10 \times log_{10}\left(\left(10^{PSD_{ch0}/10}\right) + \left(10^{PSD_{ch1}/10}\right)\right)$

For antenna (Brand: CCI Products, Model: MBM12F-HJ5B, Peak Gain = 22.1 dBi) with the directional gain greater than 6 dBi, the maximum FCC output power limit was calculated as follows:
Limit = 30 dBm – ((Maximum antenna gain – Path Loss) – 6 dBi)
Limit = 30 dBm – ((22.1 dBi – 1.5 dB) – 6 dBi)
Limit = 15.4 dBm

For antenna (Brand: CCI Products, Model: MBM12F-HJ5B, Peak Gain = 22.1 dBi) with the directional gain greater than 6 dBi, the maximum FCC power spectral density limit was calculated as follows:
Limit = 30 dBm/500 kHz – ((Maximum antenna gain – Path Loss) – 6 dBi)
Limit = 30 dBm/500 kHz – (22.1 dBi – 1.5 dB) - 6 dBi)
Limit = 15.4 dBm/500 kHz

Measurement data for antenna (Brand: MTI, Model:MT-404083/ND, Peak Gain = 19 dBi) is extracted from Nemko test report NEX 425119-3TRFWL

For antenna (Brand: MTI, Model:MT-404083/ND, Peak Gain = 19 dBi) with the directional gain greater than 6 dBi, the maximum FCC output power limit was calculated as follows:
Limit = 30 dBm – ((Maximum antenna gain – path loss) – 6 dBi
Limit = 30 dBm – ((19 dBi – 2.0 dB) – 6 dBi
Limit = 30 dBm – ((19 dBi – 2.0 dB) – 6 dBi
Limit = 19.0 dBm

For antenna (Brand: MTI, Model:MT-404083/ND, Peak Gain = 19 dBi) with the directional gain greater than 6 dBi, the maximum FCC power spectral density limit was calculated as follows:
Limit = 30 dBm/500 kHz – ((Maximum antenna gain – Path Loss) – 6 dBi)
Limit = 30 dBm/500 kHz – (19 dBi – 2.0 dB) - 6 dBi)
Limit = 19.0 dBm/500 kHz

Power spectral density was tested per ANSI C63.10, Clause 12.5 and 789033 D02, Clause II(F).
Conducted output power was tested per ANSI C63.10, Clause 12.3 and 789033 D02, Clause II(E) using method b)Method SA-1(trace averaging with the EUT transmitting at full power throughout each sweep):
Spectrum analyser settings:

Resolution bandwidth	1 MHz (500kHz for PSD)
Video bandwidth	≥ 3 MHz
Frequency span	Enough to encompass the entire 26 dB EBW or 99% OBW of the signal
Detector mode	RMS
Trace mode	average
Power aggregation	Over 26 dB EBW or 99% OBW

8.7.4 Test data

Table 8.7-1: *Output power measurements results for sector 0, CCI Products Antenna*

Bandwidth	Modulation	Frequency, MHz	Measured average conducted output power, dBm			Power limit, dBm	Margin, dB
			On ch0	On ch1	Combined		
10 MHz	QPSK	5730	10.08	9.04	12.60	15.40	2.80
		5800	10.10	9.93	13.03	15.40	2.37
		5830	9.58	9.58	12.59	15.40	2.81
	64 QAM	5845	7.06	7.28	10.18	15.40	5.22
		5730	9.86	8.82	12.38	15.40	3.02
		5800	10.07	9.88	12.99	15.40	2.41
		5830	9.94	9.86	12.91	15.40	2.49
		5845	7.24	7.13	10.20	15.40	5.20
20 MHz	QPSK	5735	11.89	11.85	14.88	15.40	0.52
		5800	11.90	11.98	14.95	15.40	0.45
		5830	10.96	10.96	13.97	15.40	1.43
	64 QAM	5840	7.02	7.05	10.05	15.40	5.35
		5735	11.47	11.30	14.40	15.40	1.00
		5800	11.88	10.55	14.28	15.40	1.12
		5830	11.74	10.87	14.34	15.40	1.06
		5840	6.72	7.17	9.96	15.40	5.44

Table 8.7-2: *PPSD measurements results for sector 0, CCI Products Antenna*

Bandwidth	Modulation	Frequency, MHz	Peak Power Spectral Density, dBm/500 kHz			PPSD limit, dBm/500 kHz	Margin, dB
			On ch0	On ch1	Combined		
10 MHz	QPSK	5730	-1.33	-0.74	1.99	15.40	13.41
		5800	-2.33	-1.28	1.24	15.40	14.16
		5830	-1.60	-1.45	1.49	15.40	13.91
	64 QAM	5845	-3.35	-2.73	-0.02	15.40	15.42
		5730	-1.92	-2.22	0.94	15.40	14.46
		5800	-1.59	-2.34	1.06	15.40	14.34
		5830	-1.86	-1.16	1.51	15.40	13.89
		5845	-3.23	-4.43	-0.78	15.40	16.18
20 MHz	QPSK	5735	-1.67	-1.20	1.58	15.40	13.82
		5800	-1.22	-1.40	1.70	15.40	13.70
		5830	-3.25	-2.72	0.03	15.40	15.37
	64 QAM	5840	-6.40	-6.48	-3.43	15.40	18.83
		5735	-1.68	-1.91	1.22	15.40	14.18
		5800	-1.79	-2.33	0.96	15.40	14.44
		5830	-1.29	-2.31	1.24	15.40	14.16
		5840	-6.96	-6.16	-3.53	15.40	18.93

Test data, continued

Table 8.7-3: *Output power measurements results for sector 2, CCI Products Antenna*

Bandwidth	Modulation	Frequency, MHz	Measured average conducted output power, dBm			Power limit, dBm	Margin, dB
			On ch0	On ch1	Combined		
10 MHz	QPSK	5730	9.56	9.95	12.77	15.40	2.63
		5800	9.69	10.37	13.05	15.40	2.35
		5830	9.79	9.80	12.81	15.40	2.59
		5845	6.94	6.88	9.92	15.40	5.48
	64 QAM	5730	8.85	10.07	12.51	15.40	2.89
		5800	8.83	9.96	12.44	15.40	2.96
		5830	8.58	9.89	12.29	15.40	3.11
		5845	6.88	6.91	9.91	15.40	5.49
20 MHz	QPSK	5735	10.73	11.37	14.07	15.40	1.33
		5800	10.31	10.72	13.53	15.40	1.87
		5830	10.52	10.23	13.39	15.40	2.01
		5840	6.75	6.07	9.43	15.40	5.97
	64 QAM	5735	11.00	11.04	14.03	15.40	1.37
		5800	10.53	10.65	13.60	15.40	1.80
		5830	10.30	10.11	13.22	15.40	2.18
		5840	6.44	6.44	9.45	15.40	5.95

Table 8.7-4: *PPSD measurements results for sector 2, CCI Products Antenna*

Bandwidth	Modulation	Frequency, MHz	Peak Power Spectral Density, dBm/ 500 kHz			PPSD limit, dBm/500 kHz	Margin, dB
			On ch0	On ch1	Combined		
10 MHz	QPSK	5730	-1.51	-0.96	1.78	15.40	13.62
		5800	-1.72	-0.89	1.73	15.40	13.67
		5830	-1.52	-1.38	1.56	15.40	13.84
		5845	-4.58	-4.30	-1.43	15.40	16.83
	64 QAM	5730	-2.62	-1.14	1.19	15.40	14.21
		5800	-3.17	-1.77	0.60	15.40	14.8
		5830	-2.69	-1.34	1.05	15.40	14.35
		5845	-4.61	-4.64	-1.61	15.40	17.01
20 MHz	QPSK	5735	-2.79	-1.14	1.12	15.40	14.28
		5800	-3.01	-2.57	0.23	15.40	15.17
		5830	-4.06	-2.72	-0.33	15.40	15.73
		5840	-6.42	-7.98	-4.12	15.40	19.52
	64 QAM	5735	-2.29	-1.86	0.94	15.40	14.46
		5800	-5.59	-2.14	-0.52	15.40	15.92
		5830	-4.07	-3.08	-0.54	15.40	15.94
		5840	-6.00	-5.29	-2.62	15.40	18.02

Test data, continued

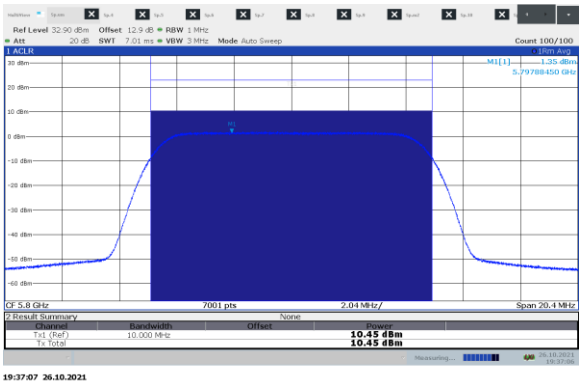


Figure 8.7-1: *Sample plot for power on 10 MHz*

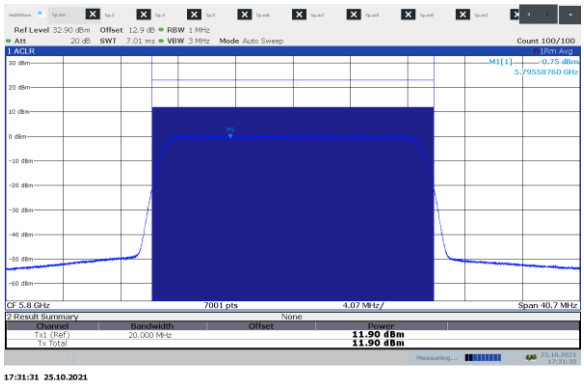


Figure 8.7-2: *Sample plot for power on 20 MHz*

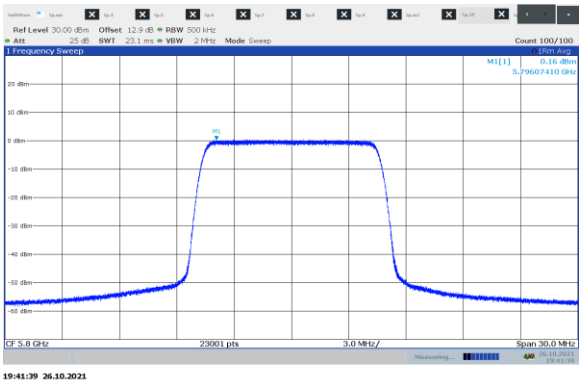


Figure 8.7-3: *Sample plot for PPSD on 10 MHz*

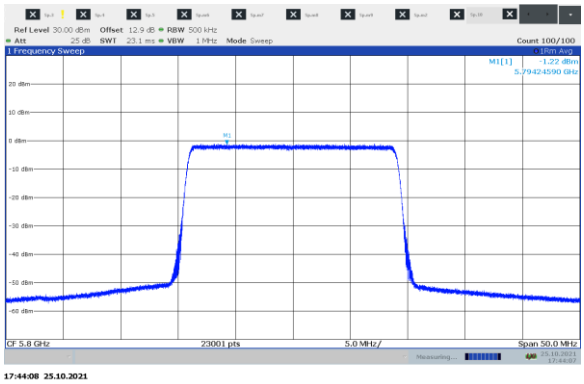


Figure 8.7-4: *Sample plot for PPSD on 20 MHz*

Test data, continued

Table 8.7-5: *Output power measurements results for sector 0, MTI Antenna*

Bandwidth	Modulation	Frequency, MHz	Measured average conducted output power, dBm			Power limit, dBm	Margin, dB
			On ch0	**On ch1**	**Combined**		
10 MHz	QPSK	5730	15.76	15.95	18.87	19.00	0.13
		5800	15.83	15.84	18.85	19.00	0.15
		5830	15.68	15.72	18.71	19.00	0.29
		5845	14.25	14.20	17.24	19.00	1.76
	64 QAM	5730	15.76	15.93	18.86	19.00	0.14
		5800	15.79	15.78	18.80	19.00	0.20
		5830	15.86	15.80	18.84	19.00	0.16
		5845	14.15	14.23	17.20	19.00	1.80
20 MHz	QPSK	5735	15.92	15.64	18.79	19.00	0.21
		5800	15.95	15.67	18.82	19.00	0.18
		5830	15.80	15.86	18.84	19.00	0.16
		5840	14.02	14.18	17.11	19.00	1.89
	64 QAM	5735	15.86	15.91	18.90	19.00	0.10
		5800	15.96	15.85	18.92	19.00	0.08
		5830	15.95	15.87	18.92	19.00	0.08
		5840	13.96	13.98	16.98	19.00	2.02

Table 8.7-6: *PPSD measurements results for sector 0, MTI Antenna*

Bandwidth	Modulation	Frequency, MHz	Peak Power Spectral Density, dBm/500 kHz			PPSD limit, dBm/500 kHz	Margin, dB
			On ch0	**On ch1**	**Combined**		
10 MHz	QPSK	5730	3.69	3.67	2.03	19.00	12.31
		5800	3.58	3.52	2.03	19.00	12.44
		5830	3.61	3.56	2.03	19.00	12.40
		5845	2.39	2.16	2.03	19.00	13.71
	64 QAM	5730	3.52	3.69	2.03	19.00	12.38
		5800	4.17	3.61	2.03	19.00	12.09
		5830	3.65	3.32	2.03	19.00	12.50
		5845	2.13	2.70	2.03	19.00	13.57
20 MHz	QPSK	5735	1.11	0.34	2.03	19.00	15.25
		5800	1.42	0.57	2.03	19.00	14.97
		5830	0.98	0.32	2.03	19.00	15.33
		5840	-1.16	-1.01	2.03	19.00	17.07
	64 QAM	5735	0.36	0.62	2.03	19.00	15.50
		5800	0.67	1.14	2.03	19.00	15.08
		5830	1.27	0.59	2.03	19.00	15.05
		5840	-0.76	-1.21	2.03	19.00	16.97

Test data, continued

Table 8.7-7: *Output power measurements results for sector 2, MTI Antenna*

Bandwidth	Modulation	Frequency, MHz	Measured average conducted output power, dBm			Power limit, dBm	Margin, dB
			On ch0	**On ch1**	**Combined**		
10 MHz	QPSK	5730	15.54	15.78	18.67	19.00	0.33
		5800	15.98	15.83	18.92	19.00	0.08
		5830	15.93	15.85	18.90	19.00	0.10
		5845	14.12	13.95	17.05	19.00	1.95
	64 QAM	5730	15.87	15.76	18.83	19.00	0.17
		5800	15.75	15.82	18.80	19.00	0.20
		5830	15.81	15.91	18.87	19.00	0.13
		5845	14.01	14.01	17.02	19.00	1.98
20 MHz	QPSK	5735	15.89	15.98	18.95	19.00	0.05
		5800	16.01	15.84	18.94	19.00	0.06
		5830	15.81	15.93	18.88	19.00	0.12
		5840	14.05	14.06	17.07	19.00	1.93
	64 QAM	5735	15.88	15.85	18.88	19.00	0.12
		5800	15.86	15.92	18.90	19.00	0.10
		5830	15.91	15.81	18.87	19.00	0.13
		5840	14.01	13.98	17.01	19.00	1.99

Table 8.7-8: *PPSD measurements results for sector 2, MTI Antenna*

Bandwidth	Modulation	Frequency, MHz	Peak Power Spectral Density, dBm/ 500 kHz			PPSD limit, dBm/500 kHz	Margin, dB
			On ch0	**On ch1**	**Combined**		
10 MHz	QPSK	5730	2.88	3.66	6.30	19.00	12.70
		5800	3.97	3.43	6.72	19.00	12.28
		5830	3.74	3.78	6.77	19.00	12.23
		5845	2.40	1.40	4.94	19.00	14.06
	64 QAM	5730	3.34	3.18	6.27	19.00	12.73
		5800	3.62	3.02	6.34	19.00	12.66
		5830	3.21	3.97	6.62	19.00	12.38
		5845	2.26	1.83	5.06	19.00	13.94
20 MHz	QPSK	5735	0.92	0.91	3.93	19.00	15.07
		5800	0.75	1.14	3.96	19.00	15.04
		5830	0.64	1.24	3.96	19.00	15.04
		5840	-0.79	-1.26	1.99	19.00	17.01
	64 QAM	5735	0.21	0.87	3.56	19.00	15.44
		5800	1.19	1.06	4.14	19.00	14.86
		5830	1.56	0.87	4.24	19.00	14.76
		5840	-1.06	-1.10	1.93	19.00	17.07

Test data, continued

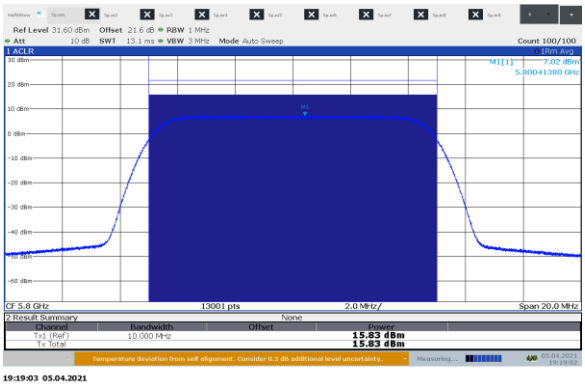


Figure 8.7-5: *Sample plot for power on 10 MHz*

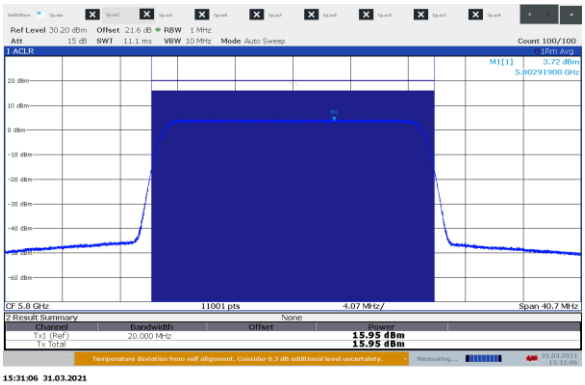


Figure 8.7-6: *Sample plot for power on 20 MHz*

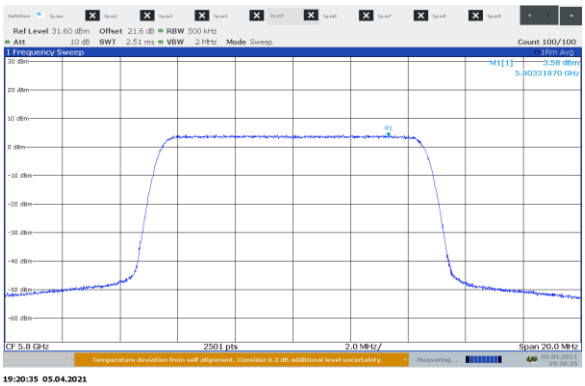


Figure 8.7-7: *Sample plot for PPSD on 10 MHz*

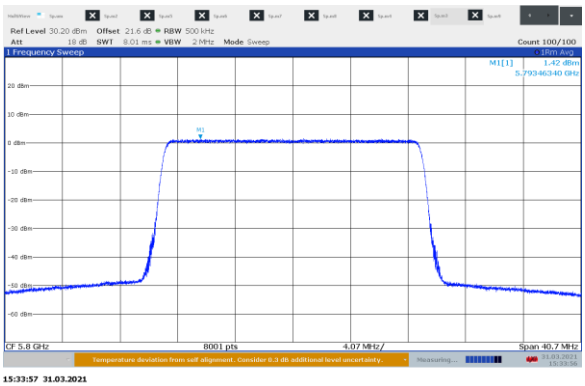


Figure 8.7-8: *Sample plot for PPSD on 20 MHz*

8.8 Spurious unwanted (undesirable) emissions

8.8.1 References, definitions and limits

FCC §15.407:

(b) Undesirable emission limits.
Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(4) For transmitters operating in the 5.725–5.85 GHz band:

(i) All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

(7) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.

(8) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in § 15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in § 15.207.

(9) The provisions of § 15.205 apply to intentional radiators operating under this section.

(10) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency band edges as the design of the equipment permits.

Table 8.8-1: *FCC §15.209 – Radiated emission limits*

	Field strength of emissions		
Frequency, MHz	**µV/m**	**dBµV/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

Notes: 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.

References, definitions and limits, continued

Table 8.8-2: *FCC restricted frequency bands*

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	Above 38.6
13.36–13.41			

8.8.2 Test summary

Verdict	Pass		
Tested by	Fahar Abdul Sukkoor	Test date	October 28, 2021

8.8.3 Observations, settings and special notes

- As part of the current assessment, the test range of 9 kHz to 40 GHz has been fully considered and compared to the actual frequencies utilized within the EUT. Since the EUT contains a transmitter in the GHz range, the EUT has been deemed compliant without formal testing in the 9 kHz to 30 MHz test range, therefore formal test results (tabular data and/or plots) are not provided within this test report.
- EUT was set to transmit with 100 % duty cycle. The EUT was transmitting on both MIMO chains simultaneously
- Conducted spurious sample plots are shown for both avg and peak limits. For average limits, emissions above line are from unrestricted bands and emissions above limit within restricted bands are zoomed in and measured prove to be within limit line.
- Cabinet spurious measurements were performed at a distance of 3 m This test was performed at the antenna ports and radiated with both antennas terminated with 50 Ohm load.
- The spurious emission was tested per ANSI C63.10, Clause 12.7 and 789033 D02, Clause II(G).
- Antennae are completely uncorrelated cross polarized antenna so EIRP limit should be individually below limit.

Spectrum analyser for peak conducted measurements within restricted bands below 1 GHz:

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

Spectrum analyser for peak conducted measurements within restricted bands above 1 GHz:

Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Detector mode:	Peak
Trace mode:	Max Hold

Average limit line was set as follows:
Limit/MHz = 54 dBµV/m – 95.23 dB – (Antenna Gain (dBi) – Path Loss (dB))
Limit/MHz = 54 dBµV/m – 95.23 dB – (21.9 dBi – 1.5 dB)
Limit = -61.63 dBm/MHz

Spectrum analyser for average conducted measurements within restricted bands above 1 GHz for frequencies where peak results were above the average limit:

Resolution bandwidth:	1 MHz
Video bandwidth:	10 MHz
Detector mode:	RMS
Trace mode:	Power average
Number of averaging traces:	100

Peak limit is 20 dB higher than the average limit: -61.83 dBm/MHz + 20 dB = -41.83 dBm/MHz

Spectrum analyser for peak conducted measurements outside restricted bands:

Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Detector mode:	Peak
Trace mode:	Max Hold

Conducted emissions measurements outside restricted bands were performed on each individual MIMO chain.
−27 dBm/MHz – 20.6 dBi =-47.6 dBm/MHz. For peak measurements, non-restricted band limits are more stringent than restricted band is taken as peak limit

8.8.4 Test data

Table 8.8-3: *Conducted peak spurious emission measurement results for sector 0*

Modulation	Antenna port	Channel BW, MHz	Frequency of max emission, MHz	Emission level, dBm/MHz	Limit, dBm/MHz	Margin, dB
QPSK	0	10(low)	5241.8	-49.27	-47.60	1.67
	1	10(low)	5241.8	-50.42	-47.60	2.82
	0	10(mid)	5311.6	-48.44	-47.60	0.84
	1	10(mid)	5308.9	-48.12	-47.60	0.52
	0	10(5830)	5340.9	-49.76	-47.60	2.16
	1	10(5830)	5215.3	-50.33	-47.60	2.73
	0	10(high)	5353.3	-51.38	-47.60	3.78
	1	10(high)	5105.3	-52.32	-47.60	4.72
	0	20(low)	5251.5	-48.47	-47.60	0.87
	1	20(low)	5243.2	-48.07	-47.60	0.47
	0	20(mid)	5300.7	-48.08	-47.60	0.48
	1	20(mid)	5301.9	-49.03	-47.60	1.43
	0	20(5830)	5340.9	-49.18	-47.60	1.58
	1	20(5830)	5340.9	-49.98	-47.60	2.38
	0	20(high)	5351.4	-50.71	-47.60	3.11
	1	20(high)	5349.8	-50.61	-47.60	3.01
64 QAM	0	10(low)	5240.2	-51.00	-47.60	3.4
	1	10(low)	5240.2	-51.11	-47.60	3.51
	0	10(mid)	5188.9	-49.28	-47.60	1.68
	1	10(mid)	5189.1	-50.22	-47.60	2.62
	0	10(5830)	5212.2	-50.96	-47.60	3.36
	1	10(5830)	5211.8	-49.30	-47.60	1.70
	0	10(high)	5230.5	-51.55	-47.60	3.95
	1	10(high)	5105.3	-52.39	-47.60	4.79
	0	20(low)	5240.1	-49.48	-47.60	1.88
	1	20(low)	5238.9	-48.18	-47.60	0.58
	0	20(mid)	5310.4	-48.27	-47.60	0.67
	1	20(mid)	5299.9	-48.16	-47.60	0.56
	0	20(5830)	5334.2	-49.53	-47.60	1.93
	1	20(5830)	5334.2	-48.17	-47.60	0.57
	0	20(high)	5347.9	-51.17	-47.60	3.57
	1	20(high)	5354.5	-51.50	-47.60	3.90

Test data, continued

Table 8.8-4: *Conducted average spurious emission measurement results for sector 0*

Modulation	Antenna port	Channel BW, MHz	Frequency of max emission, MHz	Emission level, dBm/MHz	Limit, dBm/MHz	Margin, dB
QPSK	0	10(low)	5115.6	-62.14	-61.83	0.31
	1	10(low)	5115.6	-61.90	-61.83	0.07
	0	10(mid)	5062.7	-62.44	-61.83	0.61
	1	10(mid)	5062.7	-62.37	-61.83	0.54
	0	10(5830)	5091.9	-61.89	-61.83	0.06
	1	10(5830)	5091.9	-62.28	-61.83	0.45
	0	10(high)	5353.5	-61.90	-61.83	0.07
	1	10(high)	5353.7	-63.42	-61.83	1.59
	0	20(low)	5001.4	-62.89	-61.83	1.06
	1	20(low)	5005.7	-63.50	-61.83	1.67
	0	20(mid)	5069.5	-63.31	-61.83	1.48
	1	20(mid)	5063.2	-61.92	-61.83	0.09
	0	20(5830)	5098.6	-62.66	-61.83	0.83
	1	20(5830)	5098.8	-61.96	-61.83	0.13
	0	20(high)	5350.0	-61.84	-61.83	0.01
	1	20(high)	5350.0	-61.87	-61.83	0.04
64 QAM	0	10(low)	5115.6	-61.88	-61.83	0.05
	1	10(low)	5113.4	-61.88	-61.83	0.05
	0	10(mid)	5063.5	-62.48	-61.83	0.65
	1	10(mid)	5063.5	-62.33	-61.83	0.50
	0	10(5830)	5092.7	-62.88	-61.83	1.05
	1	10(5830)	5089.5	-61.91	-61.83	0.08
	0	10(high)	5353.5	-61.84	-61.83	0.01
	1	10(high)	5353.5	-64.11	-61.83	2.28
	0	20(low)	4995.6	-63.26	-61.83	1.43
	1	20(low)	5005.3	-62.61	-61.83	0.78
	0	20(mid)	5070.2	-62.37	-61.83	0.54
	1	20(mid)	5062.7	-62.32	-61.83	0.49
	0	20(5830)	5092.7	-62.66	-61.83	0.83
	1	20(5830)	5097.6	-61.84	-61.83	0.01
	0	20(high)	5350.0	-62.27	-61.83	0.44
	1	20(high)	5350.0	-62.30	-61.83	0.47

Test data, continued

Table 8.8-5: *Conducted peak spurious emission measurement results for sector 2*

Modulation	Antenna port	Channel BW, MHz	Frequency of max emission, MHz	Emission level, dBm/MHz	Limit, dBm/MHz	Margin, dB
QPSK	0	10(low)	5235.6	-51.69	-47.60	4.09
	1	10(low)	5235.6	-49.42	-47.60	1.82
	0	10(mid)	5306.9	-49.74	-47.60	2.14
	1	10(mid)	5308.9	-48.51	-47.60	0.91
	0	10(5830)	5218.8	-49.13	-47.60	1.53
	1	10(5830)	5216.8	-49.19	-47.60	1.59
	0	10(high)	5345.9	-50.76	-47.60	3.16
	1	10(high)	5346.2	-52.62	-47.60	5.02
	0	20(low)	5250.4	-49.76	-47.60	2.16
	1	20(low)	5250.3	-49.50	-47.60	1.90
	0	20(mid)	5308.1	-48.88	-47.60	1.28
	1	20(mid)	5308.1	-49.06	-47.60	1.46
	0	20(5830)	5338.1	-49.04	-47.60	1.44
	1	20(5830)	5338.1	-49.08	-47.60	1.48
	0	20(high)	5352.1	-51.03	-47.60	3.43
	1	20(high)	5352.2	-48.93	-47.60	1.33
64 QAM	0	10(low)	5235.7	-50.30	-47.60	2.70
	1	10(low)	5235.6	-49.54	-47.60	1.94
	0	10(mid)	5305.4	-49.17	-47.60	1.57
	1	10(mid)	5305.4	-49.86	-47.60	2.26
	0	10(5830)	5217.2	-49.11	-47.60	1.51
	1	10(5830)	5339.7	-49.12	-47.60	1.52
	0	10(high)	5109.2	-51.03	-47.60	3.43
	1	10(high)	5232.8	-51.09	-47.60	3.49
	0	20(low)	5246.0	-49.84	-47.60	2.24
	1	20(low)	5246.1	-48.57	-47.60	0.97
	0	20(mid)	5308.5	-49.60	-47.60	2.00
	1	20(mid)	5308.5	-49.99	-47.60	2.39
	0	20(5830)	5336.2	-49.45	-47.60	1.85
	1	20(5830)	5336.2	-48.79	-47.60	1.19
	0	20(high)	5351.7	-51.59	-47.60	3.99
	1	20(high)	5344.4	-49.62	-47.60	2.02

Test data, continued

Table 8.8-6: *Conducted average spurious emission measurement results for sector 2*

Modulation	Antenna port	Channel BW, MHz	Frequency of max emission, MHz	Emission level, dBm/MHz	Limit, dBm/MHz	Margin, dB
QPSK	0	10(low)	5117.9	-61.87	-61.83	0.04
	1	10(low)	5117.9	-61.89	-61.83	0.06
	0	10(mid)	5065.6	-62.11	-61.83	0.28
	1	10(mid)	5062.3	-61.90	-61.83	0.07
	0	10(5830)	5094.4	-61.85	-61.83	0.02
	1	10(5830)	5094.4	-61.85	-61.83	0.02
	0	10(high)	5350.0	-61.84	-61.83	0.01
	1	10(high)	5350.0	-61.93	-61.83	0.10
	0	20(low)	4999.9	-61.88	-61.83	0.05
	1	20(low)	4999.9	-62.22	-61.83	0.39
	0	20(mid)	5062.7	-61.97	-61.83	0.14
	1	20(mid)	5059.5	-61.86	-61.83	0.03
	0	20(5830)	5099.0	-62.02	-61.83	0.19
	1	20(5830)	5092.6	-61.90	-61.83	0.07
	0	20(high)	5350.0	-62.02	-61.83	0.19
	1	20(high)	5350.0	-62.00	-61.83	0.17
64 QAM	0	10(low)	5117.9	-61.84	-61.83	0.01
	1	10(low)	5117.9	-62.31	-61.83	0.48
	0	10(mid)	5065.1	-61.84	-61.83	0.01
	1	10(mid)	5062.2	-62.63	-61.83	0.80
	0	10(5830)	5094.8	-62.19	-61.83	0.36
	1	10(5830)	5092.7	-61.93	-61.83	0.1
	0	10(high)	5109.3	-62.14	-61.83	0.31
	1	10(high)	5350.0	-62.02	-61.83	0.19
	0	20(low)	5000.1	-61.87	-61.83	0.04
	1	20(low)	5000.1	-61.85	-61.83	0.02
	0	20(mid)	5068.4	-61.97	-61.83	0.14
	1	20(mid)	5068.5	-61.89	-61.83	0.06
	0	20(5830)	5090.0	-61.89	-61.83	0.06
	1	20(5830)	5090.0	-61.86	-61.83	0.03
	0	20(high)	5100.0	-62.06	-61.83	0.23
	1	20(high)	5100.0	-62.37	-61.83	0.54

Test data, continued

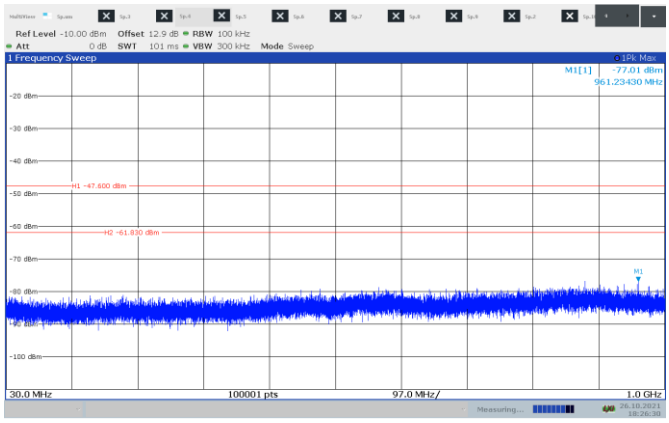


Figure 8.8-1: *Conducted peak spurious emissions 30 MHz -1 GHz on low channel 10 MHz sample plot*

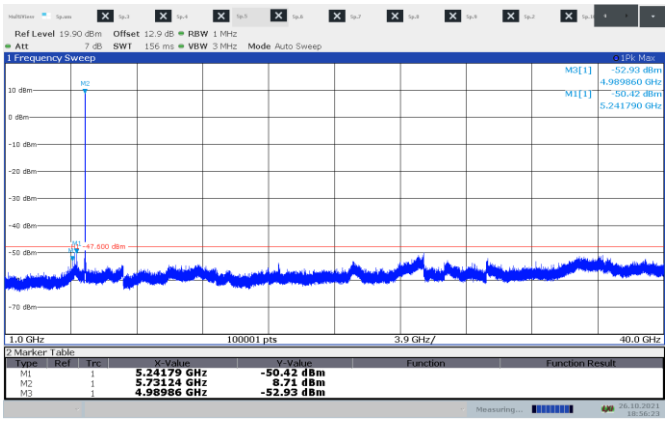


Figure 8.8-2: *Conducted peak spurious emissions 1- 40 GHz on low channel 10 MHz sample plot*

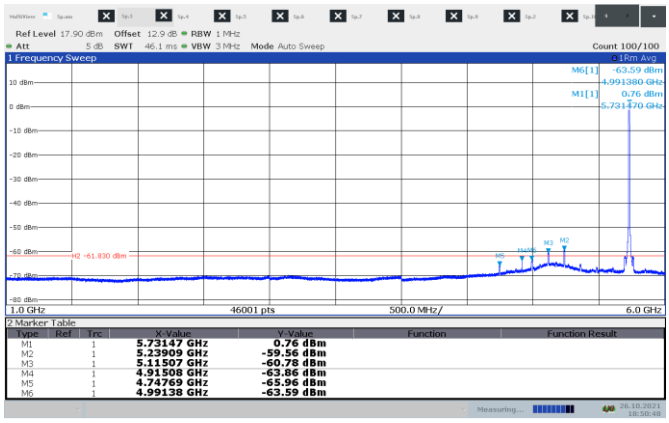


Figure 8.8-3: *Conducted average spurious emissions 1- 6 GHz on low channel 10 MHz sample plot*

Figure 8.8-4: : : *Conducted average spurious emissions 6 -40 GHz on low channel 10 MHz sample plot*

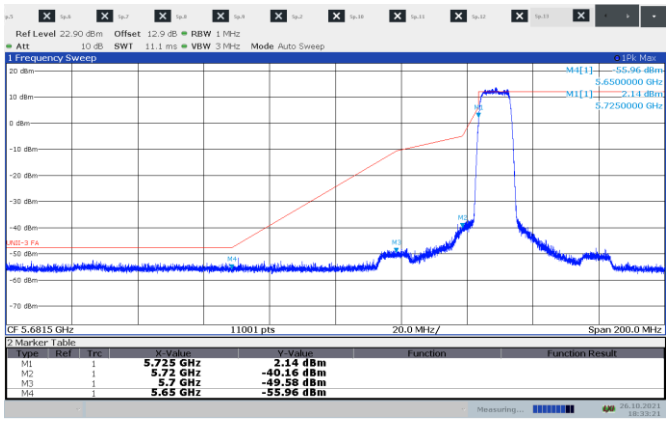


Figure 8.8-5 *Conducted Banedge mask on low channel 10 MHz channel sample plot*

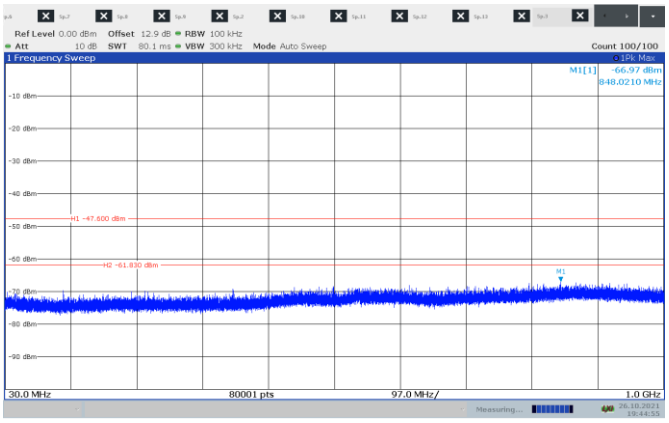


Figure 8.8-6: *Conducted peak spurious emissions 30 MHz -1 GHz on mid channel 10 MHz sample plot*

Test data, continued

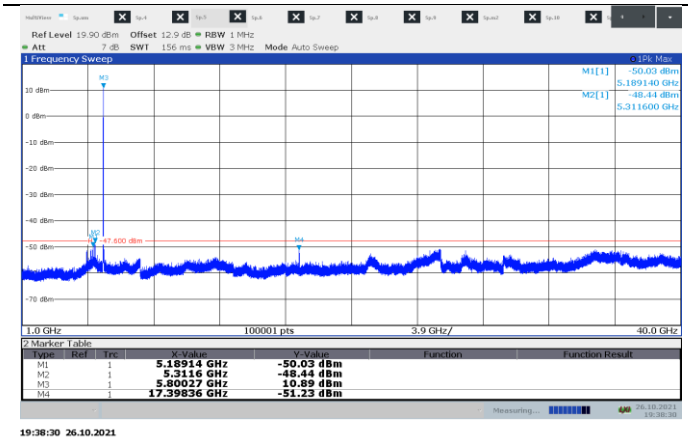


Figure 8.8-7: *Conducted peak spurious emissions 1 - 40 GHz on mid channel 10 MHz sample plot*

Figure 8.8-8: *Conducted average spurious emissions 1- 6 GHz on mid channel 10 MHz sample plot*

Figure 8.8-9 *Conducted average spurious emissions 6-40 GHz on mid channel 10 MHz sample plot*

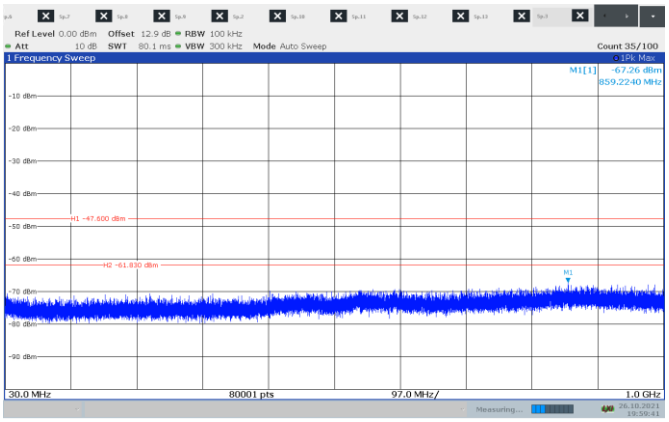


Figure 8.8-10: *Conducted peak spurious emissions 30 MHz -1 GHz on high channel 10 MHz sample plot*

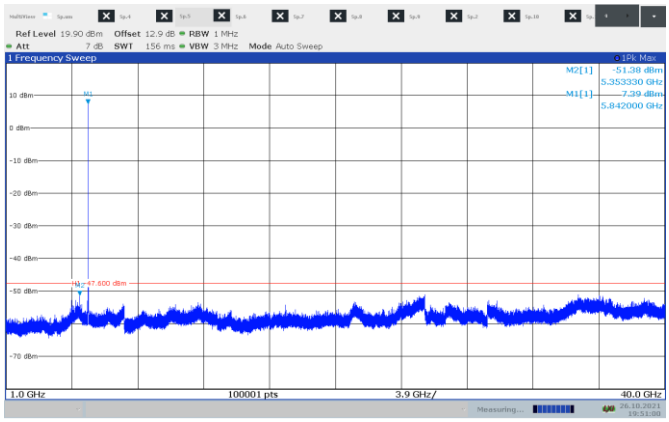


Figure 8.8-11: : *Conducted peak spurious emissions 1 - 40 GHz on high channel 10 MHz sample plot*

Figure 8.8-12: : *Conducted average spurious emissions 1- 6 GHz on high channel 10 MHz sample plot*

Test data, continued

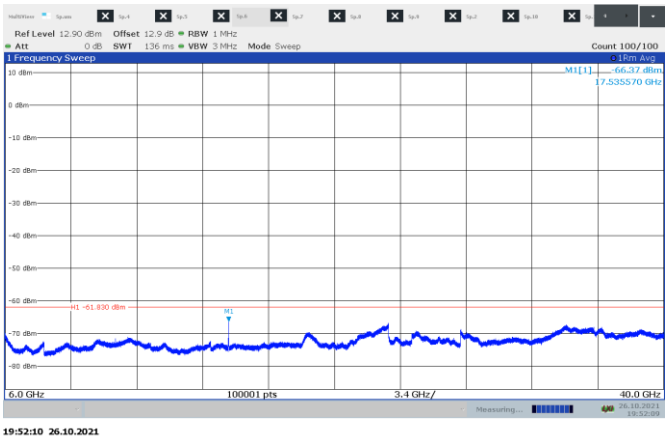


Figure 8.8-13: : *Conducted average spurious emissions 6-40 GHz on high channel 10 MHz sample plot*

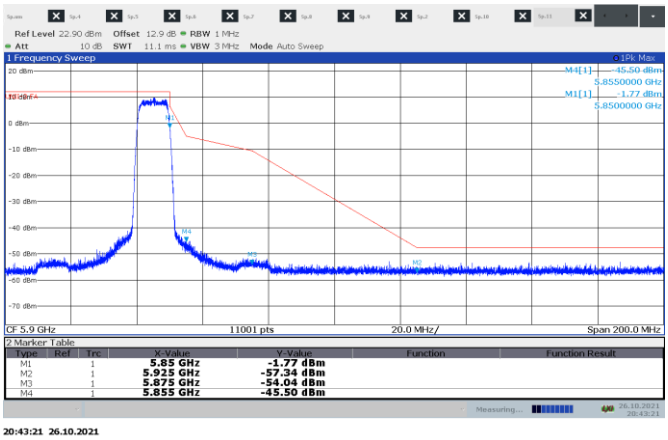


Figure 8.8-14: *Conducted Banedge mask on high channel 10 MHz channel sample plot*

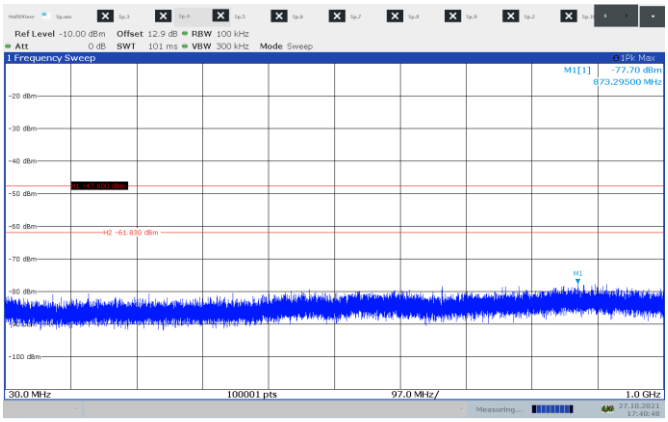


Figure 8.8-15: *Conducted peak spurious emissions 30 MHz - 1 GHz on 5830 MHz channel 10 MHz sample plot*

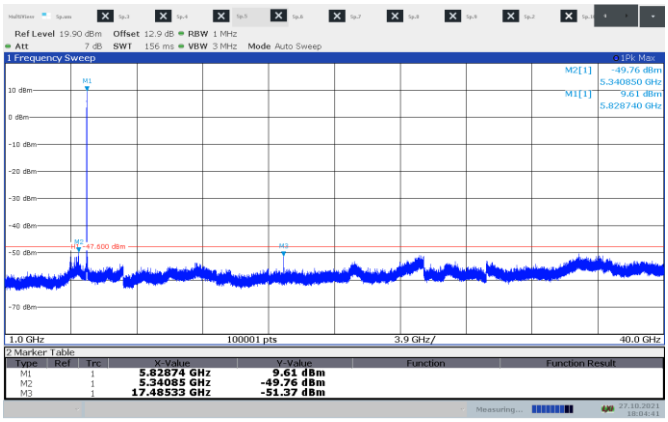


Figure 8.8-16: : *Conducted peak spurious emissions 1- 40 GHz on 5830 MHz channel 10 MHz sample plot*

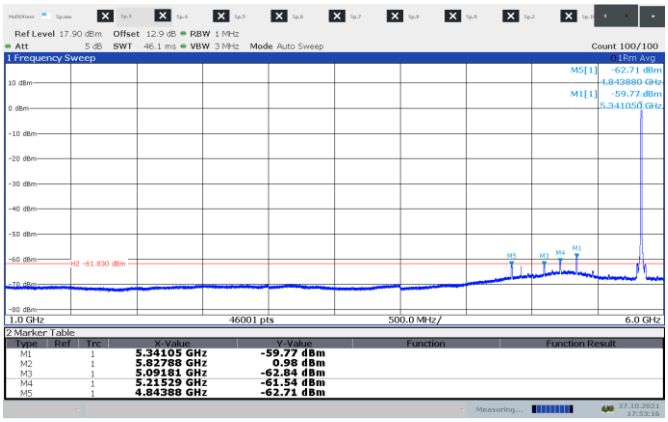


Figure 8.8-17: *Conducted average spurious emissions 1- 6 GHz on 5830 MHz channel 10 MHz sample plot*

Figure 8.8-18: *Conducted average spurious emissions 6-40 GHz on 5830 MHz channel 10 MHz sample plot*

Test data, continued

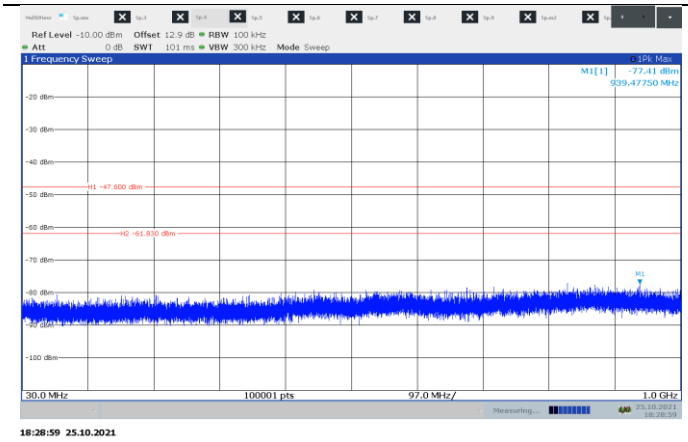


Figure 8.8-19: *Conducted peak spurious emissions 30 MHz -1 GHz on low channel 20 MHz sample plot*

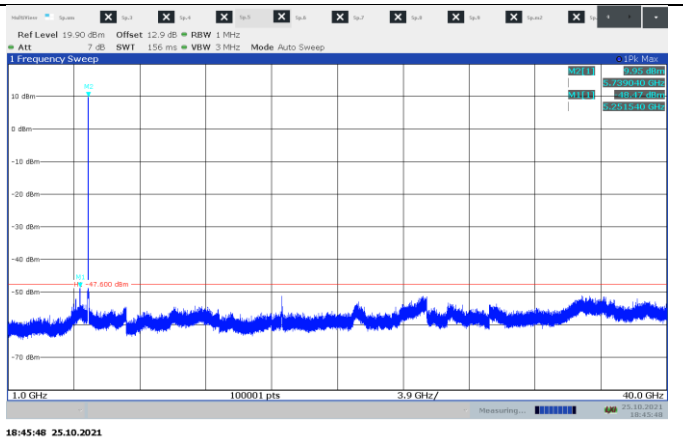


Figure 8.8-20: *Conducted peak spurious emissions 1- 40 GHz on low channel 20 MHz sample plot*

Figure 8.8-21: *Conducted average spurious emissions 1- 6 GHz on low channel 20 MHz sample plot*

Figure 8.8-22: :*Conducted average spurious emissions 6 -40 GHz on low channel 20 MHz sample plot*

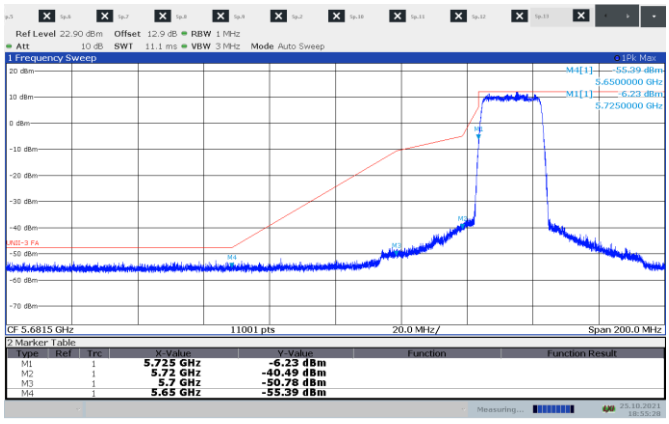


Figure 8.8-23 *Conducted Banedge mask on low channel 20 MHz channel sample plot*

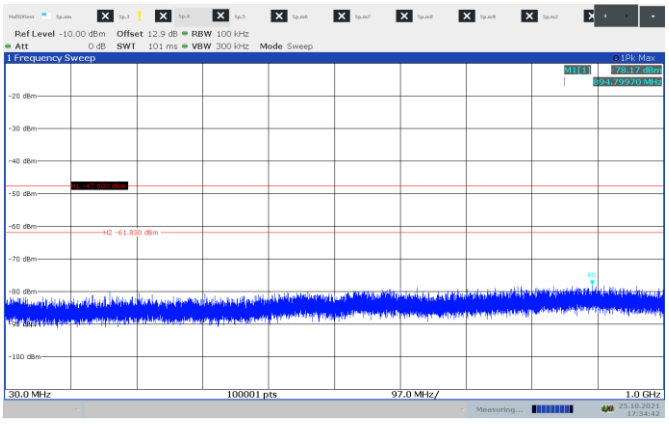


Figure 8.8-24: *Conducted peak spurious emissions 30 MHz -1 GHz on mid channel 20 MHz sample plot*

Test data, continued

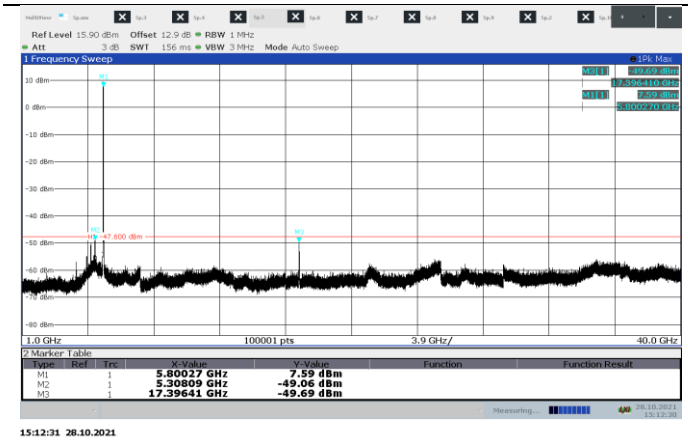


Figure 8.8-25: *Conducted peak spurious emissions 1 - 40 GHz on mid channel 20 MHz sample plot*

Figure 8.8-26: *Conducted average spurious emissions 1- 6 GHz on mid channel 20 MHz sample plot*

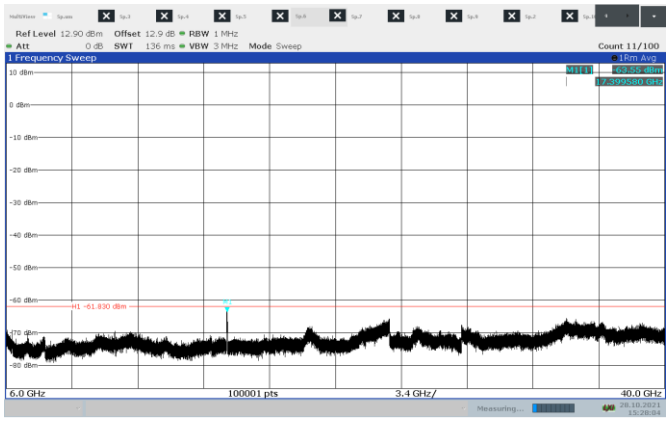


Figure 8.8-27 *Conducted average spurious emissions 6-40 GHz on mid channel 20 MHz sample plot*

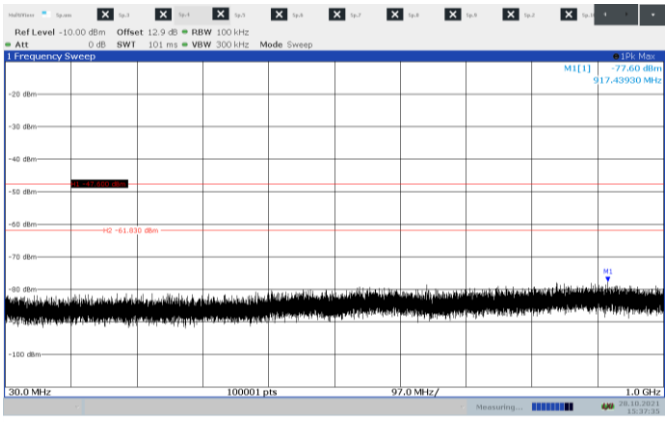


Figure 8.8-28: *Conducted peak spurious emissions 30 MHz -1 GHz on high channel 20 MHz sample plot*

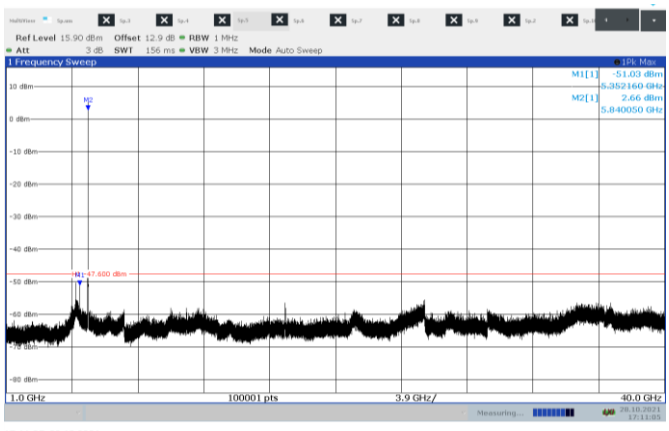


Figure 8.8-29: : *Conducted peak spurious emissions 1 - 40 GHz on high channel 20 MHz sample plot*

Figure 8.8-30: : *Conducted average spurious emissions 1- 6 GHz on high channel 20 MHz sample plot*

Test data, continued

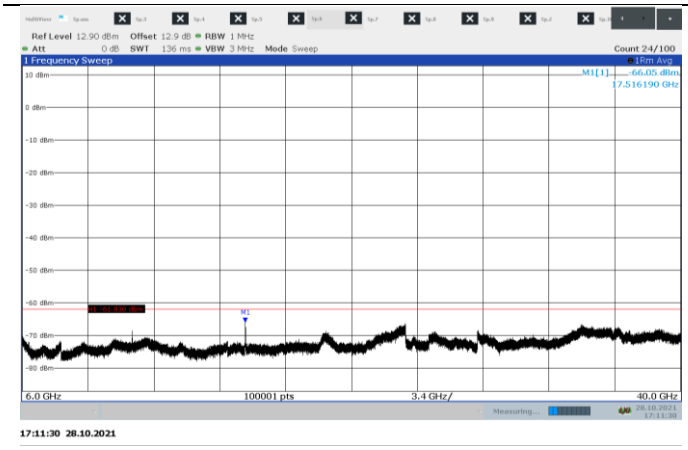


Figure 8.8-31: *Conducted average spurious emissions 6-40 GHz on high channel 20 MHz sample plot*

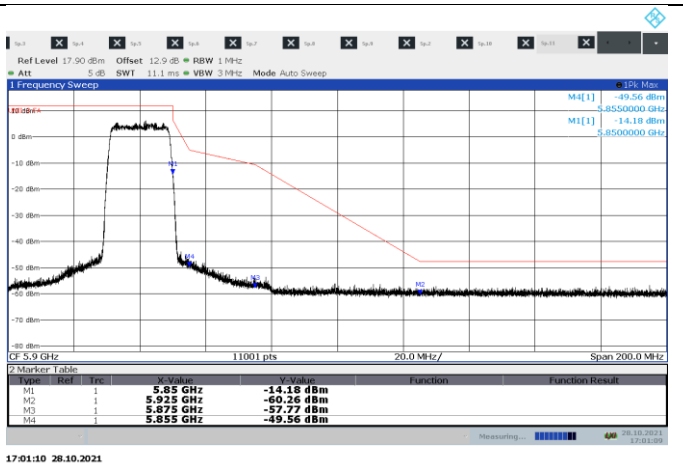


Figure 8.8-32: *Conducted Banedge mask on high channel 20 MHz channel sample plot*

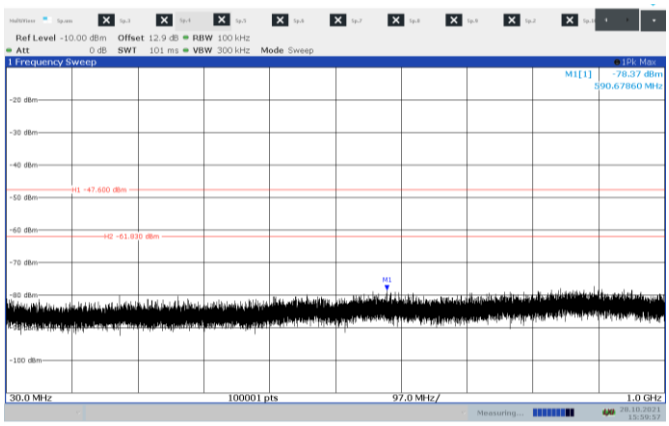


Figure 8.8-33: *Conducted peak spurious emissions 30 MHz - 1 GHz on 5830 MHz channel 20 MHz sample plot*

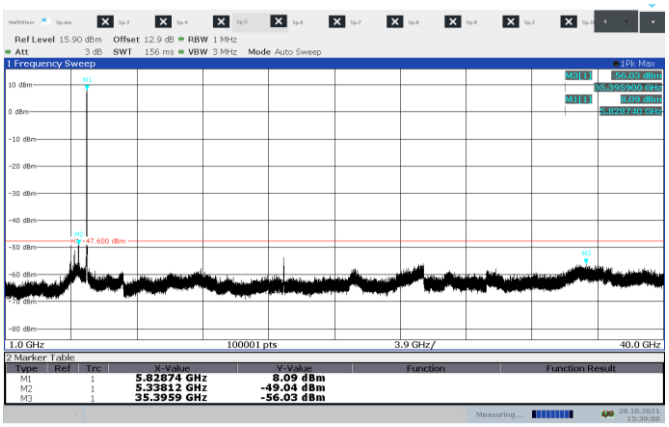


Figure 8.8-34: *Conducted peak spurious emissions 1- 40 GHz on 5830 MHz channel 20 MHz sample plot*

Figure 8.8-35: : *Conducted average spurious emissions 1- 6 GHz on 5830 MHz channel 20 MHz sample plot*

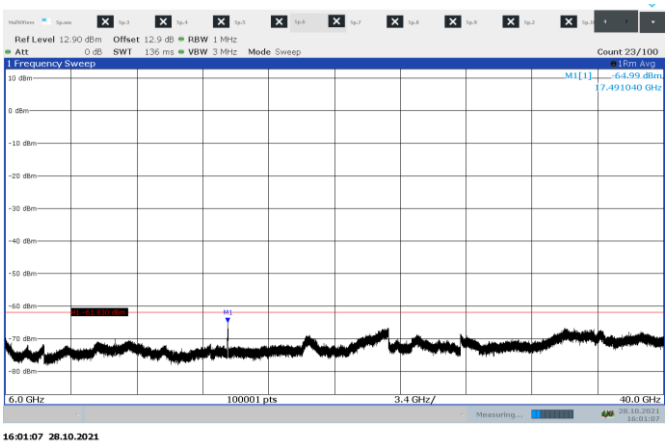


Figure 8.8-36: *Conducted average spurious emissions 6-40 GHz on 5830 MHz channel 20 MHz sample plot*

Test data, continued

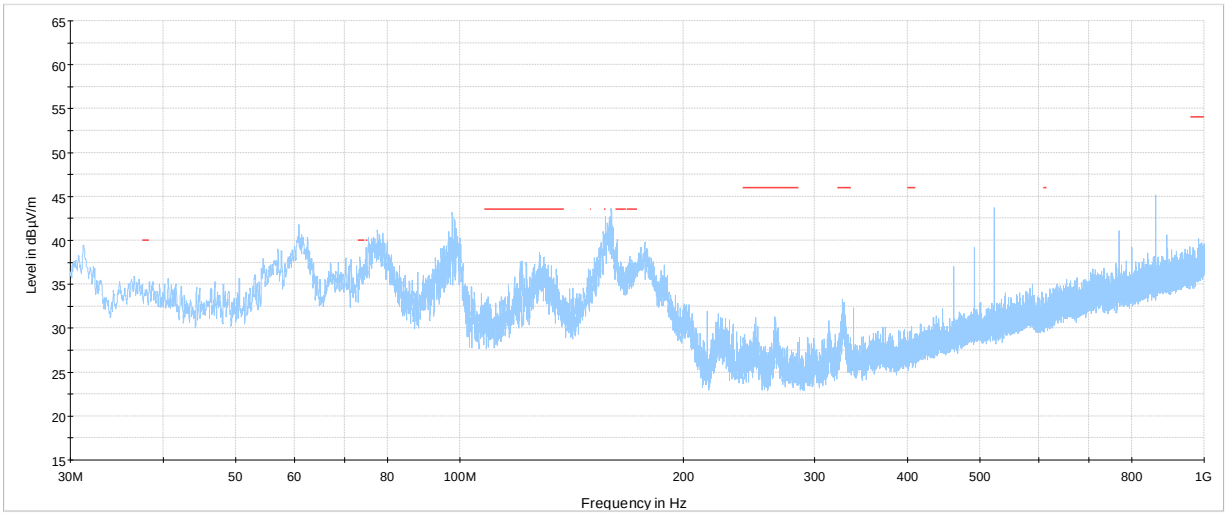


Figure 8.8-37: *Cabinet spurious emissions 30 MHz – 1 GHz, 10 MHz Channel*

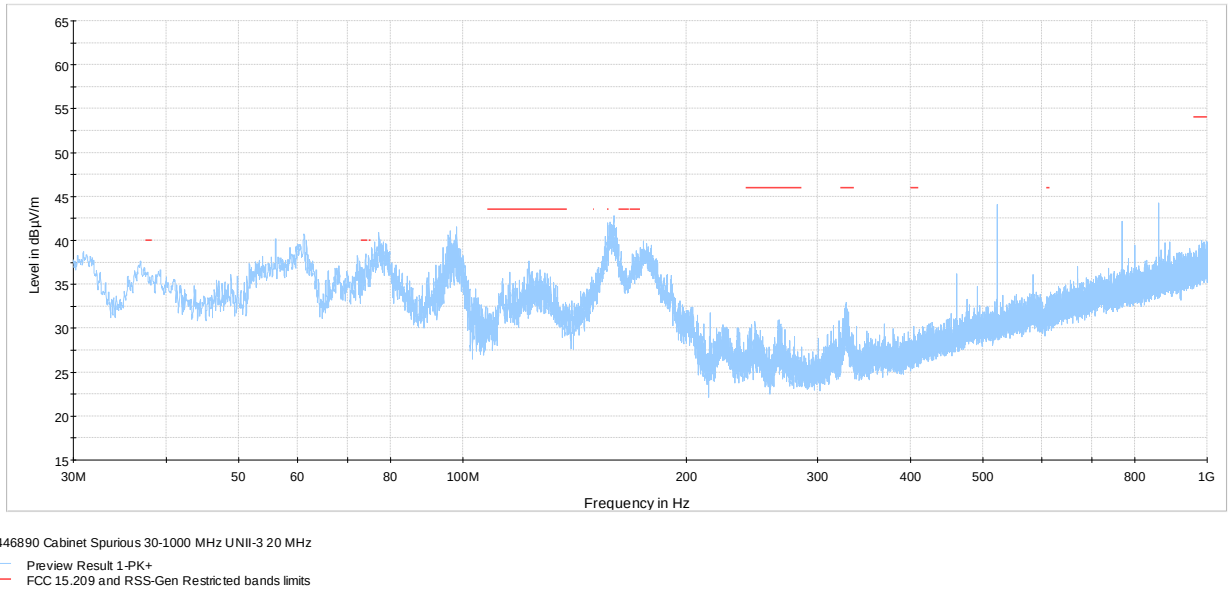
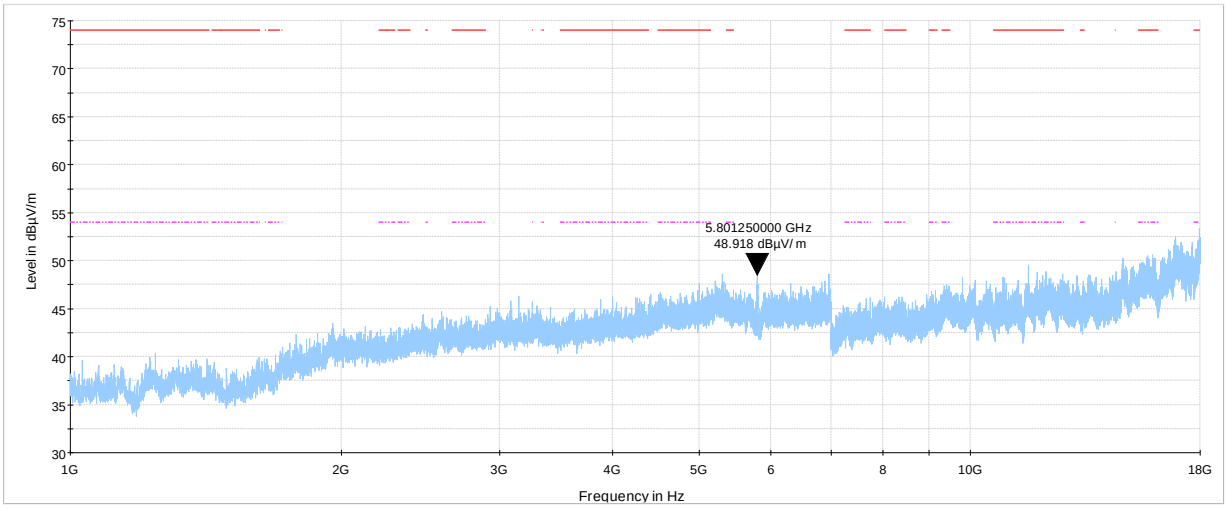


Figure 8.8-38: *Cabinet spurious emissions 30 MHz – 1 GHz, 20 MHzChannel*

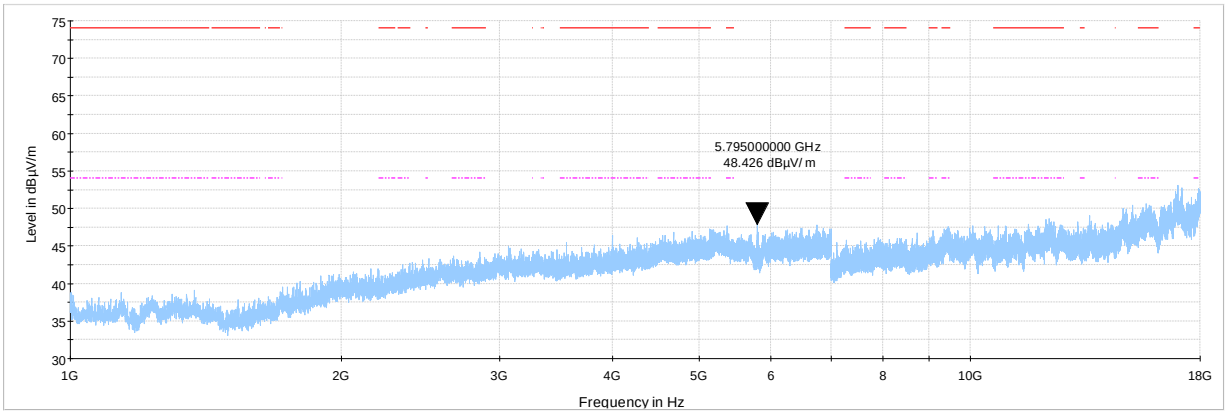
Note: All emissions above restricted bands are EMC digital noise. EUT is class A unit.

Test data, continued



NEX-446890 Cabinet Spurious 1 - 18 GHz UNII-3 10 MHz
Preview Result 1-PK+
FCC 15.209 and RSS-Gen Restricted bands peak limits
FCC 15.209 and RSS-Gen Restricted bands average limits

Figure 8.8-39: *Cabinet spurious emissions 1 – 18 GHz, 10 MHz Channel*



NEX-446890 Cabinet Spurious 1 - 18 GHz UNII-3 20 MHz
Preview Result 1-PK+
FCC 15.209 and RSS-Gen Restricted bands peak limits
FCC 15.209 and RSS-Gen Restricted bands average limits

Figure 8.8-40: *Cabinet spurious emissions 1 – 18 GHz, 20 MHz Channel*

Test data, continued

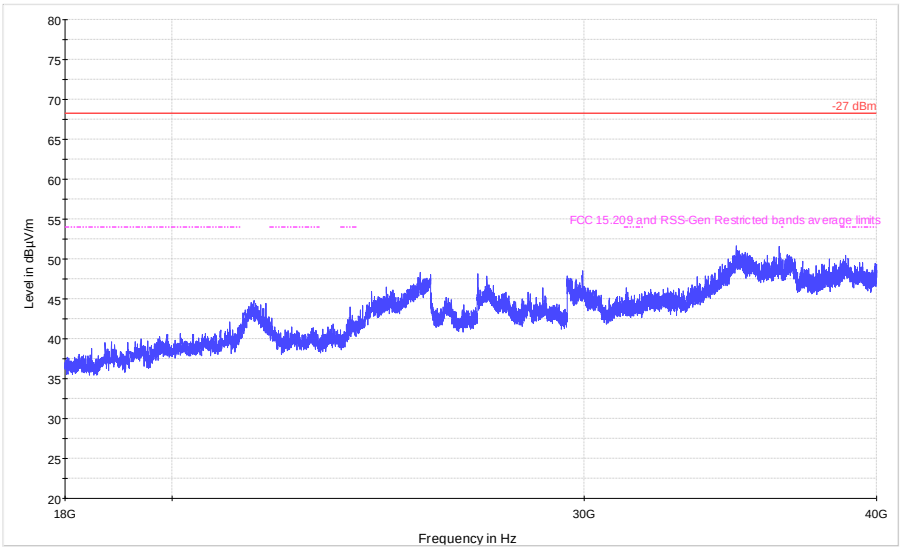


Figure 8.8-41: *Cabinet spurious emissions 1 8 - 40 GHz, 10 MHz Channel*

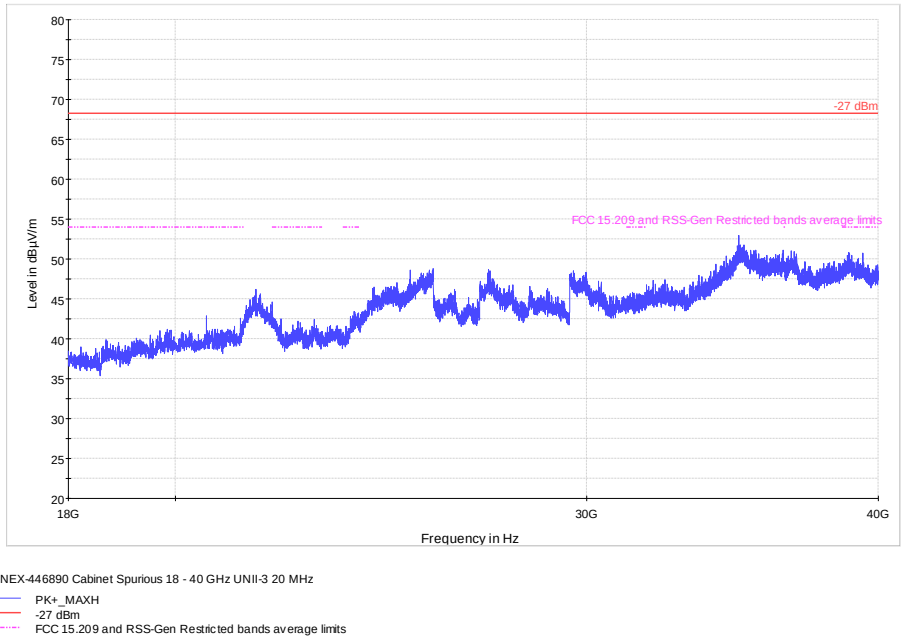


Figure 8.8-42: *Cabinet spurious emissions 18 – 40 GHz, 20 MHz Channel*

8.9 Frequency stability

8.9.1 References, definitions and limits

FCC §15.407:

(g) Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the users manual.

8.9.2 Test summary

Verdict	Pass		
Tested by	Fahar Abdul Sukkoor	Test date	October 29, 2021

8.9.3 Observations, settings and special notes

Frequency stability test was performed as per ANSI C63.10, Clause 6.8 and 789033 D02, Clause II(A)(3). Spectrum analyser settings:

Resolution bandwidth:	1% of bandwidth
Video bandwidth:	3 x RBW
Detector mode:	Peak
Trace mode:	Max Hold

8.9.4 Test data

Table 8.9-1: *Frequency drift measurement*

Test conditions	Frequency, GHz	Drift, Hz
+60 °C, Nominal	5.800003041	-23
+50 °C, Nominal	5.800004143	-1125
+40 °C, Nominal	5.800004171	-1153
+30 °C, Nominal	5.800002588	430
+20 °C, +15 %	5.800001422	1596
+20 °C, Nominal	5.800003018	*Reference*
+20 °C, −15 %	5.800000625	2393
+10 °C, Nominal	5.800004287	-1269
0 °C, Nominal	5.800003511	-493
−10 °C, Nominal	5.800003177	-159
−20 °C, Nominal	5.800003177	-159
−30 °C, Nominal	5.800004171	-1153
−40 °C, Nominal	5.800003041	-23

Test data, continued

Table 8.9-2: *Lower band edge drift calculation*

Modulation	−26 dBc lower cross point, GHz	Max negative drift, Hz	Drifted lower cross point, GHz	Band edge, GHz	Margin, MHz
QPSK	5.7251754	1269	5.725174131	5.725	0.17
64QAM	5.7251689	1269	5.725167631	5.725	0.17

Notes: Drifted lower cross point = −26 dBc lower cross point – max negative drift.

Table 8.9-3: *Upper band edge drift calculation*

Modulation	−26 dBc upper cross point, GHz	Max positive drift, Hz	Drifted upper cross point, GHz	Band edge, GHz	Margin, MHz
QPSK	5.8498363	2393	5.849838693	5.850	1.6
64QAM	5.8498050	2393	5.849807393	5.850	1.9

Notes: Drifted upper cross point = −26 dBc upper cross point + max positive drift.

Section 9 EUT photos

9.1 External photos

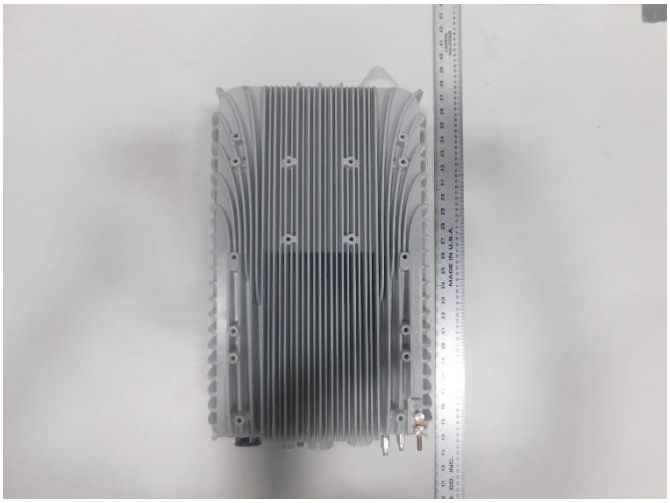


Figure 9.1-1: *Front view photo*

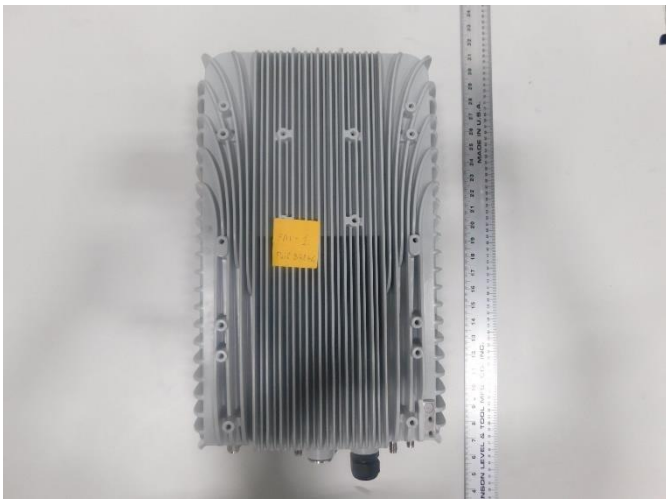


Figure 9.1-2: *Rear view photo*

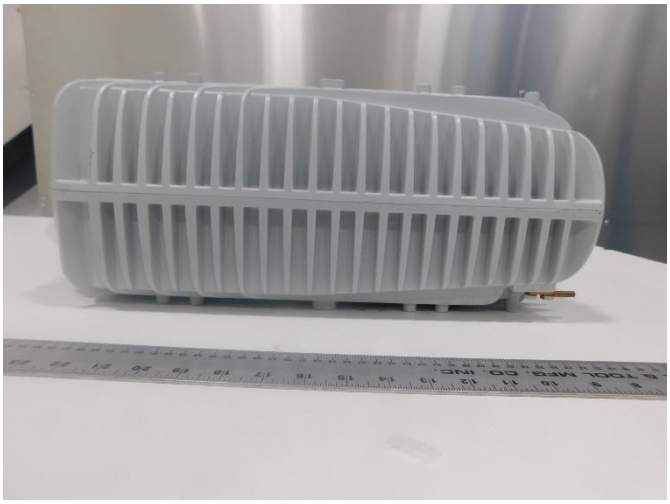


Figure 9.1-3: *Side view photo*

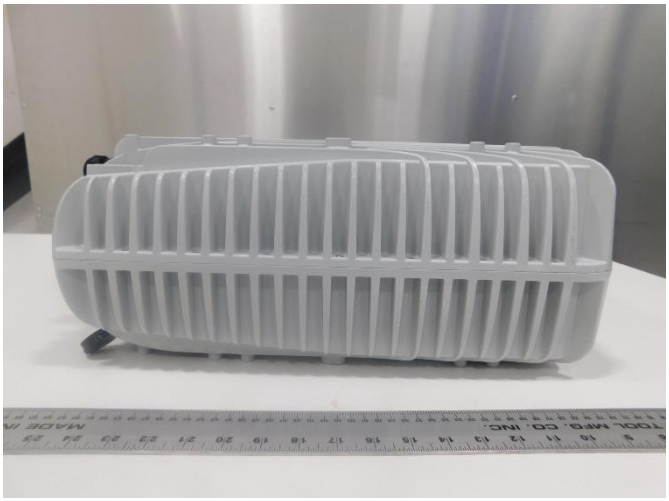


Figure 9.1-4: *Side view photo*

External photos continued

Figure 9.1-5: *Top view photo*

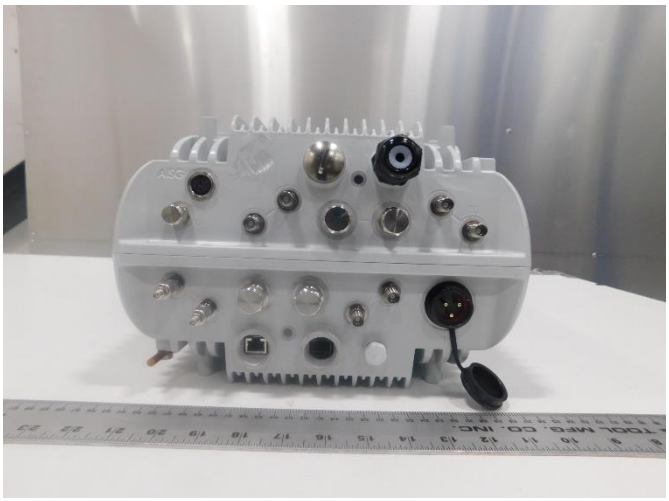


Figure 9.1-6:*Bottom view photo*

End of the test report