China

FCC\IC - TEST REPORT

Report Number	:	**709502115366-00**	Date of Issue:	February 11, 2022

Model	:	CM-03-E
Product Type	:	Tubular motor
Applicant	:	Coulisse B.V.
Address	:	Vonderweg 48, 7468 DC Enter, THE NETHERLANDS
Production Facility	:	Ningbo Dooya Mechanic & Electronic Technology Co., Ltd.
Address	:	No.168 Shengguang Road,Luotuo,Zhenhai, Ningbo, Zhejiang province, People's Republic of China
Test Result	:	**n Positive** **o Negative**
Total pages including Appendices	:	37

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China

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China

2 Details about the Test Laboratory

Details about the Test Laboratory
Test Site 1

Company name:	TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch No.16 Lane, 1951 Du Hui Road, Shanghai 201108, P.R. China
Designation Number:	CN1183
Test Firm FCC Registration Number:	820234
IC Company Number:	25988
CAB identifier:	CN0101
Telephone:	+86 21 6141 0123
Fax:	+86 21 6140 8600

3 Description of the Equipment under Test

Description of the Equipment Under Test

Product:	Tubular motor
Model no./PMN/HVIN:	CM-03-E
FCC ID:	ZY4CM03E
IC:	28177-CM03E
Options and accessories:	NA
Rating:	5V DC
RF Transmission Frequency:	433.92MHz 2405~2480 MHz (thread) 2402~2480 MHz (BLE 5.0)
Modulation:	For 433.92MHz: 2GFSK For 2.4GHz Thread: OQPSK For 2.4GHz BLE: GFSK

Channel list:

Bluetooth Low Energy							
Ch	Fre(MHz)	Ch	Fre(MHz)	Ch	Fre(MHz)	Ch	Fre(MHz)
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480

Thread			
Channel	**Frequency**	**Channel**	**Frequency**
11	2405 MHz	19	2445 MHz
12	2410 MHz	20	2450 MHz
13	2415 MHz	21	2455 MHz
14	2420 MHz	22	2460 MHz
15	2425 MHz	23	2465 MHz
16	2430 MHz	24	2470 MHz
17	2435 MHz	25	2475 MHz
18	2440 MHz	26	2480 MHz

Antenna Type: For 433.92MHz: line antenna
For 2.4GHz Thread and BLE: line Antenna

Antenna Gain: For 433.92MHz: -7.16dbi
For 2.4GHz Thread and BLE: 3.5dBi

Description of the EUT: The Equipment Under Test (EUT) is a Tubular motor which transmitted at 433.92MHz and support 2.4GHz thread and BLE5.0 (support 1Mbps and 2Mbps data rate). we tested it and listed the worst data in this report.

Test sample no.: SHA-614504-2

The sample's mentioned in this report is/are submitted/ supplied/ manufactured by client. The laboratory therefore assumes no responsibility for accuracy of information on the brand name, model number, origin of manufacture, consignment, antenna gain or any information supplied.

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4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C:2020	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators
RSS-Gen Issue 5 Amendment 1 March 2019	General Requirements for Compliance of Radio Apparatus
RSS-247 Issue 2 February 2017	Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSS) and License-Exempt Local Area Network (LE-LAN) Devices

All the test methods were according to KDB 558074 D01 15.247 Meas Guidance v05r02 and ANSI C63.10 (2013).

5 Summary of Test Results

Technical Requirements				
Test Condition		Pages	Test Site	Test Result
§15.207 & RSS-GEN 8.8	Conducted emission AC power port	12-14	Site 1	Pass
§15.247 (b) (3) & RSS-247 5.4(d)	Conducted peak output power and e.i.r.p.	15-16	Site 1	Pass
§15.247(a)(1) & RSS-247 5.1(b)	20dB bandwidth	---	---	N/A
§15.247(a)(1) & RSS-247 5.1(b)	Carrier frequency separation	---	---	N/A
§15.247(a)(1)(iii) & RSS-247 5.1(d)	Number of hopping frequencies	---	---	N/A
§15.247(a)(1)(iii) & RSS-247 5.1(d)	Dwell Time	---	---	N/A
§15.247(a)(2) & RSS-247 5.2(a) & RSS-GEN 6.7	6dB bandwidth and 99% Occupied Bandwidth	17-19	Site 1	Pass
§15.247(e) & RSS-247 5.2(b)	Power spectral density	20-21	Site 1	Pass
§15.247(d) & RSS-247 5.5	Spurious RF conducted emissions	22-25	Site 1	Pass
§15.247(d) & RSS-247 5.5	Band edge	26-27	Site 1	Pass
§15.247(d) & §15.209 & RSS-247 5.5 & RSS-Gen 6.13	Spurious radiated emissions for transmitter	28-32	Site 1	Pass
§15.203 & RSS-Gen 6.8	Antenna requirement	See note 1		Pass

Note 1: N/A=Not Applicable.
Note 2: The EUT uses a line antenna which gain is -7.16dBi for 433.92MHz and 3.5dBi for 2.4GHz thread and BLE. In accordance to §15.203, It is considered sufficiently to comply with the provisions of this section.

6 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID: ZY4CM03E, IC: 28177-CM03E, complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C Rules and RSS-247, RSS-GEN.

This report is only for the thread test report, for the 2.4GHz BLE test report please refer to 709502115326-00 and the 433.92MHz test report please refer to 709502115362-00.

SUMMARY:

All tests according to the regulations cited on page 5 were

n - Performed

o - **Not** Performed

The Equipment under Test

n - **Fulfills** the general approval requirements.

o - **Does not** fulfill the general approval requirements.

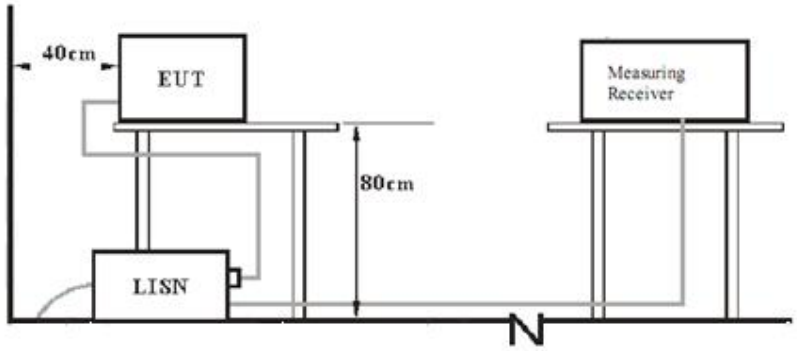
Sample Received Date:	November 19, 2021
Testing Start Date:	November 19, 2021
Testing End Date:	December 2, 2021

-TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch

Reviewed by:	Prepared by:	Tested by:
Hui TONG	Jiaxi XU	Huali CHENG
Review Engineer	Project Engineer	Test Engineer

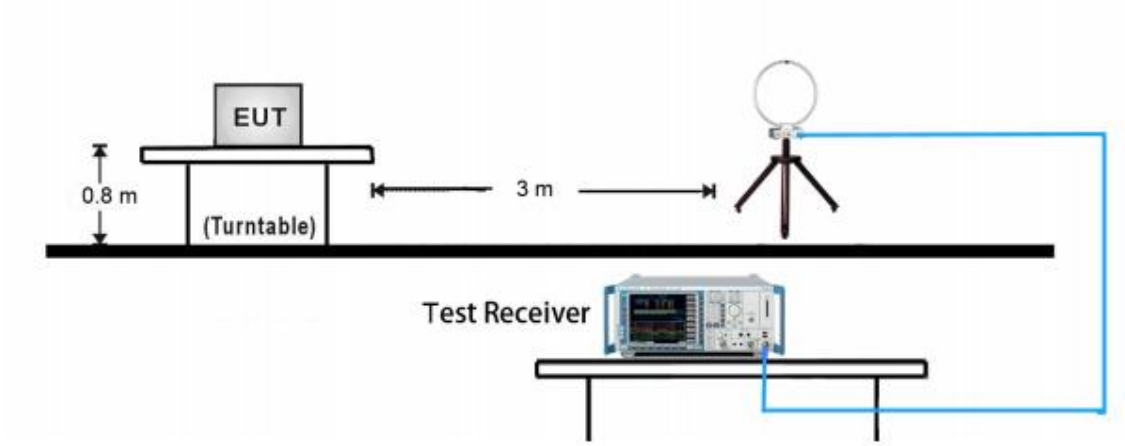
7 Test Setups

7.1 AC Power Line Conducted Emission test setups



7.2 Radiated test setups

9kHz ~ 30MHz Test Setup:



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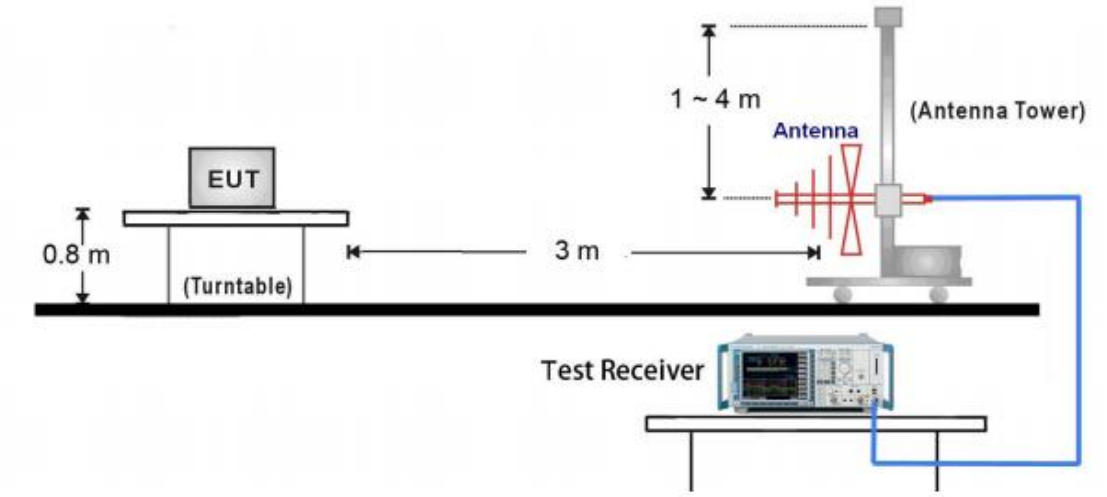
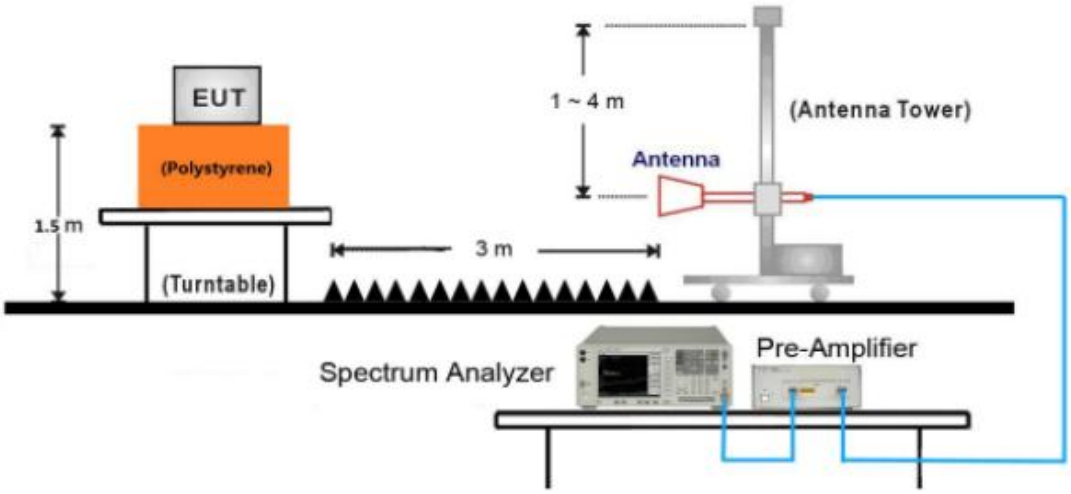
30MHz ~ 1GHz Test Setup:



1GHz ~ 18GHz Test Setup:



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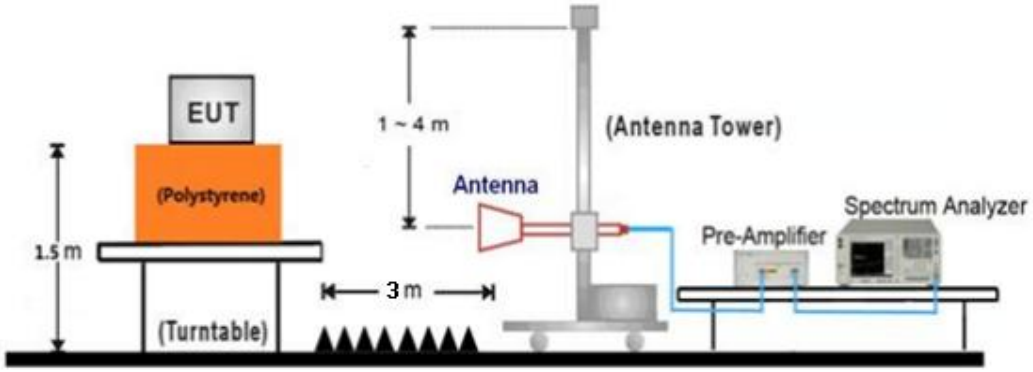
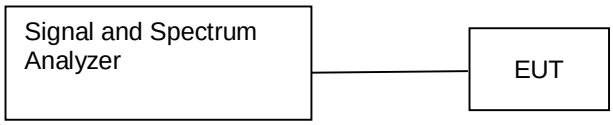
18GHz ~ 40GHz Test Setup:



7.3 Conducted RF test setups



8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.(SHIELD)	S/N(LENGTH)
Notebook	Lenove	E470	PF-OU5TS7 17/09

Test software: XCOMV2.1.exe

The system was configured to channel 11, 18, and 26 for the test.

Non-hopping mode: The system was configured to operate at a signal channel transmitting. The test software allows the configuration and operation at the worst-case duty and the highest transmit power.

9 Technical Requirement

9.1 Conducted Emission

Test Method

1. The EUT was placed on a table, which is 0.8m above ground plane
2. The power line of the EUT is connected to the AC mains through a Artificial Mains Network (A.M.N.).
3. Maximum procedure was performed to ensure EUT compliance
4. A EMI test receiver is used to test the emissions from both sides of AC line

Limit

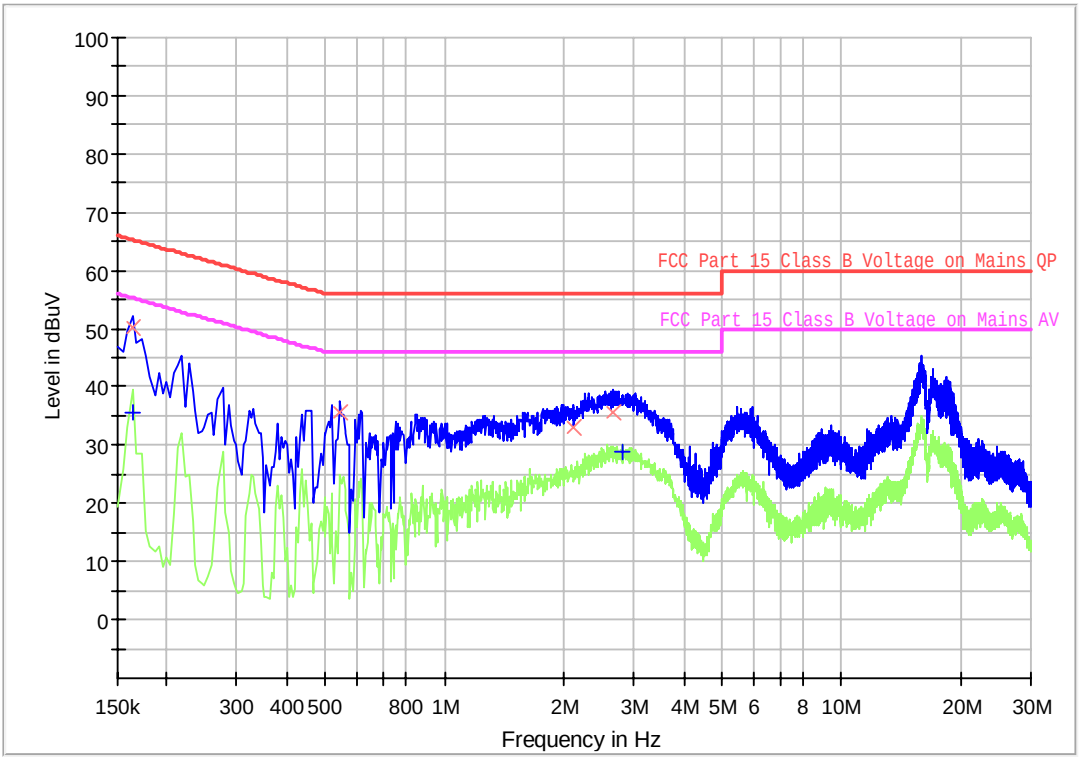
According to §15.207, conducted emissions limit as below:

Frequency MHz	QP Limit dBµV	AV Limit dBµV
0.150-0.500	66-56*	56-46*
0.500-5	56	46
5-30	60	50

Decreasing linearly with logarithm of the frequency

China

Product Type	:	Tubular motor
M/N	:	CM-03-E
Operating Condition	:	Mode 1: Tx_2405MHz (worst case)
Test Specification	:	L-line
Comment	:	AC 120V/60Hz (powered by notebook)



Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.163500	---	35.74	55.28	19.54	1000.0	9.000	L1	19.5
0.163500	50.09	---	65.28	15.19	1000.0	9.000	L1	19.5
0.546000	35.53	---	56.00	20.47	1000.0	9.000	L1	19.5
2.107500	33.04	---	56.00	22.96	1000.0	9.000	L1	19.5
2.665500	35.76	---	56.00	20.24	1000.0	9.000	L1	19.5
2.800500	---	28.95	46.00	17.05	1000.0	9.000	L1	19.5

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)
Factor (dB) = Cable Loss (dB) + LISN Factor (dB) + 10dB Attenuator

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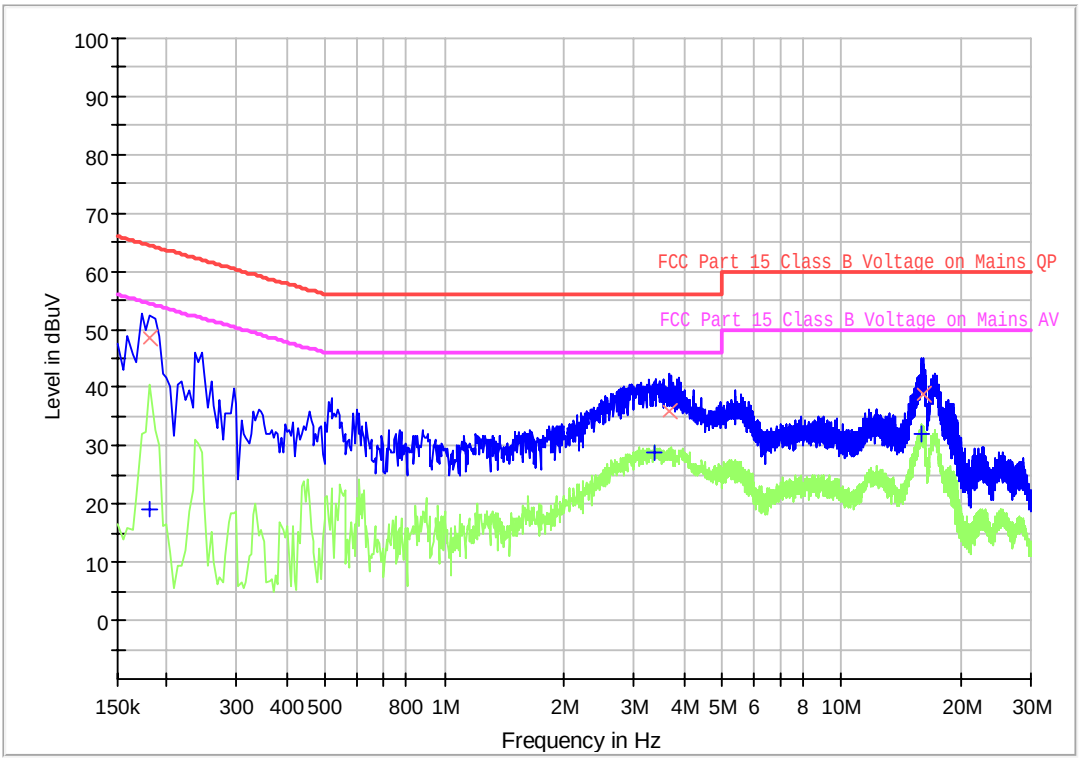
Product Type	:	Tubular motor
M/N	:	CM-03-E
Operating Condition	:	Mode 1: Tx_2405MHz (worst case)
Test Specification	:	N-line
Comment	:	AC 120V/60Hz (powered by notebook)



Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.181500	---	18.99	54.42	35.43	1000.0	9.000	N	19.5
0.181500	48.44	---	64.42	15.98	1000.0	9.000	N	19.5
3.385500	---	28.75	46.00	17.25	1000.0	9.000	N	19.5
3.682500	36.10	---	56.00	19.90	1000.0	9.000	N	19.5
15.985500	---	32.03	50.00	17.97	1000.0	9.000	N	19.8
16.035000	38.80	---	60.00	21.20	1000.0	9.000	N	19.8

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)
Factor (dB) = Cable Loss (dB) + LISN Factor (dB) + 10dB Attenuator

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9.2 Conducted peak output power and e.i.r.p.

Test Method

1. Use the following spectrum analyzer settings:
   RBW > the 6 dB bandwidth of the emission being measured, VBW≥3RBW, Span≥3RBW
   Sweep = auto, Detector function = peak, Trace = max hold.
2. Add a correction factor to the display.
3. Use a power meter to measure the conducted peak output power.

Limits

According to §15.247 (b) (1) & RSS-247 5.4(d), conducted peak output power and e.i.r.p. limit as below:

Conducted peak output power

Frequency Range MHz	Limit W	Limit dBm
2400-2483.5	≤1	≤30

e.i.r.p.

Frequency Range MHz	Limit W	Limit dBm
2400-2483.5	≤4	≤36

Test result as below table

Antenna gain=3.5dBi				
Frequency	Conducted Peak Output Power	Result	e.i.r.p.	Result
MHz	dBm		dBm	
Low channel 2405MHz	**6.63**	Pass	**10.13**	Pass
Middle channel 2440MHz	6.41	Pass	9.91	Pass
High channel 2480MHz	6.06	Pass	9.56	Pass

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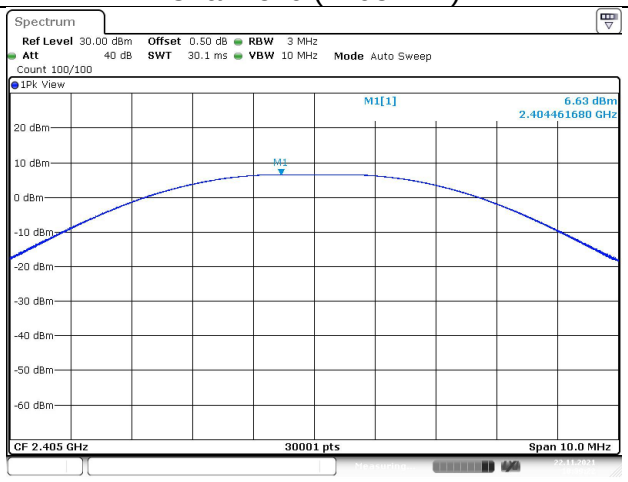
Peak output power

Channel 0 (2405MHz)



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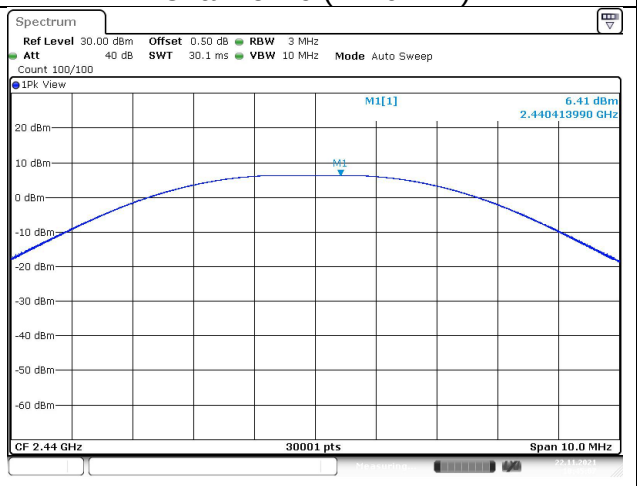
Channel 19 (2440MHz)



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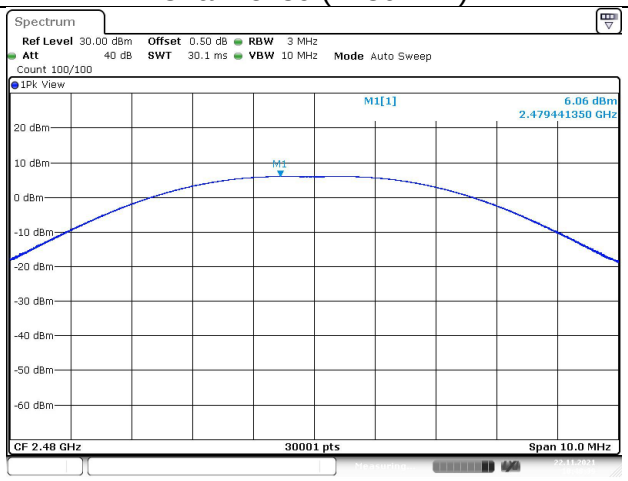
Channel 39 (2480MHz)



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9.3 6dB bandwidth and 99% Occupied Bandwidth

Test Method

1. Use the following spectrum analyzer settings:
   RBW=100K, VBW≥3RBW, Sweep = auto, Detector function = peak, Trace = max hold
2. Use the automatic bandwidth measurement capability of an instrument, may be employed using the X dB bandwidth mode with X set to 6 dB, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.
3. Allow the trace to stabilize, record the X dB Bandwidth value.

Limit

Limit [kHz]
≥500

Test Method for 99 % Bandwidth

1. Use the following spectrum analyzer settings:
   RBW=1% to 5% of the actual occupied, VBW≥3RBW, Sweep = auto,
   Detector function = peak, Trace = max hold
2. Use the automatic bandwidth measurement capability of an instrument, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.
3. Allow the trace to stabilize, record the X dB Bandwidth value.

Limit

Limit [kHz]
N/A

Test result

Frequency MHz	6dB bandwidth kHz	Result	99% occupied bandwidth KHz
Top channel 2405MHz	1468	Pass	2238
Middle channel 2440MHz	1369	Pass	2248
Bottom channel 2480MHz	1473	Pass	2268

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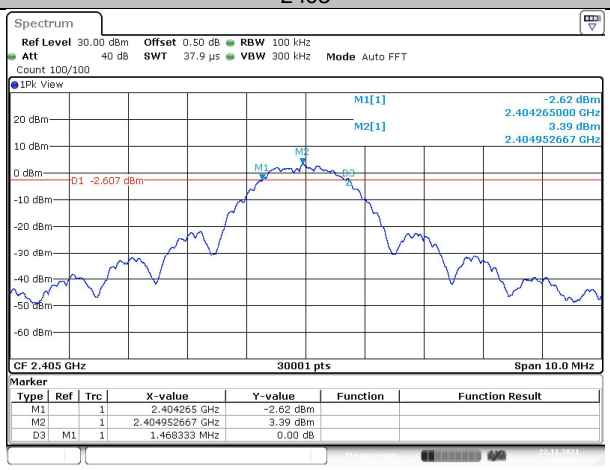
6dB Bandwidth

2405



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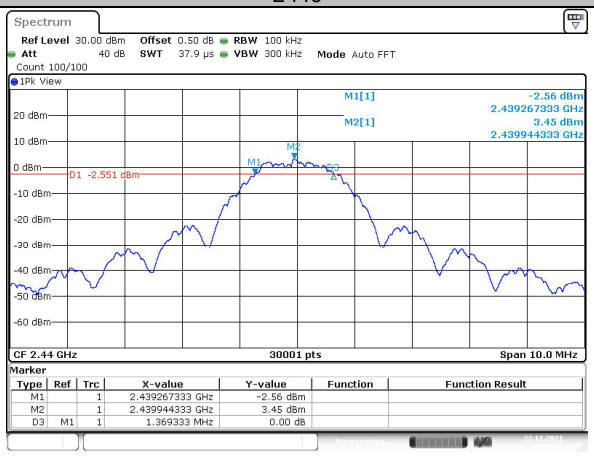
2440



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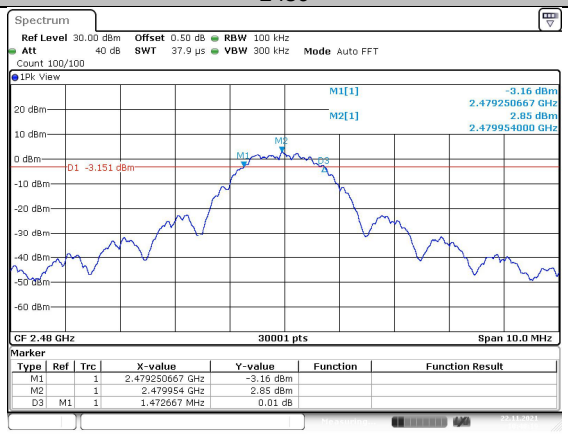
2480



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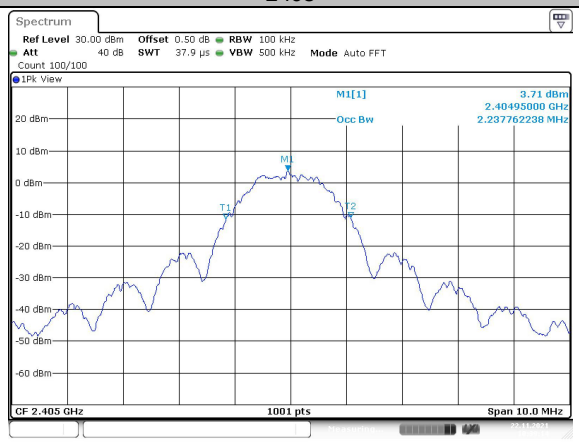
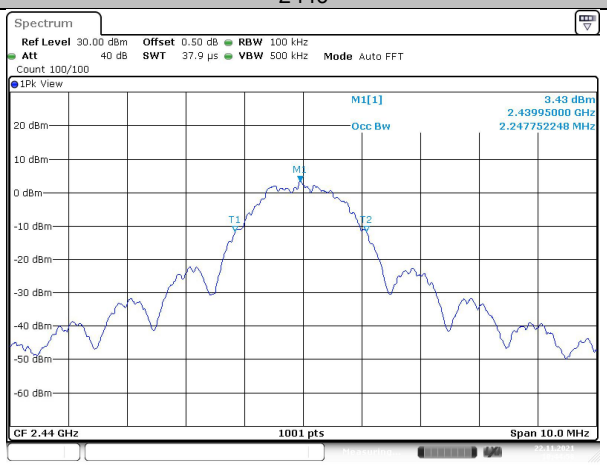
99% Occupied Bandwidth

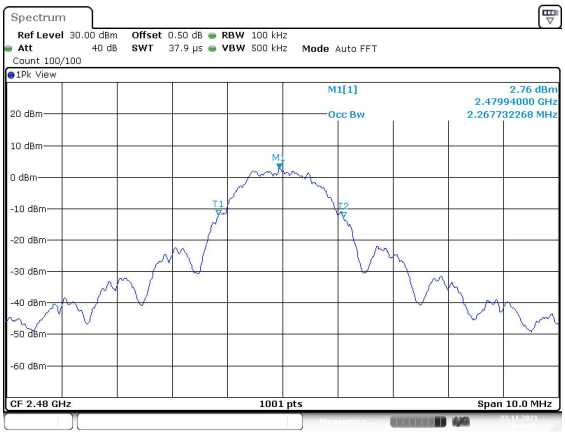
2405



2440



2480



9.4 Power spectral density

Test Method

This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance:

1. Set analyzer center frequency to DTS channel center frequency. RBW=3kHz, VBW≥3RBW, Span=1.5 times DTS bandwidth, Detector=Peak, Sweep=auto, Trace= max hold.
2. Allow trace to fully stabilize, use the peak marker function to determine the maximum amplitude level within the RBW.
3. Repeat above procedures until other frequencies measured were completed.

Limit

Limit [dBm/3kHz]
≤8

Test result

Frequency	Power spectral density	Data transmission rate	Result
MHz	**dBm/3KHz**		
Top channel 2405MHz	-2.73	1Mbps	Pass
Middle channel 2440MHz	-6.81	1Mbps	Pass
Bottom channel 2480MHz	-3.51	1Mbps	Pass

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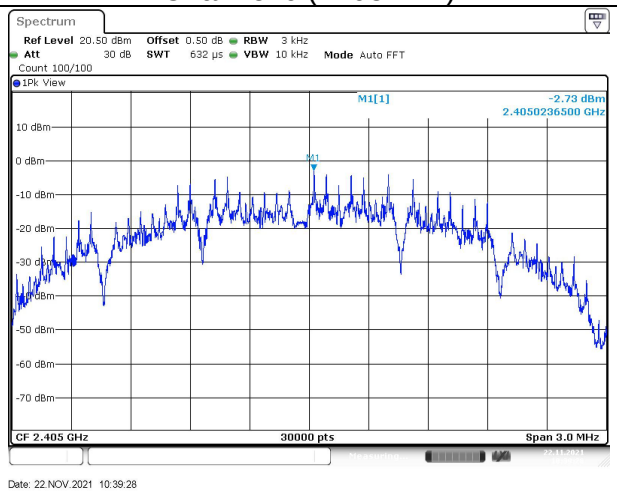
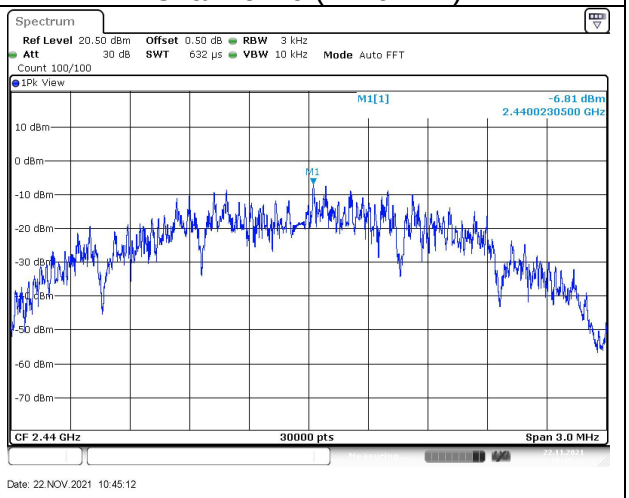
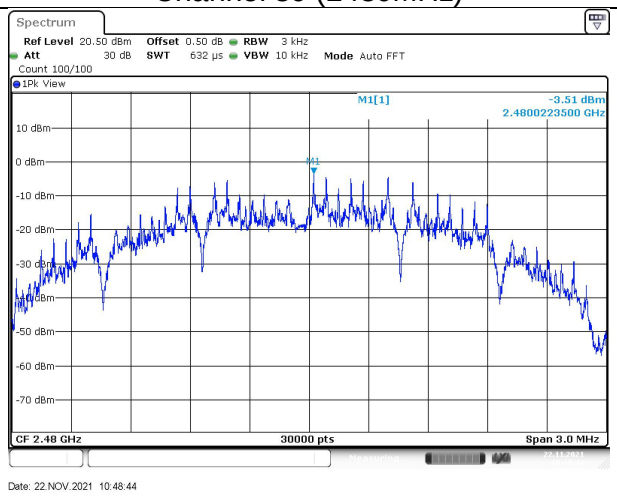
Power spectral density

PK PSD	
Channel 0 (2405MHz)	Channel 19 (2440MHz)
	
Channel 39 (2480MHz)	
	

9.5 Spurious RF conducted emissions

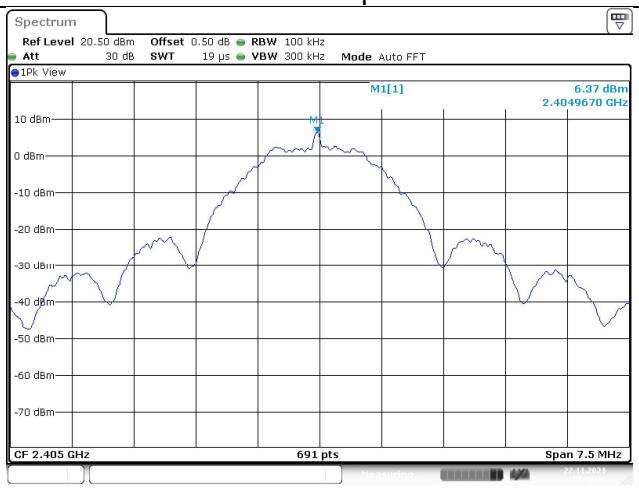
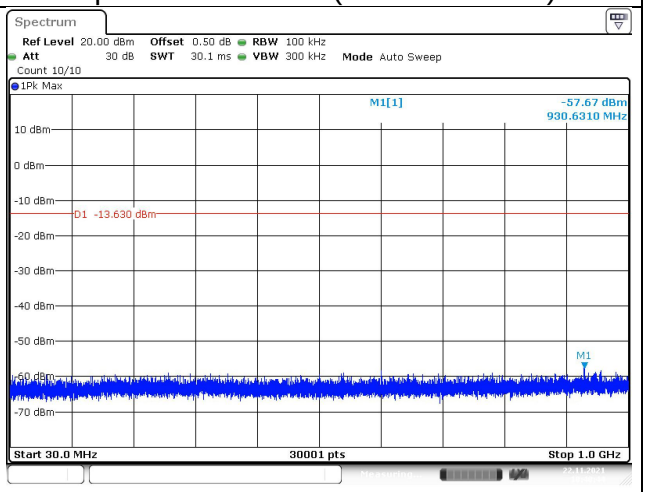
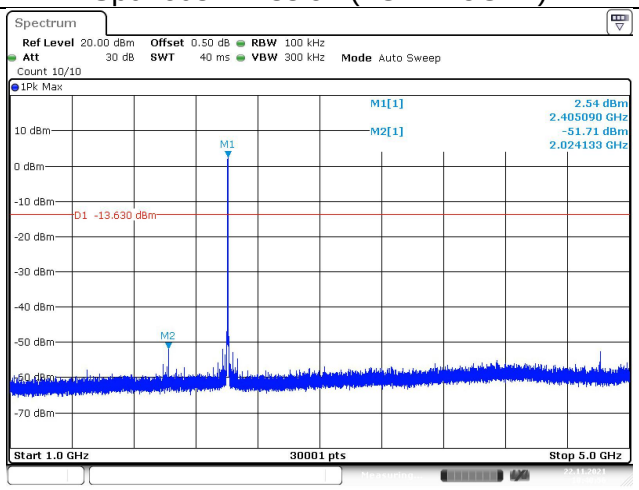
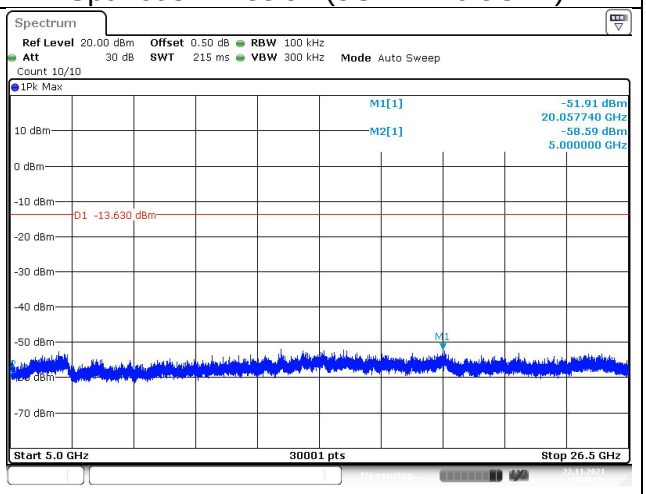
Test Method

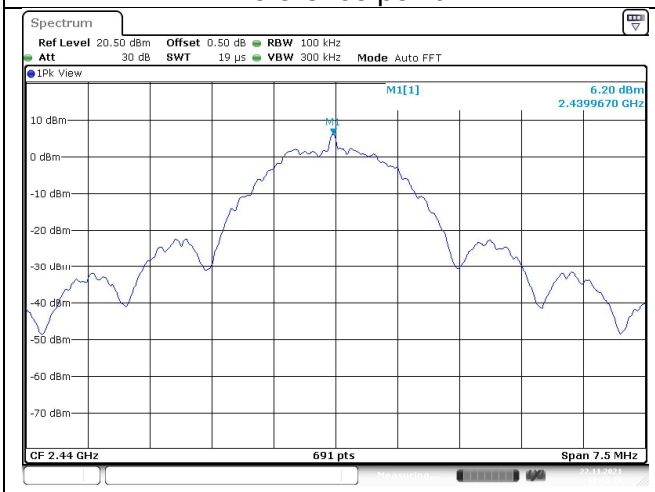
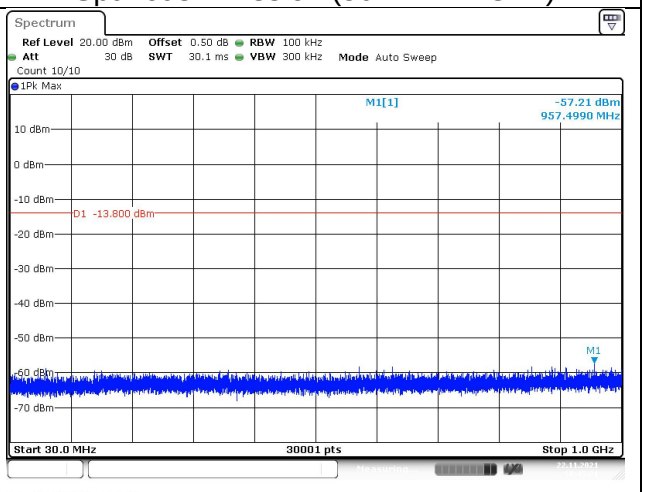
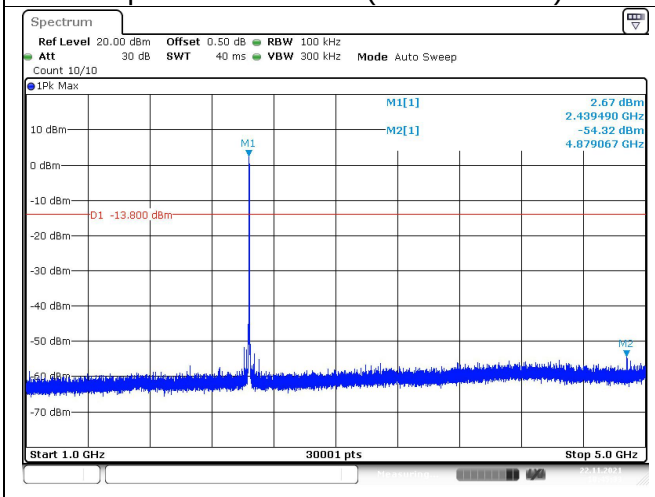
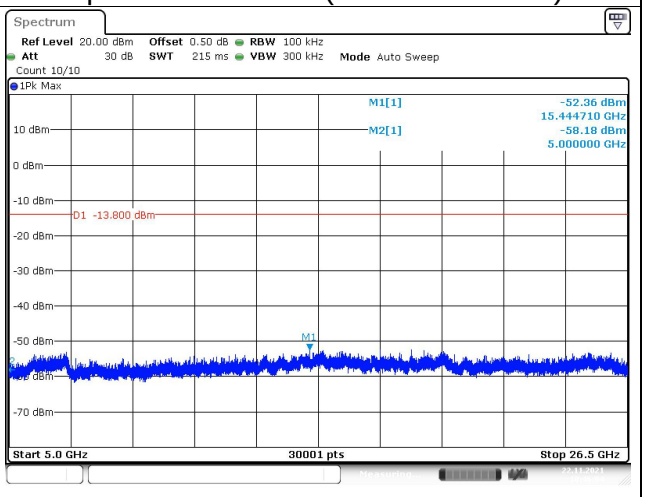
1. Establish a reference level by using the following procedure:
   a. Set RBW=100 kHz. VBW≥3RBW. Detector =peak, Sweep time = auto couple, Trace mode = max hold.
   b. Allow trace to fully stabilize, use the peak marker function to determine the maximum PSD level.
2. Use the maximum PSD level to establish the reference level.
   a. Set the center frequency and span to encompass frequency range to be measured.
   b. Use the peak marker function to determine the maximum amplitude level. Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements, report the three highest emissions relative to the limit.
3. Repeat above procedures until other frequencies measured were completed.

Limit

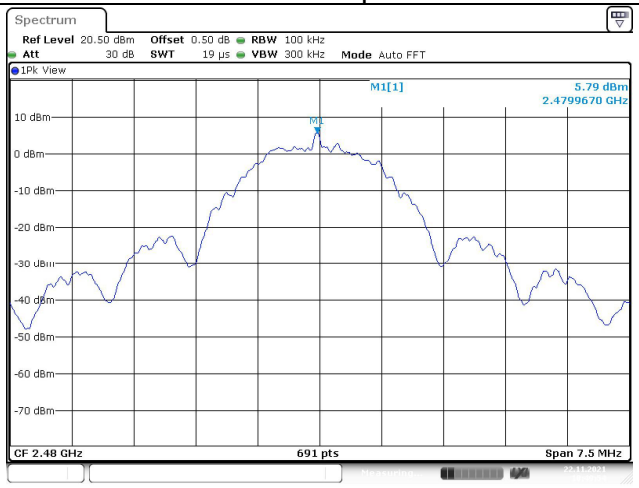
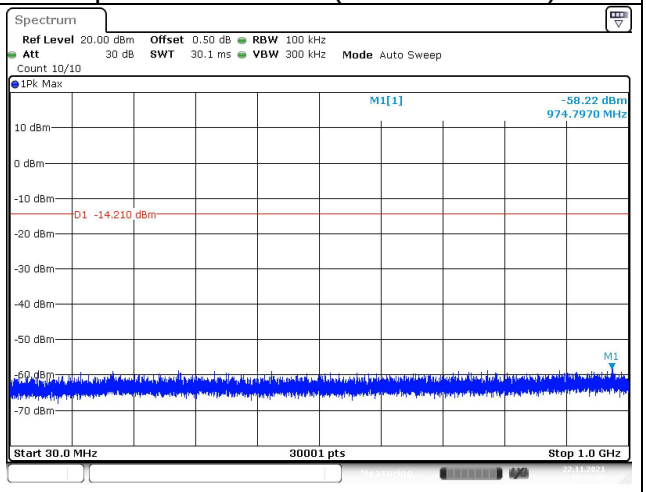
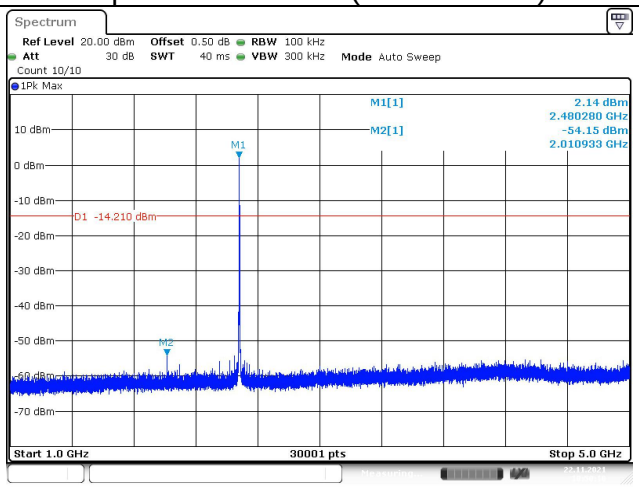
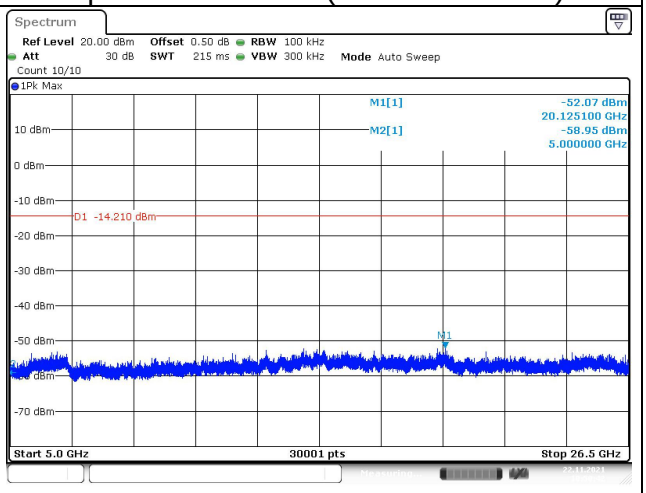
Frequency Range MHz	Limit (dBc)
30-25000	-20

Spurious RF conducted emissions

Out-of-Band Emissions	
Channel 0 (2405MHz)	
Reference point	Spurious Emission (30MHz – 1GHz)
	
Spurious Emission (1GHz –5GHz)	Spurious Emission (5GHz –26.5GHz)
	

Out-of-Band Emissions	
Channel 19 (2440MHz)	
Reference point	Spurious Emission (30MHz – 1GHz)
	
Spurious Emission (1GHz –5GHz)	Spurious Emission (5GHz –26.5GHz)
	

China

Out-of-Band Emissions	
Channel 39 (2480MHz)	
Reference point	Spurious Emission (30MHz – 1GHz)
	
Spurious Emission (1GHz –5GHz)	Spurious Emission (5GHz –26.5GHz)
	

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9.6 Band edge

Test Method

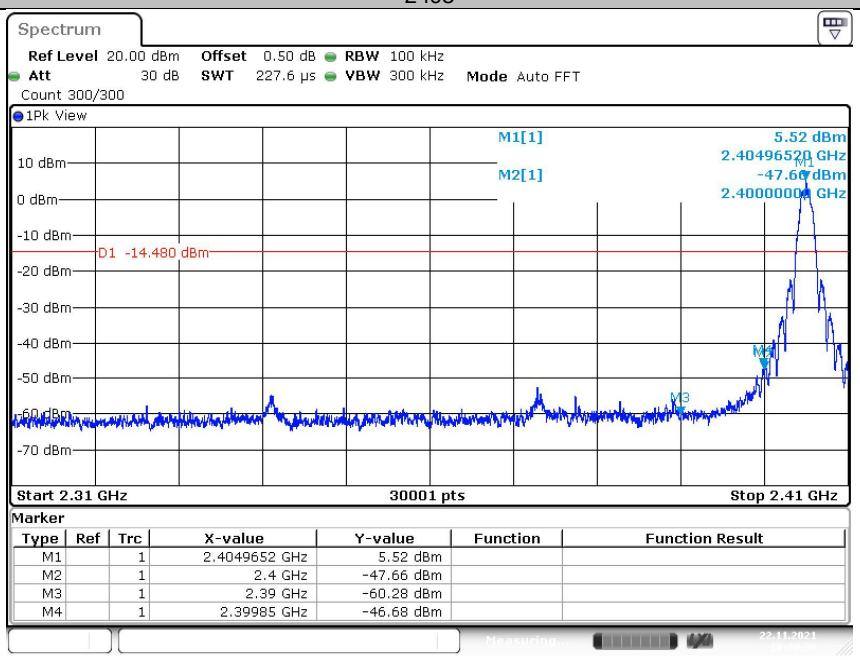
1 Use the following spectrum analyzer settings:
Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 100 kHz, VBW≥RBW, Sweep = auto, Detector function = peak, Trace = max hold.
2 Allow the trace to stabilize, use the peak and delta measurement to record the result.
3 The level displayed must comply with the limit specified in this Section.

Limit

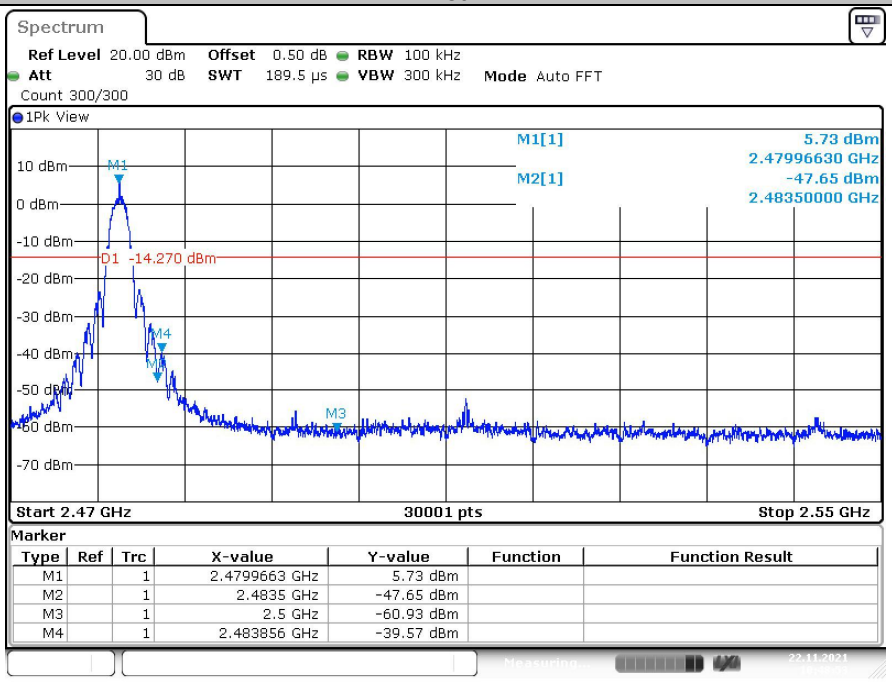
According to §15.247(d) and RSS-247 5.5, in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a) and RSS-Gen 8.10, must also comply with the radiated emission limits specified in 15.209(a) (see Section 15.205(c)) and RSS-Gen.

Test result

2405



2480



9.7 Spurious radiated emissions for transmitter

Test Method

1. The EUT was place on a turn table which is 1.5m above ground plane for above 1GHz and 0.8m above ground for below 1GHz at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference – receiving antenna, which was mounted on the top of a variable – height antenna tower.
3. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. Use the following spectrum analyzer settings According to C63.10:

For Below 1GHz

Use the following spectrum analyzer settings:
Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 100 kHz to 120 kHz, VBW≥RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

For Peak unwanted emissions Above 1GHz:

Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 1MHz, VBW≥RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

Procedures for average unwanted emissions measurements above 1000 MHz

a) RBW = 1MHz.
b) VBW ≥ [3 × RBW].
c) Detector = RMS (power averaging), if [span / (# of points in sweep)] ≤ RBW / 2. Satisfying this condition can require increasing the number of points in the sweep or reducing the span. If the condition is not satisfied, then the detector mode shall be set to peak.
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.

Limit

The radio emission outside the operating frequency band shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power. Radiated emissions which fall in the restricted bands, as defined in section15.205 and RSS-GEN 8.10 must comply with the radiated emission limits specified in section 15.209.

Frequency MHz	Field Strength uV/m	Measured Distance Meters
0.009~0.490	2400/F (kHz)	300
0.490~1.705	24000/F (kHz)	30
1.705~30	30	30

Frequency MHz	Field Strength uV/m	Field Strength dBµV/m	Detector
30-88	100	40	QP
88-216	150	43.5	QP
216-960	200	46	QP
960-1000	500	54	QP
Above 1000	500	54	AV
Above 1000	5000	74	PK

Spurious radiated emissions for transmitter

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.
Pre-scan with three orthogonal axis and worst case as X axis. The only worse case test result is listed in the report.

Test result

Test mode: GFSK (1Mbps)					
Channel 0 (2405MHz)					
Frequency (MHz)	**Measure Level (dBuV/m)**	**Limit (dBuV/M)**	**Margin (dB)**	**Detector**	**Polarization**
2384.2	43.21	74.00	30.79	Peak	Horizontal
4822.7	43.61	74.00	30.39	Peak	Horizontal
6035.9	46.21	74.00	27.79	Peak	Horizontal
2380.7	42.38	74.00	31.62	Peak	Vertical
4810.2	42.63	74.00	31.37	Peak	Vertical
6833.8	47.18	74.00	26.82	Peak	Vertical

Test mode: GFSK (1Mbps)					
Channel 19 (2440MHz)					
Frequency (MHz)	**Measure Level (dBuV/m)**	**Limit (dBuV/M)**	**Margin (dB)**	**Detector**	**Polarization**
4823.8	41.70	74.00	32.30	Peak	Horizontal
6914.3	47.01	74.00	26.99	Peak	Horizontal
4731.5	43.27	74.00	30.73	Peak	Vertical
7318.3	48.05	74.00	25.95	Peak	Vertical

Test mode: GFSK (1Mbps)					
Channel 39 (2480MHz)					
Frequency (MHz)	**Measure Level (dBuV/m)**	**Limit (dBuV/M)**	**Margin (dB)**	**Detector**	**Polarization**
2483.5	57.08	74.00	16.92	Peak	Horizontal
2483.5	50.09	54.00	3.91	AV	Horizontal
4818.7	42.58	74.00	31.42	Peak	Horizontal
6113.4	45.67	74.00	28.33	Peak	Horizontal
2483.5	51.24	74.00	22.76	Peak	Vertical
7438.4	48.92	74.00	25.08	Peak	Vertical
9853.3	51.60	74.00	22.40	Peak	Vertical

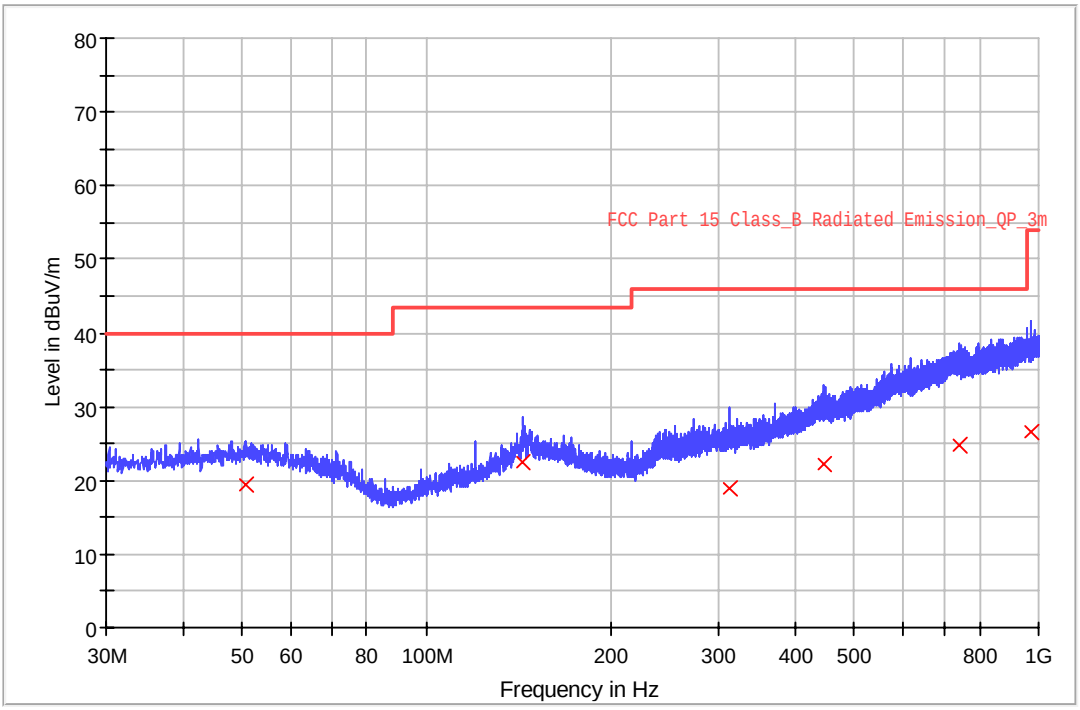
Remark:

(1) Emission level= Original Receiver Reading + Correct Factor
(2) Correct Factor = Antenna Factor + Cable Loss -Amplifier gain
(3) Margin = limit – Corrected Reading

The worst case of Radiated Emission below 1GHz:

Site: 3 meter chamber	Time: 2021/11/23 - 10:24
Limit: FCC_Part15.209_RE(3m) Class B	Engineer: Yongqing ZHENG
Probe: VULB9168	Polarity: Horizontal
EUT: Tubular motor, Model no: CM-03-E	Power: DC 5.0V
Note: Transmit by at channel 2405MHz. Note: Pre-scan with three orthogonal axis and worst case as X axis	

RE_VULB9168_pre_Cont_30-1000



Limit and Margin

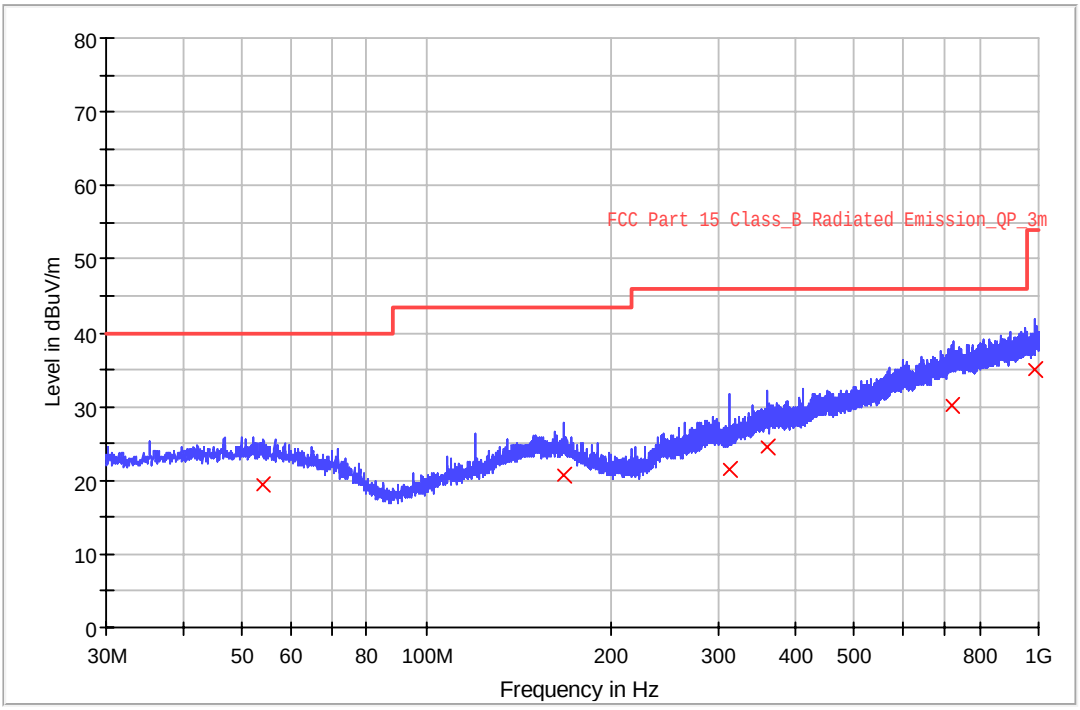
Frequency (MHz)	QuasiPeak (dBuV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBuV/m)
50.760000	19.5	1000.0	120.000	100.0	H	322.0	20.6	20.5	40.0
143.960000	22.5	1000.0	120.000	200.0	H	256.0	20.5	21.0	43.5
312.040000	18.9	1000.0	120.000	150.0	H	158.0	21.9	27.1	46.0
445.360000	22.3	1000.0	120.000	300.0	H	228.0	25.8	23.7	46.0
743.680000	24.9	1000.0	120.000	200.0	H	105.0	31.7	21.1	46.0
972.240000	26.5	1000.0	120.000	400.0	H	68.0	33.9	27.5	54.0

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)
Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)
Note 2: The test trace is same as the ambient noise and the amplitude of the emissions are attenuated more than 20dB below the permissible (the test frequency range: 9kHz ~ 30MHz, 18GHz ~ 25GHz), therefore no data appear in the report.

The worst case of Radiated Emission below 1GHz:

Site: 3 meter chamber	Time: 2021/11/23 - 10:01
Limit: FCC_Part15.209_RE(3m) Class B	Engineer Yongqing ZHENG
Probe: VULB9168	Polarity: Vertical
EUT: Tubular motor, Model no: CM-03-E	Power: DC5.0V
Note: Transmit by at channel 2405MHz. Note: Pre-scan with three orthogonal axis and worst case as X axis	

RE_VULB9168_pre_Cont_30-1000



Limit and Margin

Frequency (MHz)	QuasiPeak (dBuV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBuV/m)
54.160000	9.3	1000.0	120.000	100.0	V	300.0	20.4	30.7	40.0
168.000000	16.6	1000.0	120.000	150.0	V	280.0	20.4	26.9	43.5
311.960000	21.5	1000.0	120.000	200.0	V	50.0	21.9	24.5	46.0
360.000000	24.5	1000.0	120.000	300.0	V	328.0	23.0	21.5	46.0
723.360000	21.2	1000.0	120.000	400.0	V	180.0	31.2	24.8	46.0
987.960000	24.0	1000.0	120.000	300.0	V	100.0	34.3	29.9	54.0

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)
Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)
Note 2: The test trace is same as the ambient noise and the amplitude of the emissions are attenuated more than 20dB below the permissible (the test frequency range: 9kHz ~ 30MHz, 18GHz ~ 25GHz), therefore no data appear in the report.

10 Test Equipment List

List of Test Instruments
Test Site1

	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DATE	CAL. DUE DATE
C	Signal Analyzer	Rohde & Schwarz	FSV40	101091	2021-8-2	2022-8-1
RE	EMI Test Receiver	Rohde & Schwarz	ESR3	101906	2021-8-2	2022-8-1
	Signal Analyzer	Rohde & Schwarz	FSV40	101091	2021-8-2	2022-8-1
	Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9168	961	2019-3-16	2022-3-15
	Horn Antenna	Rohde & Schwarz	HF907	102393	2021-3-15	2024-3-14
	Pre-amplifier	Rohde & Schwarz	SCU-18D	19006451	2021-8-2	2022-8-1
	Loop antenna	Rohde & Schwarz	HFH2-Z2	100443	2021-5-21	2022-5-20
	DOUBLE-RIDGED WAVEGUIDE HORN WITH PRE-AMPLIFIER (18 GHZ - 40 GHZ)	ETS-Lindgren	3116C-PA	002222727	2020-9-23	2023-9-22
	3m Semi-anechoic chamber	TDK	9X6X6	----	2021-5-8	2024-5-7

Measurement Software Information			
Test Item	Software	Manufacturer	Version
C	Bluetooth and WiFi Test System	Shenzhen JS tonscend co.,ltd	2.6.77.0518
RE	EMC 32	Rohde & Schwarz	V9.15.00
CE	EMC 32	Rohde & Schwarz	V9.15.03

C - Conducted RF tests

- Conducted peak output power
- 6dB bandwidth and 99% Occupied Bandwidth
- Power spectral density*
- Spurious RF conducted emissions
- Band edge

11 System Measurement Uncertainty

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

Items	Extended Uncertainty
Radiated Disturbance	30MHz to 1GHz, ±5.03dB (Horizontal) ±5.12dB (Vertical) 1GHz to 18GHz, ±5.49dB 18GHz to 40GHz, ±5.63dB
Carrier power conducted measurement	50MHz~18GHz, ±1.238dB
Spurious Emission Conducted Measurement	9kHz ~40GHz, ± 1.224dB

Measurement Uncertainty Decision Rule:

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115: 2007, clause 4.4.3 and 4.5.1.

12 Photographs of Test Set-ups

Refer to the < Test Setup photos >.

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13 Photographs of EUT

Refer to the < External Photos > & < Internal Photos >.

THE END

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