

RADIO TEST REPORT

Report ID:

REP071320

Project number:

PRJ0069926

Type of assessment:

Final product testing

Type of radio equipment:

Radar

Applicant:

Define Design Deploy Corp. dba D3

Description of product:

DesignCore mmWave Radar Sensor

Model/HVIN:

RS-6843AOP

Product marketing name (PMN):

RS-6843AOP

FCC identifier:

FCC ID: 2ASVZ-02

ISED certification number:

IC: 30644-02

Specifications:

- ◆ FCC 47 CFR Part 15 Subpart C, §15.255
- ◆ RSS-210 Issue 11, June 2024, Annex J

Date of issue: December 19, 2024

Tarek Elkholy, EMC/RF Specialist

Tested by

David Duchesne, EMC/RF Lab Manager

Reviewed by



Signature



Signature

Nemko Canada Inc., a testing laboratory, is accredited by ANSI National Accreditation Board (ANAB).
The tests included in this report are within the scope of this accreditation.
The ANAB symbol is an official symbol of the ANSI National Accreditation Board, used under licence.

ANAB File Number: AT-3195 (Ottawa/Almonte); AT-3193 (Pointe-Claire); AT-3194 (Cambridge)

Lab locations

Company name	Nemko Canada Inc.
Facilities	<p>Ottawa site: 303 River Road, Ottawa, ON, Canada, K1V 1H2 Tel: +1 613 737 9680, Fax: +1 613 737 9691</p> <p>Montréal site: 292 Labrosse Avenue, Pointe-Claire, QC, Canada, H9R 5L8 Tel: +1 514 694 2684, Fax: +1 514 694 3528</p> <p>Cambridge site: 1-130 Saltsman Drive, Cambridge, ON, Canada, N3E 0B2 Tel: +1 519 650 4811</p>
Test site registration number:	<ul style="list-style-type: none"> – CA2040 (Ottawa) – CA2041 (Montreal) – CA0101 (Cambridge)
Website	www.nemko.com

Limits of responsibility

Note that this report's results 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 this report.

This test report has been completed following the requirements of ISO/IEC 17025. All results contained in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

Copyright notification

Nemko Canada Inc. authorizes the applicant to reproduce this report, provided it is reproduced in its entirety and for use by the company's employees only. Any use that a third party makes of this report, or any reliance on, or decisions made based on it, is such third parties' responsibility.

Nemko Canada Inc. accepts no responsibility for damages, if any, suffered by any third party due to decisions made or actions based on this report.

© Nemko Canada Inc.

Table of Contents

Table of Contents	3
Section 1 Report summary	4
1.1 Test specifications	4
1.2 Test methods	4
1.3 Exclusions	4
1.4 Statement of compliance.....	4
1.5 Test report revision history.....	4
Section 2 Engineering considerations	5
2.1 Modifications incorporated in the EUT for compliance	5
2.2 Technical judgment	5
2.3 Model variant declaration	5
2.4 Deviations from laboratory tests procedures	5
Section 3 Test conditions	6
3.1 Atmospheric conditions	6
3.2 Power supply range	6
Section 4 Information provided by the applicant	7
4.1 Disclaimer	7
4.2 Applicant / Manufacturer	7
4.3 EUT information	7
4.4 Radio technical information.....	7
4.5 EUT setup details	8
Section 5 Summary of test results	9
5.1 location	9
5.2 Testing period.....	9
5.3 Sample information	9
5.4 FCC test results	9
5.5 ISED test results	10
Section 6 Test equipment.....	11
6.1 Test equipment list	11
Section 7 Testing data	13
7.1 Variation of power source	13
7.2 Number of frequencies.....	14
7.3 Antenna requirement	16
7.4 AC power line conducted emissions limits.....	17
7.5 Radiated power limits.....	20
7.6 Limits on spurious emissions	24
7.7 Frequency stability	31
Section 8 Test setup diagrams	32
8.1 Radiated emissions set-up for frequencies below 1 GHz	32
8.2 Radiated emissions set-up for frequencies above 1 GHz	32

Section 1 Report summary

1.1 Test specifications

FCC 47 CFR Part 15 Subpart C, Clause 15.255	Operation within the band 57-71 GHz
RSS-210 Issue 11, June 2024, Annex J	Licence-Exempt Radio Apparatus: Category I Equipment Annex J: Devices operating in the band 57-71 GHz

1.2 Test methods

RSS-Gen, Issue 5, April 2018	General Requirements for Compliance of Radio Apparatus
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.

Determining compliance is based on the results of the compliance measurement, not taking into account measurement uncertainty, in accordance with section 1.3 of ANSI C63.10 v2013.

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
REP071320	December 19, 2024	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

None

2.3 Model variant declaration

There were no model variants declared by the applicant.

2.4 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 $\pm 5\%$, for which the equipment was designed.

Section 4 Information provided by the applicant

4.1 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.

4.2 Applicant / Manufacturer

Applicant name	Define Design Deploy Corp. dba D3
Applicant address	150 Lucius Gordon Drive, West Henrietta, NY, 14586, USA
Manufacturer name	Same as applicant
Manufacturer address	Same as applicant

4.3 EUT information

Product description	DesignCore mmWave Radar Sensor
Model / HVIN	RS-6843AOP
HMN:	RS-6843AOPC
Serial number	40080
Part number	1001593
Power supply requirements	5 V _{DC} (via external 100–240 V _{AC} , 50/60 Hz power adapter)
Product description and theory of operation	A miniature mmWave radar sensor employing an antenna on package system on chip including supporting power supplies and flash memory.

4.4 Radio technical information

Category of Transmission equipment	FMCW mmWave radar sensor
Allocated frequency band	57–71 GHz
Center of transmission	62 GHz
Frequency start	60 GHz
Frequency stop	64 GHz
Field strength, dBμV/m @ 3 m	110.9 dBμV/m
Measured BW (GHz), 99% OBW	3.97 GHz
Type of modulation	FCWM
Transmitter spurious, dBμV/m @ 3 m	83.7 dBμV/m, Peak, at 84.8 GHz
Antenna information	Type: integrated patch antenna, Manufacturer: Texas Instruments, Model: IWR6843AOP, Gain: 5 dBi.

4.5 EUT setup details

4.5.1 Radio exercise details

Operating conditions	The EUT was powered up using the support AC/DC adapter, the support CANUSB adapter was connected to a laptop USB port, Once the EUT was powered up its application was running and it was continuously transmitting, using a term interface at the laptop side the continuous operation was observed.
Transmitter state	Transmitter set into continuous mode.

4.5.2 EUT setup configuration

Table 4.5-1: EUT interface ports

Description	Qty.
4 pins connector	1

Table 4.5-2: Support equipment

Description	Brand name	Serial number, Part number, Model, Revision level
CAN-USB converter	Grid Connect	MN: CANUSB, Rev. 1.02
AC/DC adapter	CUI-INC	PN: SWI18-5-N-P5, MN: SWI18-5-N, Rev. XX
Laptop	Dell	MN: Latitude E6420, DPN: VVF52 A01, SN: 28MCCS1

Table 4.5-3: Inter-connection cables

Cable description	From	To	Length (m)
DC power cable	AC/DC adapter	EUT	0.5
CAN-USB data cable	CAN-USB adapter	EUT	0.5



Figure 4.5-1: Radiated testing block diagram

Section 5 Summary of test results

5.1 location

Test location (s)	Cambridge
-------------------	-----------

5.2 Testing period

Test start date	November 27, 2024	Test end date	December 3, 2024
-----------------	-------------------	---------------	------------------

5.3 Sample information

Receipt date	November 27, 2024	Nemko sample ID number(s)	PRJ00699260001
--------------	-------------------	---------------------------	----------------

5.4 FCC test results

Table 5.4-1: FCC general requirements results

Part	Test description	Verdict
Generic requirements		
§15.207(a)	Conducted limits	Pass ¹
§15.31(e)	Variation of power source	Pass
§15.31(m)	Number of tested frequencies	Pass
§15.203	Antenna requirement	Pass

Notes: ¹ The EUT is DC powered, the test was performed using the support AC/DC adapter.

Table 5.4-2: FCC Part 15 Subpart C, intentional radiators test results

Part	Test description	Verdict
§15.255(c)	Equivalent isotopically radiated power (EIRP)	Pass
§15.255(d)	Transmitter spurious emissions	Pass
§15.255(e)	Peak conducted output power	Not applicable
§15.255(f)	Frequency stability	Pass

Notes: ¹EUT is not a Fixed, point-to-point operating system

5.5 ISED test results

Table 5.5-1: ISED general requirements results

Part	Test description	Verdict
RSS-Gen, 6.7	Occupied bandwidth	Pass
RSS-Gen, 6.9	Operating bands and selection of test frequencies	Pass
RSS-Gen, 7.3	Receiver radiated emission limits	Not applicable ¹
RSS-Gen, 7.4	Receiver conducted emission limits	Not applicable ¹
RSS-Gen, 8.8	AC powerline conducted emissions limits	Pass ²

Notes: ¹According to sections 5.2 and 5.3 of RSS-Gen, Issue 5 the EUT does not have a stand-alone receiver neither scanner receiver, therefore exempt from receiver requirements.
²The EUT is DC powered, the test was performed using the support AC/DC adapter

Table 5.5-2: ISED RSS-210 Annex J requirements results

Clause	Test description	Verdict
J.3	Equivalent isotopically radiated power (EIRP)	Pass
J.4, J.5	Spurious emissions	Pass
J.6	Frequency stability	Pass

Notes: None

Section 6 Test equipment

6.1 Test equipment list

Table 6.1-1: Equipment list

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Receiver/spectrum analyzer	Rohde & Schwarz	ESR26	FA002969	1 year	May 17, 2025
3 m EMI test chamber	TDK	SAC-3	FA003012	1 year	January 22, 2025
Flush mount turntable	SUNAR	FM2022	FA003006	—	NCR
Controller	SUNAR	SC110V	FA002976	—	NCR
Antenna mast	SUNAR	TLT2	FA003007	—	NCR
Bilog antenna (30–2000 MHz)	SUNAR	JB1	FA003009	1 year	April 24, 2025
Horn antenna (1–18 GHz)	ETS Lindgren	3117	FA002911	1 year	May 16, 2025
Preamp (1–18 GHz)	ETS Lindgren	124334	FA002956	1 year	April 2, 2025
Horn antenna (18–40 GHz)	EMCO	3116B	FA002948	1 year	April 4, 2025
Preamp 18-40 GHz	None	PA1840	FA003323	1 year	April 2, 2025
Standard gain horn (50-75 GHz)	Mi-Wave	261V-25/385	FA003270	—	NCR
Hamonic mixer (50-75 GHz)	Rohde & Schwarz	FS-Z75	FA003263	3years	Oct 26, 2026
Standard gain horn (75-110 GHz)	Mi-Wave	261W-25/387	FA003271	—	NCR
Hamonic mixer (75-110 GHz)	Rohde & Schwarz	FS-Z110	FA003262	3years	Sep 28, 2026
Hamonic mixer (110-170 GHz)	Rohde & Schwarz	FS-Z170	FA003296	3years	Sep 26, 2026
Standard gain horn (110-170 GHz)	Mi-Wave	261D-25/387	FA003272	—	NCR
Hamonic mixer (140-220 GHz)	Rohde & Schwarz	FS-Z220	FA003269	3years	Sep 21, 2026
Standard gain horn (110-170 GHz)	Mi-Wave	261D-25/387	FA003272	—	NCR
Temperature humidity Chamber	LIK	LKPTH-100E	FA003430	-	NCR
Temperature meter	VAISALA	MI70/ HMP76B	FA003318	1 year	June 12, 2025
50 Ω SMA coax cable	Huber + Suhner	None	FA003056	1 year	Mar 1, 2025
50 Ω coax cable	Huber + Suhner	None	FA003402	1 year	July 29, 2025
50 Ω coax cable	Huber + Suhner	None	FA003047	1 year	July 29, 2025
Two-line v-network	Rohde & Schwarz	ENV216	FA002965	1 year	November 30, 2025
50 Ω coax cable	Rohde & Schwarz	None	FA003074	1 year	July 29, 2025
AC Power source	Chroma	61605	FA003034	—	NCR

Note: NCR - no calibration required

All equipment related to the contribution of measurement has been included in this list. Such items include, but are not limited to, cables, attenuators, directional couplers, and pre-amps.

Table 6.1-2: Automation software details

Test description	Manufacturer of Software	Details
Radio/EMC test software	Rohde & Schwarz	EMC32, Software for EMC Measurements, Version 10.60.00

Test equipment, continued

Table 6.1-3: Measurement uncertainty calculations based on equipment list

Measurement	Measurement uncertainty, \pm dB
AC power line conducted emissions	3.33
Radiated spurious emissions (30 MHz to 1 GHz)	4.27
Radiated spurious emissions (1 GHz to 6 GHz)	4.74
Radiated spurious emissions (6 GHz to 18 GHz)	5.04
Radiated spurious emissions (18 GHz to 26 GHz)	4.47
Radiated spurious emissions (18 GHz to 40 GHz)	4.78
Radiated spurious emissions (40 GHz to 220 GHz)	5.81
RF Output power measurement using Spectrum Analyzer	0.71
Notes: UKAS Lab 34, TIA-603 and ETSI TR 100 028-1&2 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 calculations assume a coverage factor of $K = 2$ with 95% certainty.	

Section 7 Testing data

7.1 Variation of power source

7.1.1 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.

7.1.2 Test summary

Verdict	Pass		
Test date	November 27, 2024	Temperature	23 °C
Tested by	Tarek Elkholy	Air pressure	984 mbar
Test location	Cambridge	Relative humidity	40 %

7.1.3 Observations, settings and special notes

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

- 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.
- For devices, where operating at a supply voltage deviating $\pm 15\%$ 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.
- 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.
- 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.

7.1.4 Test data

The EUT is powered via 5 VDC powered via external external AC adapter, no observed noticeable output power variation.

7.2 Number of frequencies

7.2.1 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.

RSS-Gen, Clause 6.9:

Except where otherwise specified, measurements shall be performed for each frequency band of operation for which the radio apparatus is to be certified, with the device operating at the frequencies in each band of operation shown in table below. The frequencies selected for measurements shall be reported in the test report.

Table 7.2-1: 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.

7.2.2 Test summary

Verdict	Pass		
Test date	November 27, 2024	Temperature	23 °C
Tested by	Tarek Elkholy	Air pressure	984 mbar
Test location	Cambridge	Relative humidity	40 %

7.2.3 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:

- 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.
- 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.
- 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:

- 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).
- 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).
- 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.

7.2.4 Test data

Table 7.2-2: Test channels selection

Start of Frequency range, GHz	End of Frequency range, GHz	Frequency range bandwidth, GHz	Signal description
57	71	14	Transmitter operates between two frequencies: from 60 GHz to 64 GHz with 4 GHz bandwidth

7.3 Antenna requirement

7.3.1 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.

FCC §15.249:

- (b) Fixed, point-to-point operation as referred to in this paragraph shall be limited to systems employing a fixed transmitter transmitting to a fixed remote location. Point-to-multipoint systems, omnidirectional applications, and multiple co-located intentional radiators transmitting the same information are not allowed. Fixed, point-to-point operation is permitted in the 24.05–24.25 GHz band subject to the following conditions
- (3) Antenna gain must be at least 33 dBi. Alternatively, the main lobe beamwidth must not exceed 3.5 degrees. The beamwidth limit shall apply to both the azimuth and elevation planes. At antenna gains over 33 dBi or beamwidths narrower than 3.5 degrees, power must be reduced to ensure that the field strength does not exceed 2500 millivolts/meter.

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.

7.3.2 Test summary

Verdict	Pass		
Test date	November 27, 2024	Temperature	23 °C
Tested by	Tarek Elkholy	Air pressure	984 mbar
Test location	Cambridge	Relative humidity	40 %

7.3.3 Observations, settings and special notes

None

7.3.4 Test data

EUT is professional installed, EUT does not have detachable antenna

Table 7.3-1: Antenna information

Antenna type	Manufacturer	Model number	Maximum gain	Connector type
Integrated patch antenna	Texas Instruments	IWR6843AOP	5 dBi	PCB antenna

7.4 AC power line conducted emissions limits

7.4.1 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 μ H/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 7.4-1: Conducted emissions limit

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

Notes: * - The level decreases linearly with the logarithm of the frequency.

 ** - A linear average detector is required.

7.4.2 Test summary

Verdict	Pass		
Test date	November 27, 2024	Temperature	23 °C
Tested by	Tarek Elkholy	Air pressure	984 mbar
Test location	Cambridge	Relative humidity	40 %

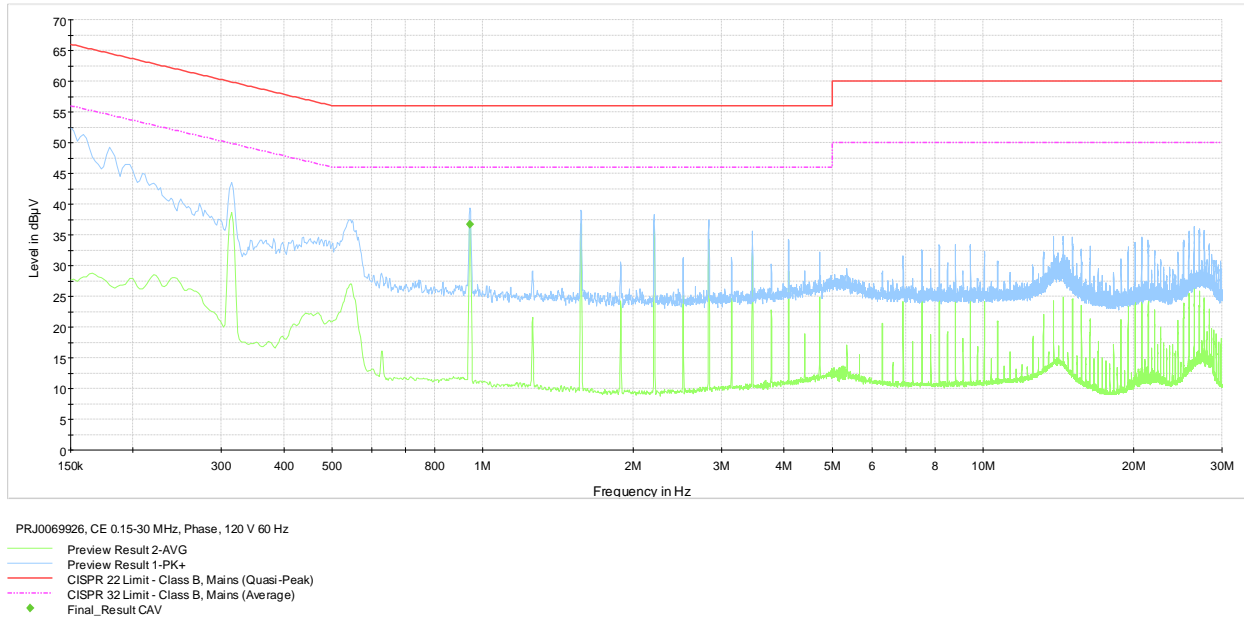
7.4.3 Observations, settings and special notes

Port under test – Coupling device	AC/DC adapter AC power input – Artificial Mains Network (AMN)
EUT power input during test	120 V _{AC} , 60 Hz
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:	<ul style="list-style-type: none"> – 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.

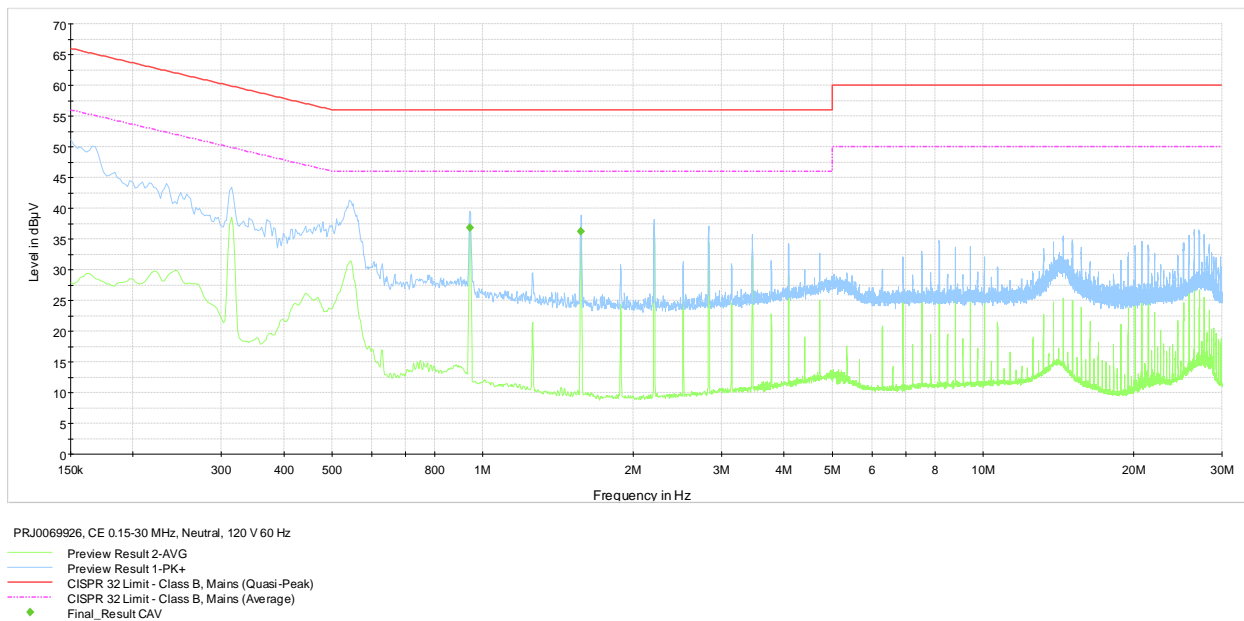
Receiver settings:

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)

7.4.4 Test data



Plot 7.4-1: *Conducted emissions on phase line*



Plot 7.4-2: *Conducted emissions on neutral line*

7.5 Radiated power limits

7.5.1 References, definitions and limits

FCC §15.255:

- (c)(2)(iii) 57.0-64.0 GHz
 (B) The peak EIRP shall not exceed 20 dBm, and the sum of continuous transmitter off-times of at least two milliseconds shall equal at least 16.5 milliseconds within any contiguous interval of 33 milliseconds when operated outdoors:
 (1) As part of a temporary or permanently fixed application; or
 (2) When being used in vehicular applications to perform specific tasks of moving something or someone, except for in-cabin applications;

RSS-210, Annex J

J.3.2 FDS operating in the 57.0-64.0 GHz band shall comply with one of the following limits, depending on the operating condition of the device:

- (b)(iii)
 2. For devices employed for outdoor operation (temporary or permanently fixed application) or vehicular uses (excluding in-cabin applications and operations), the peak e.i.r.p. shall not exceed 20 dBm and the sum of continuous transmitter off-times of at least 2 ms shall equal at least 16.5 ms within any contiguous interval of 33 ms

7.5.2 Test summary

Verdict	Pass		
Test date	December 3, 2024	Temperature	23 °C
Tested by	Tarek Elkholy	Air pressure	988 mbar
Test location	Cambridge	Relative humidity	38 %

7.5.3 Observations, settings and special notes

Radiated measurements were performed at a distance of 3 m.

Spectrum analyzer settings:

Detector mode	Peak
Resolution bandwidth	10 MHz
Video bandwidth	10 MHz
Trace mode	Max Hold

7.5.4 Test data

Table 7.5-1: Fundamental signal emissions field strength limits

Frequency, GHz	Field strength, dBμV/m	EIRP, dBm	Limit, dBm	Margin, dB
60.0-64.0	110.9	15.7	20.0	4.3

Note: The factor of 95.32 dB was used to calculate the EIRP of the fundamental signal

Table 7.5-2: Transmitter off time measurement result

Interval time, ms	Transmitter off-time within the interval, ms	Minimum limit, ms	Margin, ms
33.0	28.5	16.5	12

Test data, continued

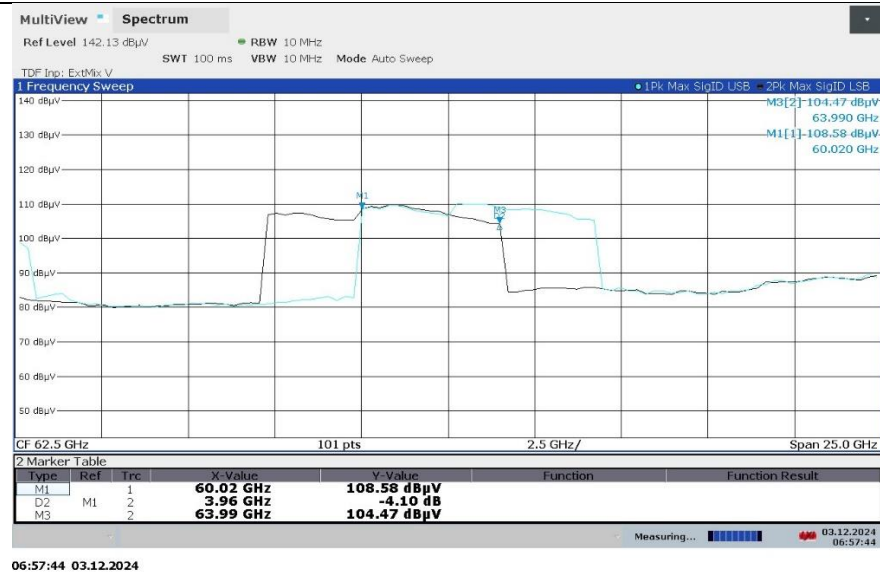


Figure 7.5-1: Fundamental emission view

Note: Fundamental signal is shown from 60.0 – 63.9 GHz (M1 to M3), rest of emissions observed in the plot are images from the RF mixer.

Table 7.5-3: OBW measurement result

OBW start frequency, GHz	OBW stop frequency, GHz	OBW, GHz
60.02	63.99	3.97

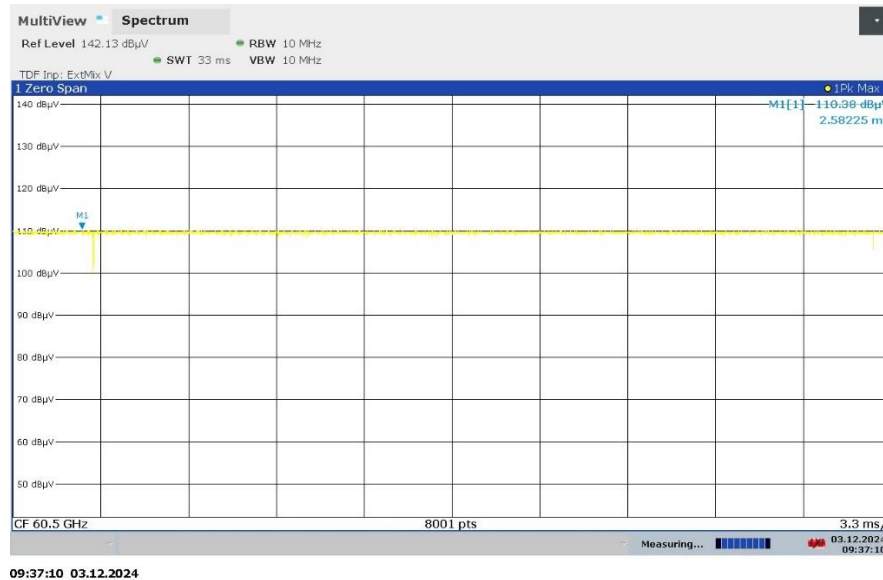


Figure 7.5-2: Field strength of fundamental emissions (bottom part of the signal), Zero span

Test data, continued

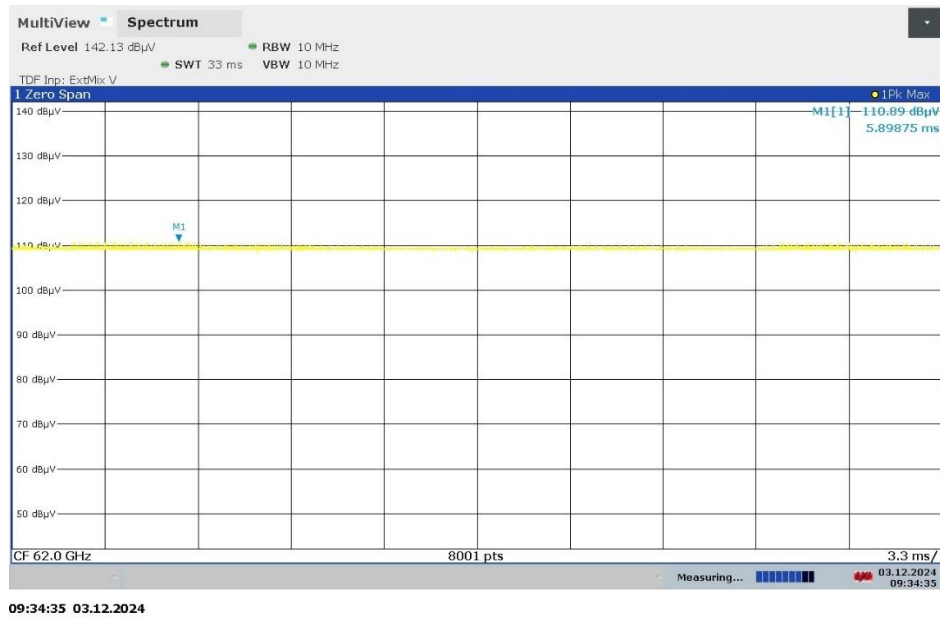


Figure 7.5-3: Field strength of fundamental emissions (middle part of the signal), Zero span

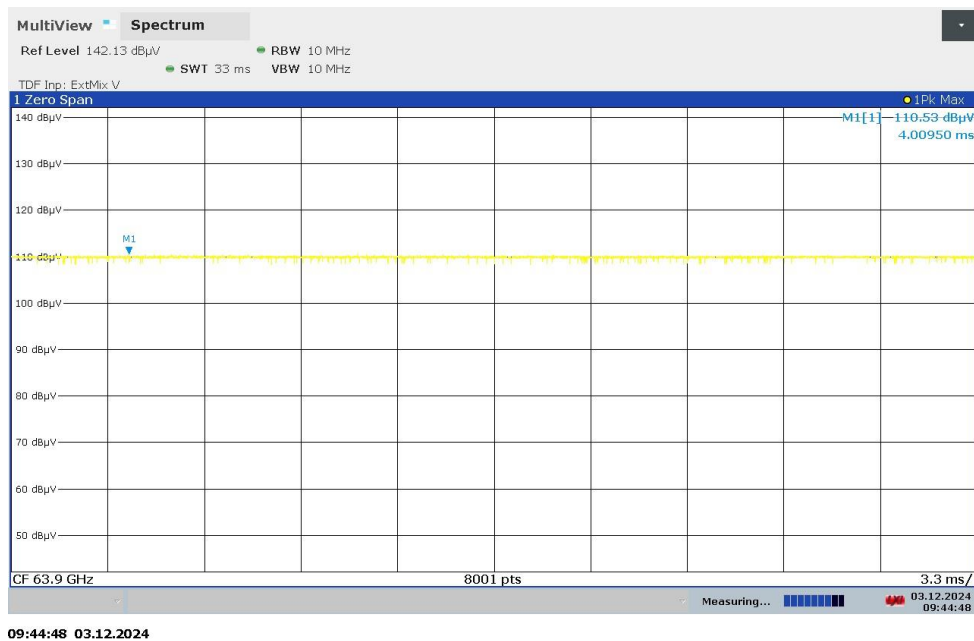
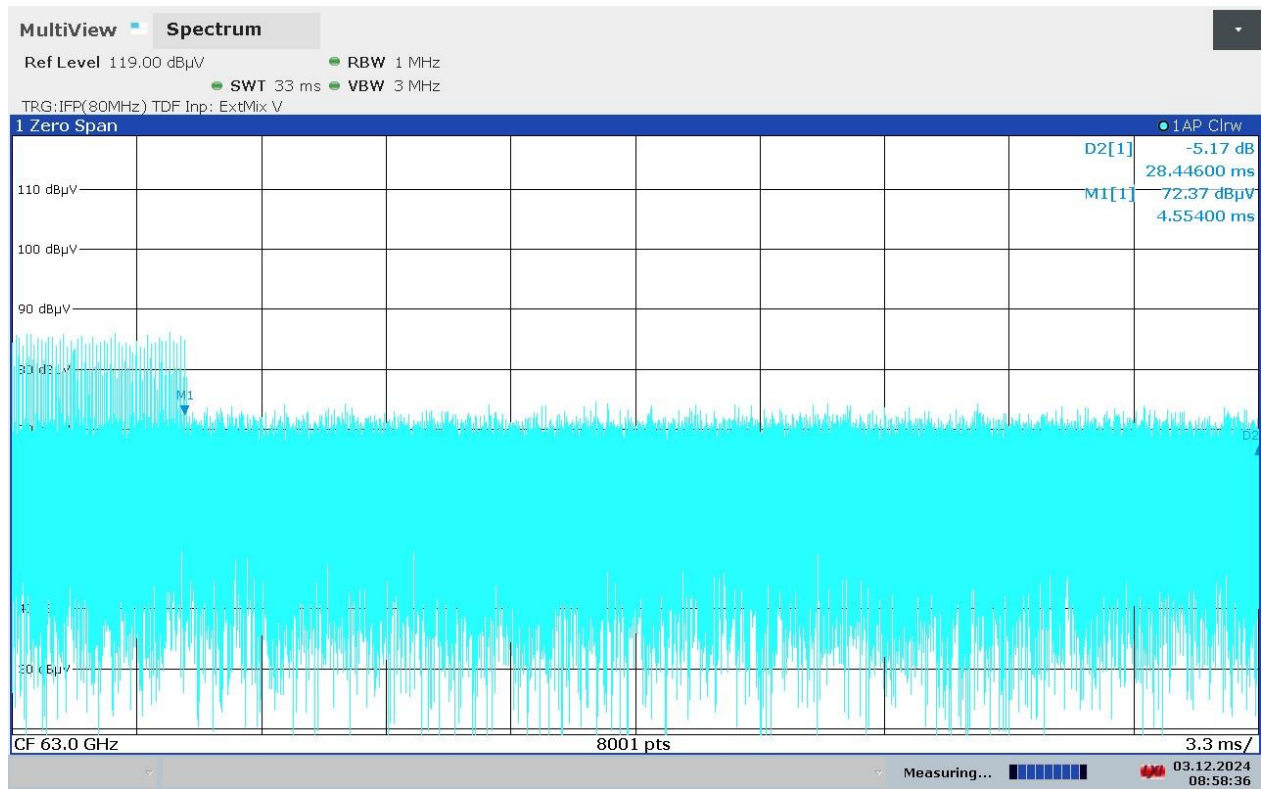


Figure 7.5-4: Field strength of fundamental emissions (top part of the signal), Zero span

Test data, continued



08:58:36 03.12.2024

Figure 7.5-5: Off-time duration within 33 ms interval

7.6 Limits on spurious emissions

7.6.1 References, definitions and limits

FCC §15.255:

- (d)
- (1) The power density of any emissions outside the 57-71 GHz band shall consist solely of spurious emissions.
 - (2) Radiated emissions below 40 GHz shall not exceed the general limits in § 15.209.
 - (3) Between 40 GHz and 200 GHz, the level of these emissions shall not exceed 90 pW/cm² at a distance of 3 meters.
 - (4) The levels of the spurious emissions shall not exceed the level of the fundamental emission.

RSS-210, Annex J.4

Any emissions outside the band 57-71 GHz shall consist solely of spurious emissions and shall not exceed:

- (a) the fundamental emission levels
- (b) the general field strength limits specified in RSS-Gen, General Requirements for Compliance of Radio Apparatus, for emissions below 40 GHz
- (c) 90 pW/cm² at a distance of 3 m for emissions between 40 GHz and 200 GHz

Table 7.6-1: 15.209 and RSS-Gen emissions field strength limits

Frequency, MHz	Field strength of emissions		Measurement distance, m
	μV/m	dBμV/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

7.6.2 Test summary

Verdict	Pass		
Test date	November 27, 2024	Temperature	23 °C
Tested by	Tarek Elkholy	Air pressure	984 mbar
Test location	Cambridge	Relative humidity	40 %

7.6.3 Observations, settings and special notes

- As part of the current assessment, the test range of 9 kHz to 220 GHz harmonic 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.
- The spectrum was searched from 30 MHz to 220 GHz.
- Radiated measurements were performed at a distance of 3 m, except for 18–25 GHz was performed at 1 m, 25–40 GHz was performed at 30 cm, 110–220 GHz was performed at 10 cm to maintain low noise floor.

Spectrum analyser settings for radiated measurements below 1 GHz:

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

Spectrum analyser settings for radiated measurements 1 -40 GHz:

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

Spectrum analyser settings for average radiated measurements 40-220 GHz:

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

7.6.4 Test data

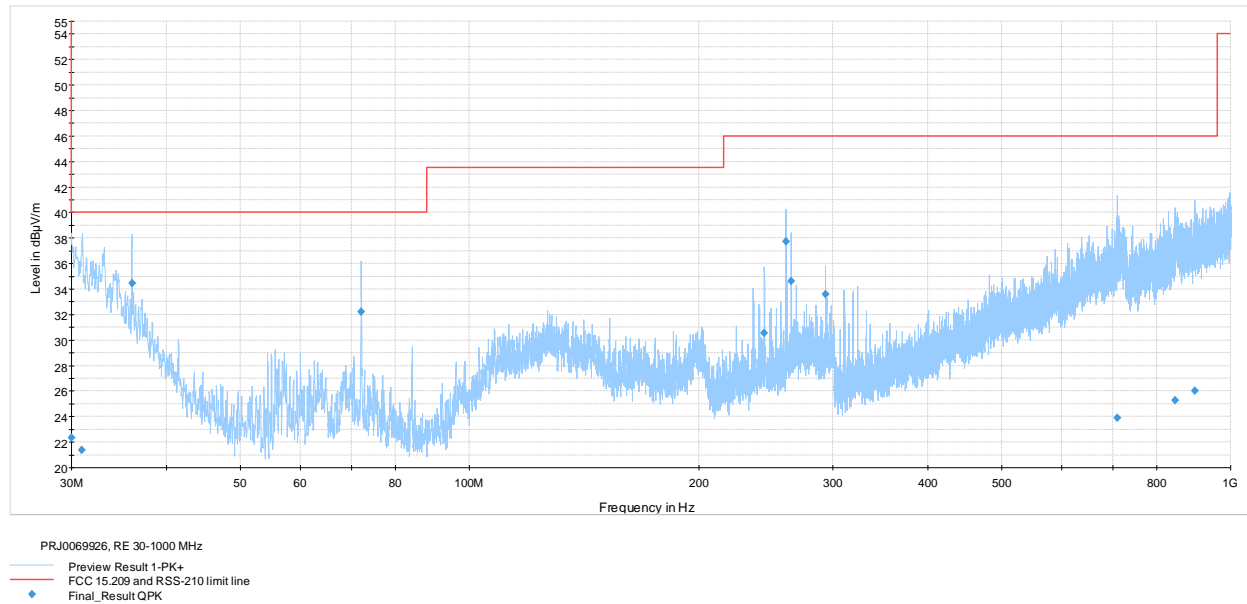


Figure 7.6-1: Radiated spurious emissions below 1000 MHz

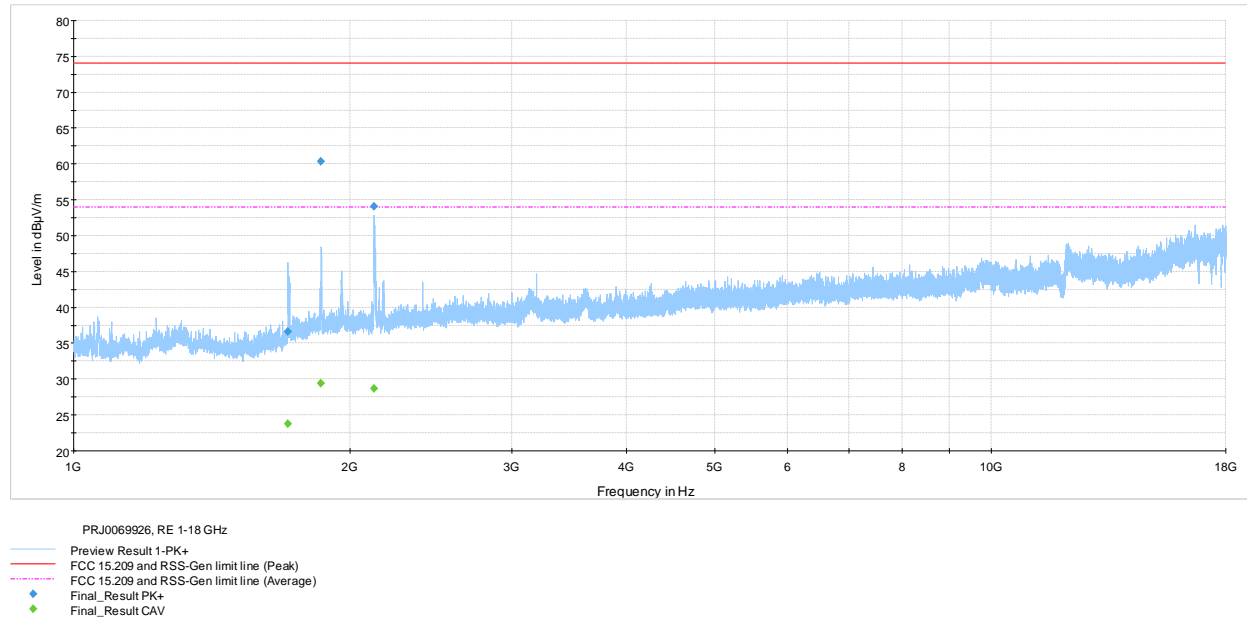


Figure 7.6-2: Radiated spurious emissions above 1-18 GHz

Test data, continued

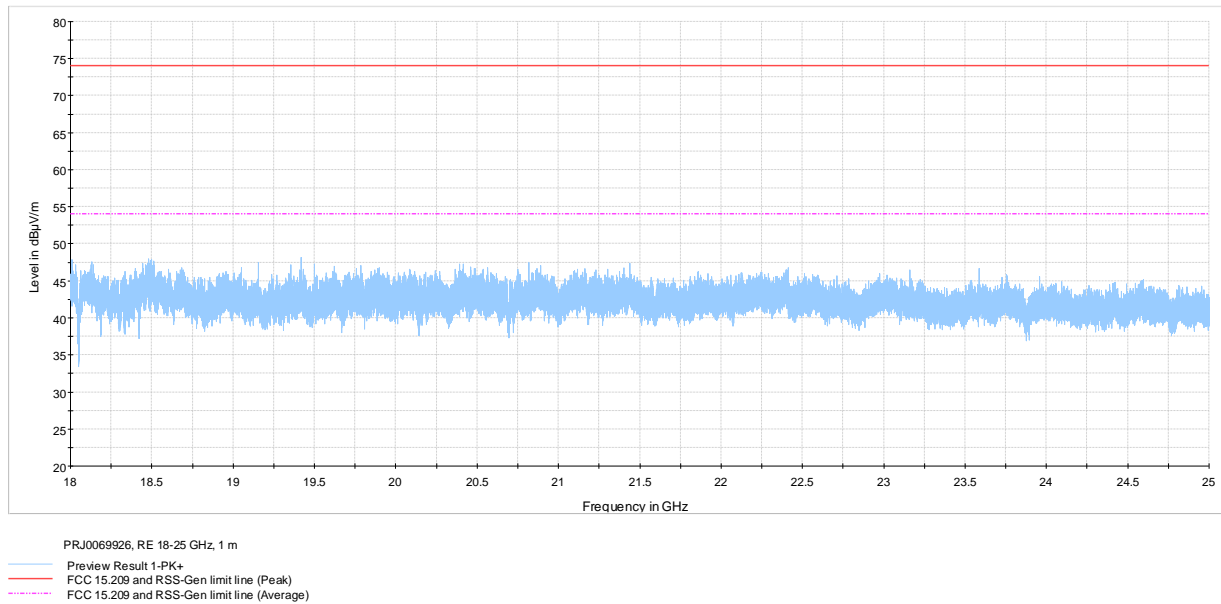


Figure 7.6-3: Radiated spurious emissions 18-25 GHz

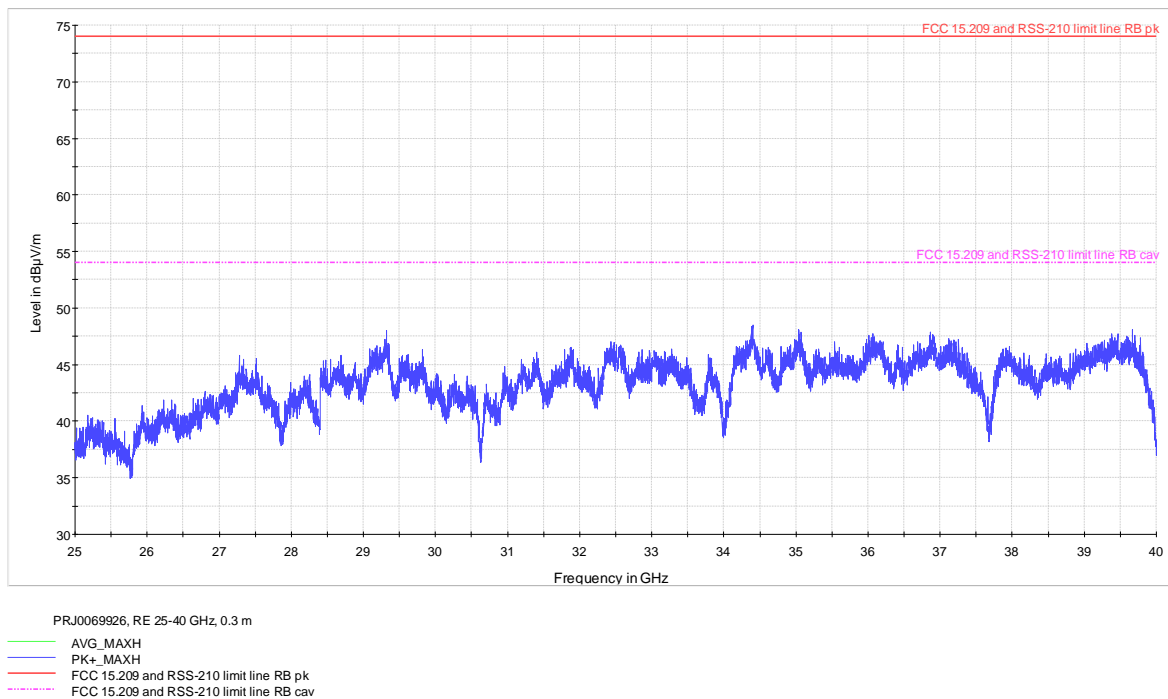


Figure 7.6-4: Radiated spurious emissions 25-40 GHz

Test data, continued

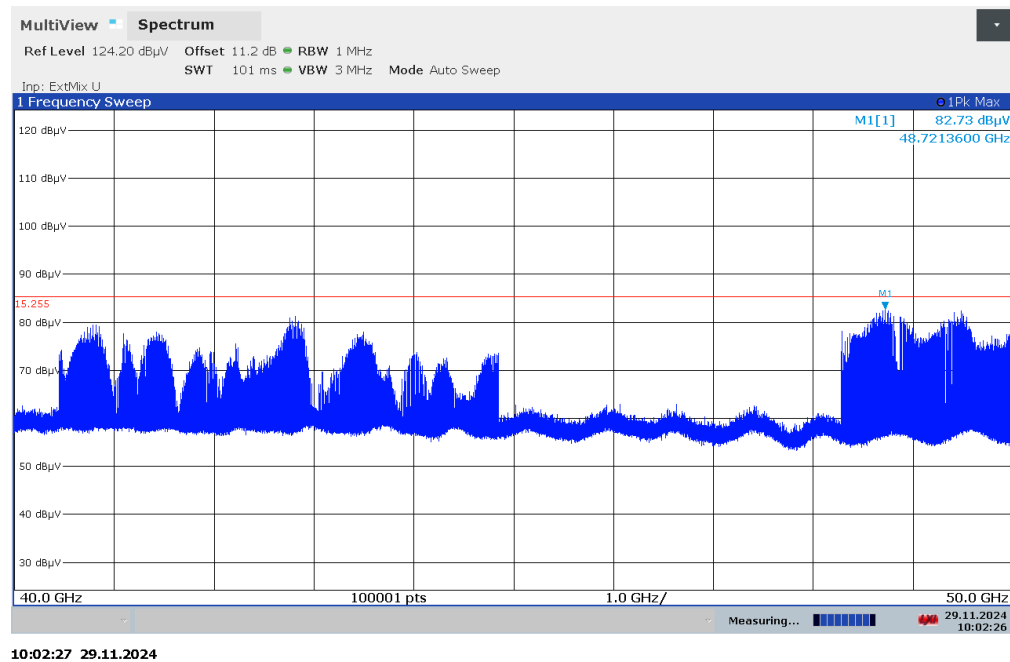


Figure 7.6-5: Radiated spurious emissions 40-50 GHz

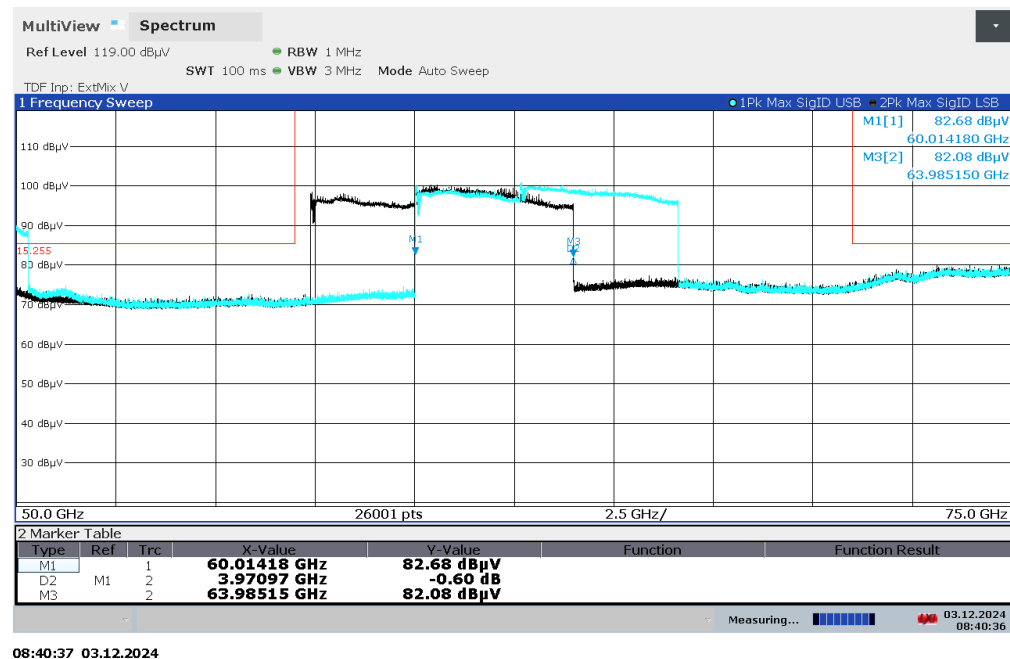


Figure 7.6-6: Radiated spurious emissions 50-75 GHz

Note: Fundamental signal is shown from 60.0 – 63.9 GHz (M1 to M3), rest of emissions observed in the plot are images from the RF mixer.

Test data, continued

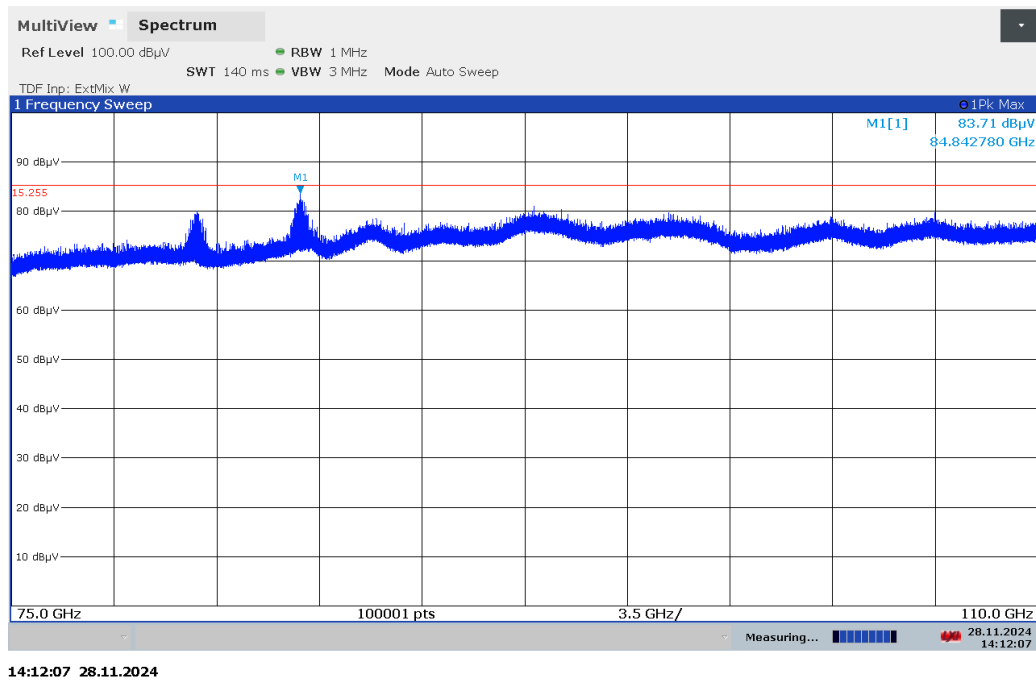


Figure 7.6-7: Radiated spurious emissions 75-110 GHz

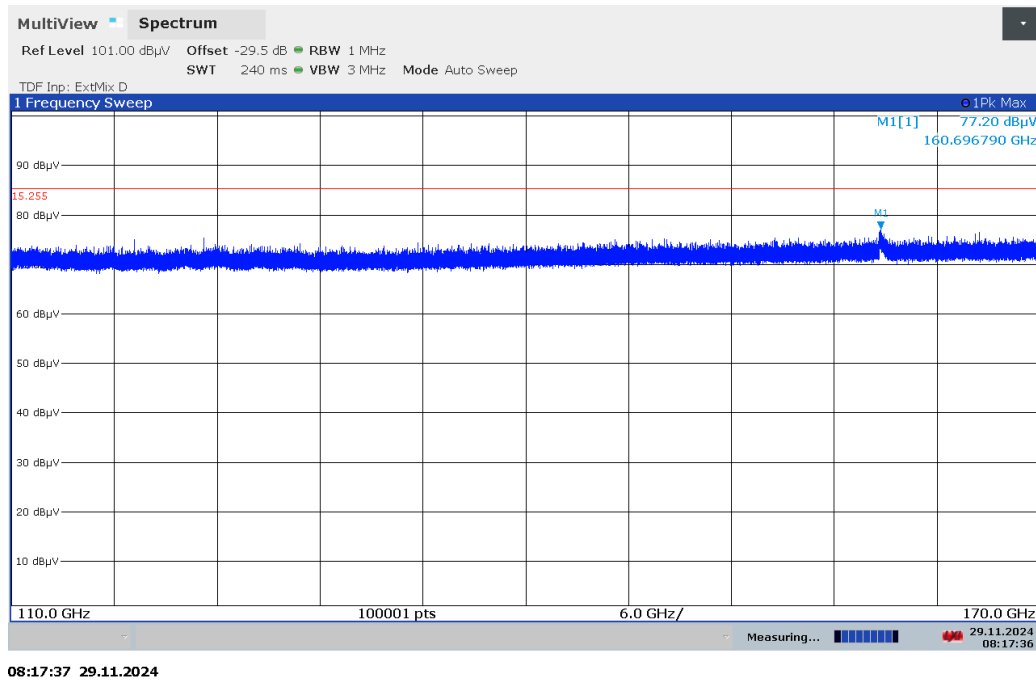
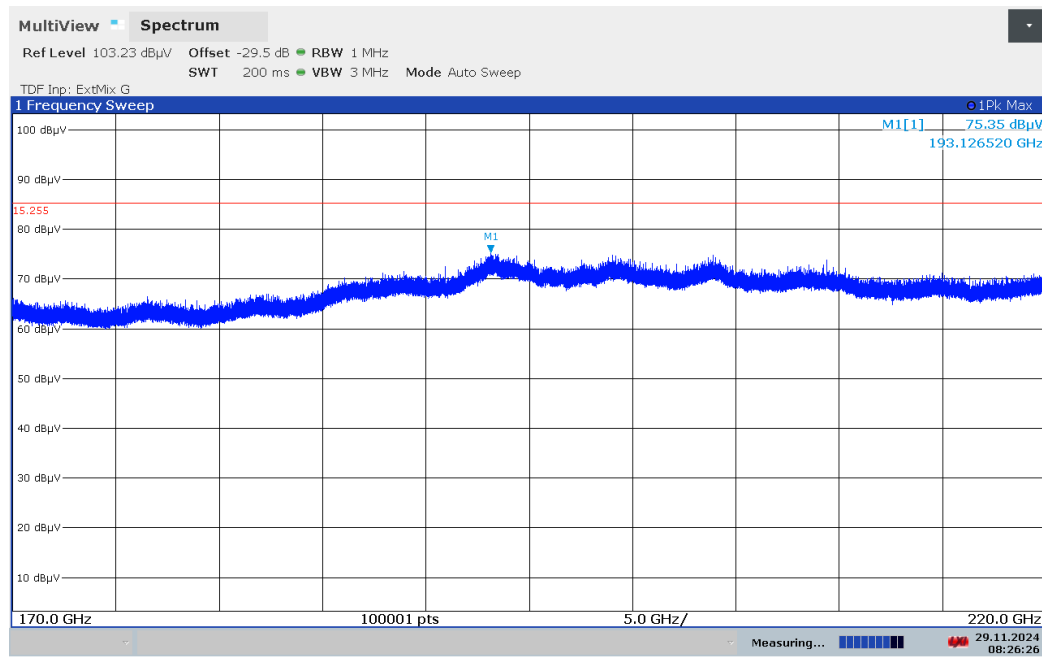


Figure 7.6-8: Radiated spurious emissions 110-170 GHz

Test data, continued



08:26:26 29.11.2024

Figure 7.6-9: Radiated spurious emissions 170-220 GHz

7.7 Frequency stability

7.7.1 References, definitions and limits

FCC §15.255:

- (f) **Frequency stability.** Fundamental emissions must be contained within the frequency bands specified in this section during all conditions of operation. Equipment is presumed to operate over the temperature range –20 to + 50 degrees Celsius with an input voltage variation of 85% to 115% of rated input voltage, unless justification is presented to demonstrate otherwise.

RSS-210, J.6 Transmitter frequency stability

Fundamental emissions shall be contained within the frequency bands specified in this annex during all conditions of operation when tested at the temperature and voltage variations specified for the frequency stability measurement in RSS-Gen.

7.7.2 Test summary

Verdict	Pass		
Test date	December 3, 2024	Temperature	23 °C
Tested by	Tarek Elkholy	Air pressure	988 mbar
Test location	Cambridge	Relative humidity	38 %

7.7.3 Observations, settings and special notes

Spectrum analyser settings:

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

7.7.4 Test data

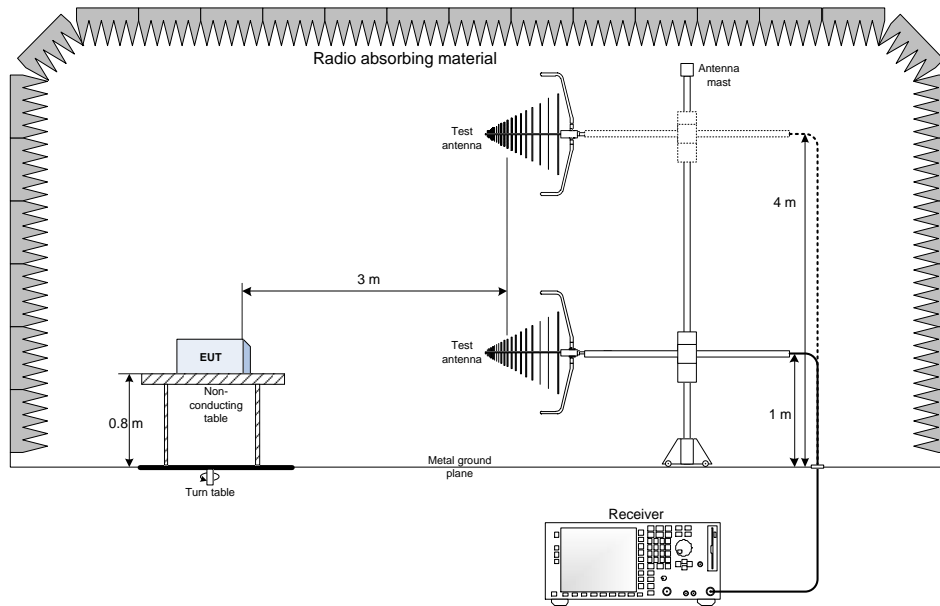
Table 7.7-1: Frequency drift measurement

Test conditions	Signal frequency range, GHz	Verdict
+50 °C, Nominal	60.01-63.98	Pass
+40 °C, Nominal	60.01-63.98	Pass
+30 °C, Nominal	60.01-63.98	Pass
+20 °C, +15 %	60.01-63.98	Pass
+20 °C, Nominal	60.01-63.98	Reference
+20 °C, –15 %	60.01-63.98	Pass
+10 °C, Nominal	60.03-63.98	Pass
0 °C, Nominal	60.02-63.98	Pass
–10 °C, Nominal	60.02-63.98	Pass
–20 °C, Nominal	60.01-63.98	Pass

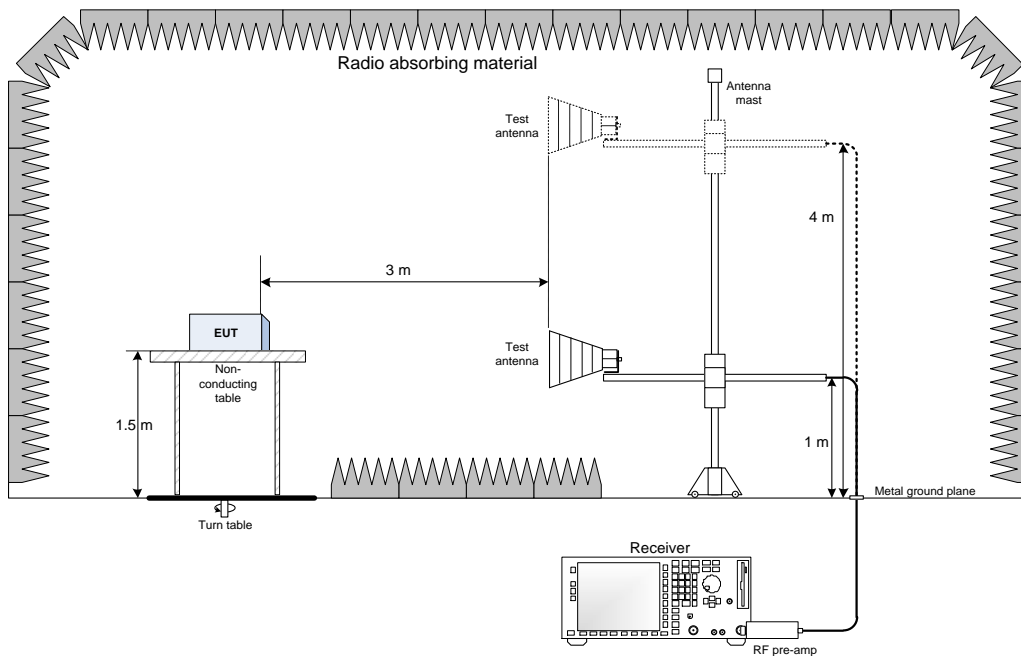
Max drift is –20 MHz

Section 8 Test setup diagrams

8.1 Radiated emissions set-up for frequencies below 1 GHz



8.2 Radiated emissions set-up for frequencies above 1 GHz



End of the test report