RF TEST REPORT

Applicant	Quectel Wireless Solutions Co., Ltd.
FCC ID	XMR2023FC64EB
Product	Wi-Fi & Bluetooth Module
Brand	Quectel
Model	FC64E-B
Report No.	R2301A0040-R3V1
Issue Date	November 2, 2023

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC CFR47 Part 15C (2022)**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

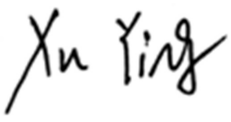

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TABLE OF CONTENT

Version	Revision Description	Issue Date
Rev.0	Initial issue of report.	September 20, 2023
Rev.1	Update information.	November 2, 2023
Note: This revised report (Report No.: R2301A0040-R3V1) supersedes and replaces the previously issued report (Report No.: R2301A0040-R3). Please discard or destroy the previously issued report and dispose of it accordingly.		

Summary of Measurement Results

Number	Test Case	Clause in FCC rules	Verdict
1	Maximum output power	15.247(b)(3)	Not Required [1]
2	99% Bandwidth and 6dB Bandwidth	15.247(a)(2) C63.10 6.9	Not Required [1]
3	Power spectral density	15.247(e)	Not Required [1]
4	Band Edge	15.247(d)	Not Required [1]
5	Spurious RF Conducted Emissions	15.247(d)	Not Required [1]
6	Unwanted Emissions	15.247(d),15.205,15.209	Test 802.11ax HE20 Channel 6 and PASS Others Not Required [1]
7	Conducted Emissions	15.207	Not Required [1]
Date of Testing: September 1, 2023 ~ September 5, 2023 Date of Sample Received: August 18, 2023			
Note: 1. Not Required means after evaluation, test items are no need to recorded, the test results please refers to Original Report. 2. All indications of Pass/Fail in this report are opinions expressed by TA Technology (Shanghai) Co., Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only.			

FC64E-B (Report No.: R2301A0040-R3V1) is a variant model of FC64E (Report No.: FCC022022-06260RF1; Report Version: V1.0; FCC ID: XMR202208FC64E).
This report tests Unwanted Emissions (802.11ax HE20 Channel 6) and also verifies Maximum output power, powers of new variant are varied due to measurement uncertainty, and sample tolerance of the acceptance range.
The detailed product change description please refers to the Difference Declaration Letter.

1. Test Laboratory

1.1. Notes of the Test Report

This report shall not be reproduced in full or partial, without the written approval of **TA Technology (Shanghai) Co., Ltd.** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein .Measurement Uncertainties were not taken into account and are published for informational purposes only. This report is written to support regulatory compliance of the applicable standards stated above.

1.2. Test Facility

FCC (Designation number: CN1179, Test Firm Registration Number: 446626)

TA Technology (Shanghai) Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform measurements.

A2LA (Certificate Number: 3857.01)

TA Technology (Shanghai) Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform measurement.

1.3. Testing Location

Company:	TA Technology (Shanghai) Co., Ltd.
Address:	Building 3, No.145, Jintang Rd, Pudong Shanghai, P.R.China
City:	Shanghai
Post code:	201201
Country:	P. R. China
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Website:	http://www.ta-shanghai.com
E-mail:	xukai@ta-shanghai.com

2. General Description of Equipment Under Test

2.1. Applicant and Manufacturer Information

Applicant	Quectel Wireless Solutions Co., Ltd.
Applicant address	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China, 200233
Manufacturer	Quectel Wireless Solutions Co., Ltd.
Manufacturer address	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China, 200233

2.2. General Information

EUT Description		
Model	FC64E-B	
SN	Conducted	E1N22KF12000063
	Radiated	E1N22KF12000047
Hardware Version	R1.0	
Software Version	NA	
Power Supply	External power supply	
Antenna Type	Dipole Antenna	
Antenna Gain	0.73 dBi	
Antenna Connector	SMA Male (The antenna connector will be fixed in the actual use of the finished product and cannot be replaced)	
Operating Frequency Range(s)	802.11b/g/n(HT20)/ax(HE20): 2412 ~ 2462 MHz 802.11n(HT40)/ax(HE40): 2422 ~ 2452 MHz	
Modulation Type	802.11b: DSSS 802.11g/n: OFDM 802.11ax: OFDMA	
Note: 1. The EUT is sent from the applicant to TA and the information of the EUT is declared by the applicant.		

3. Applied Standards

According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

Test standards:

FCC CFR47 Part 15C (2022) Radio Frequency Devices

ANSI C63.10-2013

Reference standard:

KDB 558074 D01 15.247 Meas Guidance v05r02

KDB 662911 D01 Multiple Transmitter Output v02r01

4. Test Configuration

Test Mode

The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application.

The radiated emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in lie-down position (X axis) and the loop antenna is vertical, the others are vertical and horizontal. and the worst case was recorded.

In order to find the worst case condition, Pre-tests are needed at the presence of different data rate. Preliminary tests have been done on all the configuration for confirming worst case. Data rate below means worst-case rate of each test item.

Worst-case data rates are shown as following table.

Test Mode	Data Rate
802.11ax HE20	MCS0

5. Test Case Results

5.1. Unwanted Emission

Ambient Condition

Temperature	Relative humidity
20°C ~ 25°C	45% ~ 50%

Method of Measurement

The test set-up was made in accordance to the general provisions of ANSI C63.10.
The Equipment Under Test (EUT) was set up on a non-conductive table in the semi-anechoic chamber. The test was performed at the distance of 3 m between the EUT and the receiving antenna.

The turntable shall be rotated from 0 to 360 degrees for detecting the maximum of radiated spurious signal level. The measurements shall be repeated with orthogonal polarization of the test antenna.The data of cable loss and antenna factor has been calibrated in full testing frequency range before the testing. Sweep the Restricted Band and the emissions less than 20 dB below the permissible value are reported.
The radiated emissions measurements were made in a typical installation configuration.
Sweep the whole frequency band through the range from 9 kHz to the 10th harmonic of the carrier, and the emissions less than 20 dB below the permissible value are reported.

This method refer to ANSI C63.10.
The procedure for peak unwanted emissions measurements above 1000 MHz is as follows:
Set the spectrum analyzer in the following:
9kHz~150 kHz
RBW=200Hz, VBW=1kHz/ Sweep=AUTO
150 kHz~30MHz
RBW=9KHz, VBW=30KHz,/ Sweep=AUTO
Below 1GHz
RBW=100kHz / VBW=300kHz / Sweep=AUTO
a) Peak emission levels are measured by setting the instrument as follows:
Above 1GHz
PEAK: RBW=1MHz VBW=3MHz/ Sweep=AUTO
b) Average emission levels are measured by setting the instrument as follows:
Above 1GHz
AVERAGE: RBW=1MHz / VBW=3MHz / Sweep=AUTO
c) Detector: The measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands

are based on measurements employing an average detector.

d) Averaging type = power (i.e., rms) (As an alternative, the detector and averaging type may be set for linear voltage averaging. Some instruments require linear display mode to use linear voltage averaging. Log or dB averaging shall not be used.)

e) Sweep time = auto.

f) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, then the number of traces shall be increased by a factor of 1 / D, where D is the duty cycle. For example, with 50% duty cycle, at least 200 traces shall be averaged. (If a specific emission is demonstrated to be continuous—i.e., 100% duty cycle—then rather than turning ON and OFF with the transmit cycle, at least 100 traces shall be averaged.)

g) If tests are performed with the EUT transmitting at a duty cycle less than 98%, then a correction factor shall be added to the measurement results prior to comparing with the emission limit, to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows:

1) If power averaging (rms) mode was used in the preceding step e), then the correction factor is [10 log (1 / D)], where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 3 dB shall be added to the measured emission levels.

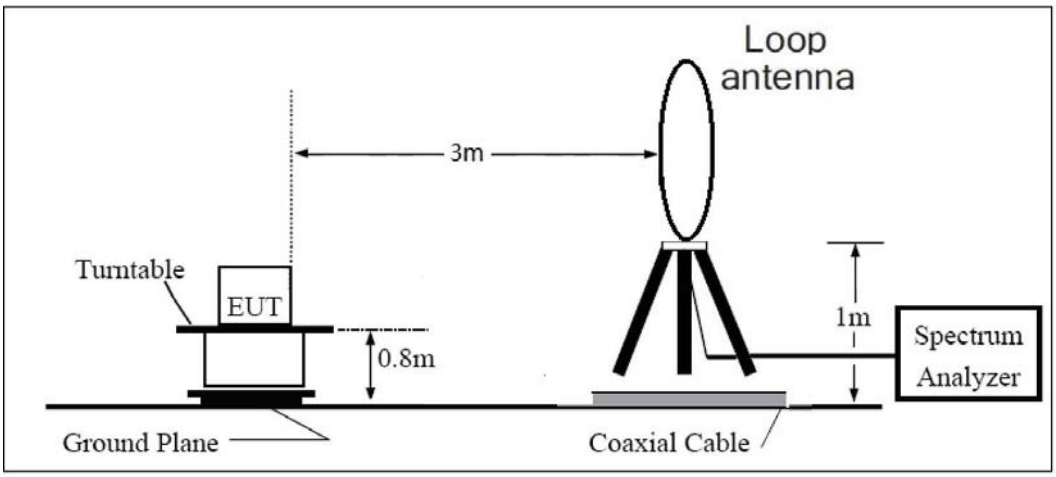
2) If linear voltage averaging mode was used in the preceding step e), then the correction factor is [20 log (1 / D)], where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 6 dB shall be added to the measured emission levels.

3) If a specific emission is demonstrated to be continuous (100% duty cycle) rather than turning ON and OFF with the transmit cycle, then no duty cycle correction is required for that emission.

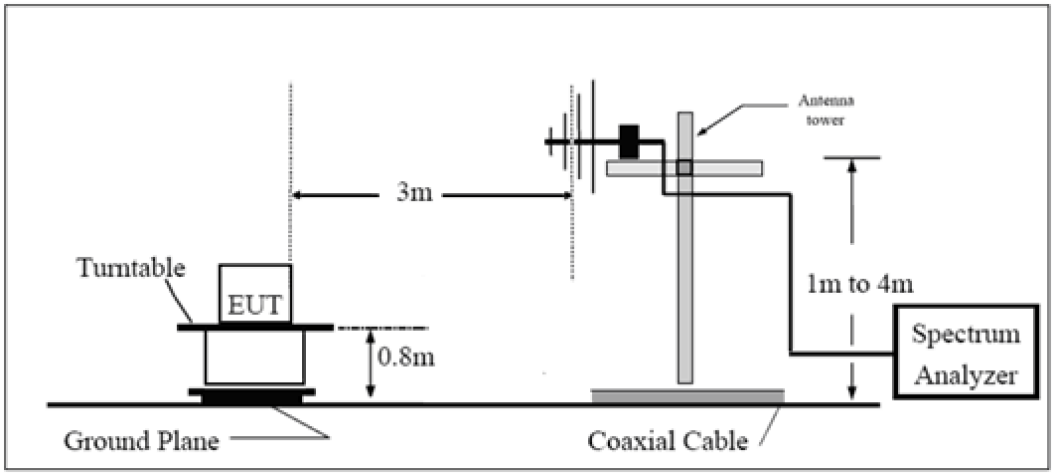
The test is in transmitting mode.

Test Setup

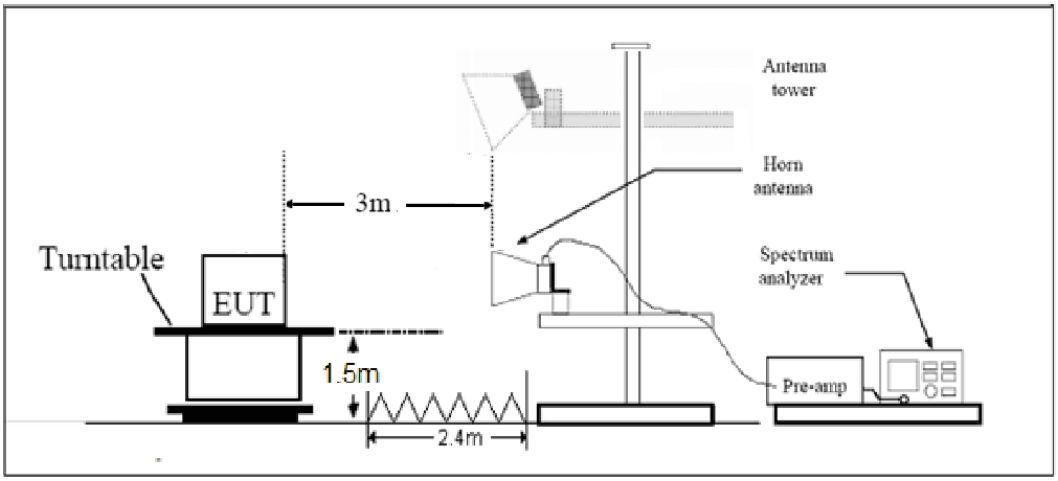
9KHz~ 30MHz



30MHz~ 1GHz



Above 1GHz



Note: Area side:2.4mX3.6m

Limits

Rule Part 15.247(d) specifies that “In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).”

Limit in restricted band

Frequency of emission (MHz)	Field strength(μV/m)	Field strength(dBμV/m)
0.009–0.490	2400/F(kHz)	/
0.490–1.705	24000/F(kHz)	/
1.705–30.0	30	/
30-88	100	40
88-216	150	43.5
216-960	200	46
Above960	500	54

§15.35(b)

There is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit.

Peak Limit=74 dBμV/m

Average Limit=54 dBμV/m

Spurious Radiated Emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
[1] 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	([2])
13.36-13.41			

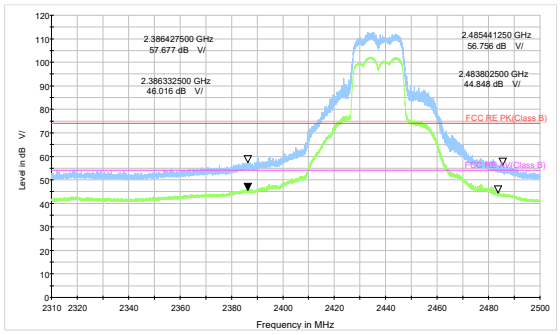
Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor *k* = 1.96.

Frequency	Uncertainty
9KHz-30MHz	3.55 dB
30MHz-200MHz	4.17 dB
200MHz-1GHz	4.84 dB
1-18GHz	4.35 dB
18-26.5GHz	5.90 dB
26.5GHz~40GHz	5.92 dB

Test Results:

A symbol (dB V/) in the test plot below means (dBμV/m)

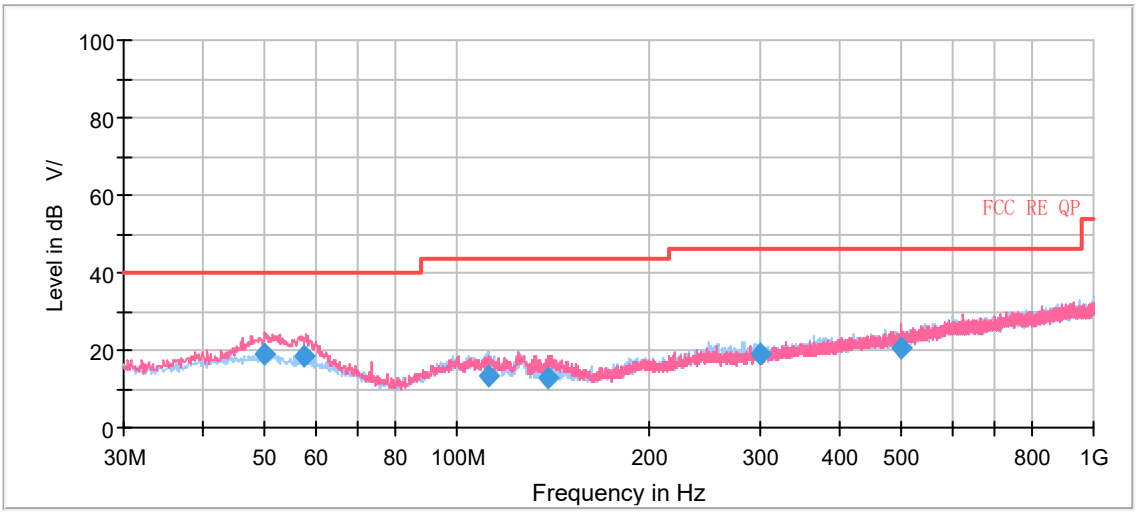


802.11ax HE20-Channel 6 Peak+ Average

Result of RE

Test result

A symbol (dB V/) in the test plot below means (dBμV/m)



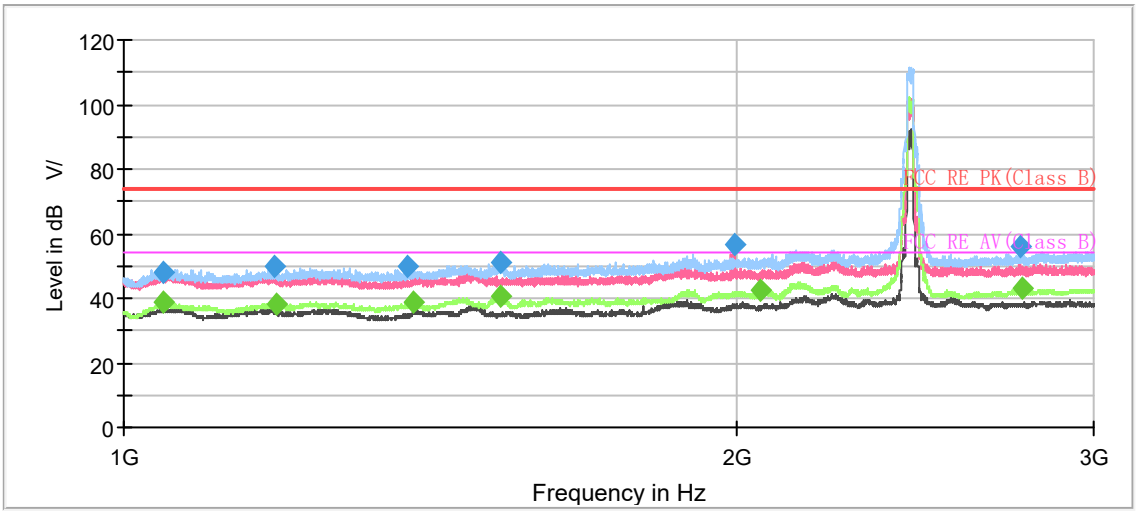
Radiates Emission from 30MHz to 1GHz

Frequency (MHz)	Quasi-Peak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)
50.006250	19.14	40.00	20.86	101.0	V	73.0	20.6
57.408750	18.40	40.00	21.60	100.0	V	354.0	19.8
111.965000	13.29	43.50	30.21	225.0	H	128.0	17.9
139.612500	12.69	43.50	30.81	110.0	V	210.0	14.8
300.023750	18.83	46.00	27.17	110.0	H	241.0	20.4
500.006250	20.74	46.00	25.26	111.0	V	0.0	24.8

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)

2. Margin = Limit – Quasi-Peak

802.11ax HE20 CH6



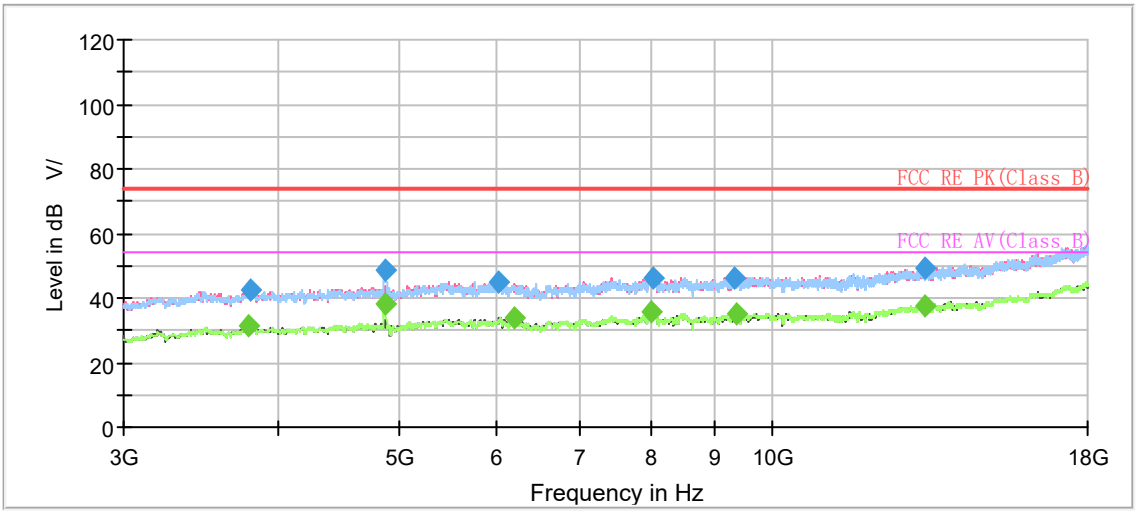
Note: The signal beyond the limit is carrier.

Radiates Emission from 1GHz to 3GHz

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1045.500000	---	38.90	54.00	15.10	500.0	200.0	H	309.0	-8.2
1046.000000	48.26	---	74.00	25.74	500.0	200.0	H	300.0	-8.2
1187.250000	49.89	---	74.00	24.11	500.0	200.0	H	254.0	-7.1
1187.750000	---	38.40	54.00	15.60	500.0	100.0	H	253.0	-7.1
1379.000000	49.97	---	74.00	24.03	500.0	200.0	H	267.0	-5.8
1388.750000	---	39.01	54.00	14.99	500.0	200.0	H	267.0	-5.7
1533.500000	50.95	---	74.00	23.05	500.0	200.0	H	290.0	-4.5
1533.750000	---	40.66	54.00	13.34	500.0	200.0	H	290.0	-4.5
1996.000000	56.81	---	74.00	17.19	500.0	200.0	V	276.0	-2.6
2056.500000	---	42.37	54.00	11.63	500.0	200.0	H	272.0	-2.3
2757.750000	55.98	---	74.00	18.02	500.0	100.0	V	319.0	0.6
2765.000000	---	42.99	54.00	11.01	500.0	200.0	H	309.0	0.7

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)

2. Margin = Limit –MAX Peak/ Average

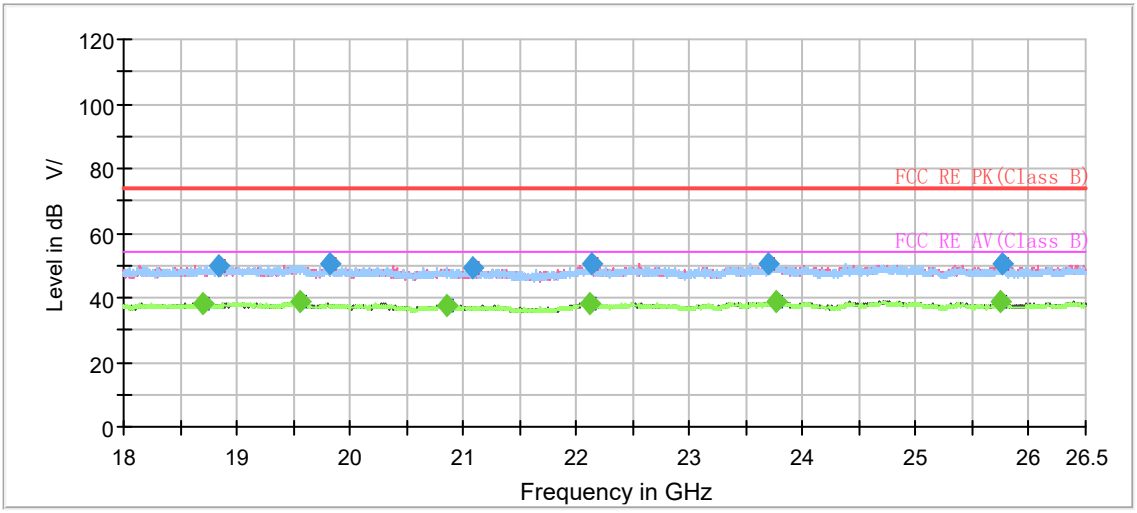


Radiates Emission from 3GHz to 18GHz

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
3780.000000	---	31.27	54.00	22.73	500.0	200.0	V	176.0	-3.9
3796.875000	42.75	---	74.00	31.25	500.0	100.0	H	293.0	-3.7
4873.125000	---	38.45	54.00	15.55	500.0	100.0	H	135.0	-2.0
4882.500000	48.35	---	74.00	25.65	500.0	100.0	H	135.0	-2.1
6024.375000	45.07	---	74.00	28.93	500.0	100.0	V	28.0	-0.2
6193.125000	---	33.83	54.00	20.17	500.0	100.0	H	140.0	0.1
8010.000000	---	35.45	54.00	18.55	500.0	200.0	H	213.0	2.5
8032.500000	46.17	---	74.00	27.83	500.0	200.0	V	140.0	2.4
9346.875000	46.45	---	74.00	27.55	500.0	100.0	V	195.0	2.2
9382.500000	---	34.90	54.00	19.10	500.0	100.0	H	302.0	2.6
13286.250000	---	37.38	54.00	16.62	500.0	100.0	H	358.0	7.2
13312.500000	49.29	---	74.00	24.71	500.0	100.0	H	74.0	7.2

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)

2. Margin = Limit –MAX Peak/ Average



Radiates Emission from 18GHz to 26.5GHz

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
18699.125000	---	38.31	54.00	15.69	500.0	100.0	H	150.0	-5.6
18833.000000	50.07	---	74.00	23.93	500.0	200.0	V	192.0	-5.6
19555.500000	---	38.60	54.00	15.40	500.0	200.0	V	212.0	-5.3
19830.687500	50.39	---	74.00	23.61	500.0	100.0	H	179.0	-5.2
20850.687500	---	37.76	54.00	16.24	500.0	200.0	V	40.0	-5.1
21089.750000	49.21	---	74.00	24.79	500.0	100.0	V	0.0	-5.1
22120.375000	---	38.13	54.00	15.87	500.0	200.0	H	139.0	-4.1
22139.500000	50.49	---	74.00	23.51	500.0	200.0	H	310.0	-4.1
23702.437500	50.52	---	74.00	23.48	500.0	100.0	V	276.0	-2.5
23760.875000	---	38.76	54.00	15.24	500.0	100.0	V	354.0	-2.4
25752.000000	---	38.54	54.00	15.46	500.0	100.0	H	38.0	-2.6
25755.187500	50.72	---	74.00	23.28	500.0	100.0	V	0.0	-2.6

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)

2. Margin = Limit –MAX Peak/ Average

6. Main Test Instruments

Name of Equipment	Manufacturer	Type/Model	Serial Number	Calibration Date	Expiration Time
Radiated Emission					
EMI Test Receiver	R&S	ESR	102389	2023-05-12	2024-05-11
Signal Analyzer	R&S	FSV40	101186	2023-05-12	2024-05-11
Loop Antenna	SCHWARZBECK	FMZB1519	1519-047	2023-04-16	2026-04-15
TRILOG Broadband Antenna	SCHWARZBECK	VULB 9163	1023	2023-07-14	2026-07-13
Horn Antenna	R&S	HF907	102723	2021-07-24	2024-07-23
Horn Antenna	ETS-Lindgren	3160-09	00102643	2021-10-10	2024-10-09
Software	R&S	EMC32	9.26.01	/	/

ANNEX A: The EUT Appearance

The EUT Appearance are submitted separately.

ANNEX B: Test Setup Photos

The Test Setup Photos are submitted separately.

ANNEX C: Product Change Description

The Product Change Description are submitted separately.

******** END OF REPORT ********