Report No.: ZR/2020/8007403 Page: 1 of 43

FCC TEST REPORT

Application No:	ZR/2020/80074
Applicant:	vivo Mobile Communication Co., Ltd.
Address of Applicant	#283,BBK Road,Wusha,Chang'An,DongGuan City,China
Manufacturer:	vivo Mobile Communication Co., Ltd.
Address of Manufacturer	#283,BBK Road,Wusha,Chang'An,DongGuan City,China
EUT Description:	Mobile phone
Model No.:	V2028
Trade Mark:	vivo
FCC ID:	2AUCY-V2027
Standards:	47 CFR FCC Part 2, Subpart J
	47 CFR Part 15, Subpart C
Test Method	KDB558074 D01 15.247 Meas Guidance v05r02
	ANSI C63.10 (2013)
Date of Receipt:	2020/8/7(the original report ZR/2020/8001703)
Date of Test:	2020/8/7 to 2020/8/30(the original report ZR/2020/8001703)
	2020/9/3 to 2020/9/17(the new report ZR/2020/8007403)
Date of Issue:	2020/8/31(the original report ZR/2020/8001703)
	2020/9/17(the new report ZR/2020/8007403)
Test Result:	PASS *

* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:

Derde yang

Derek Yang Wireless Laboratory Manager



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1 Version

Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2020/9/17		Original

Authorized for issue by:		
Tested By	Mike Mu (Mike Hu) /Project Engineer	
Checked By	David Chen (David Chen) /Reviewer	



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2 Test Summary

SG

Test Item	Test Requirement	Test method	Test Result	Result
AC Power Line Conducted Emission	15.207	ANSI C63.10 2013	Clause 4.2	PASS
Conducted Output Power	15.247 (b)(3)	ANSI C63.10 2013	Clause 4.3	PASS
DTS (6 dB) Bandwidth & 99% Occupied Bandwidth	15.247 (a)(2)	ANSI C63.10 2013	Clause 4.4	PASS
Power Spectral Density	15.247 (e)	ANSI C63.10 2013	Clause 4.5	PASS
Band-edge for RF Conducted Emissions	15.247(d)	ANSI C63.10 2013	Clause 4.6	PASS
RF Conducted Spurious Emissions	15.247(d)	ANSI C63.10 2013	Clause 4.7	PASS
Radiated Spurious Emissions	15.205/15.209	ANSI C63.10 2013	Clause 4.8	PASS
Restricted bands around fundamental frequency (Radiated Emission)	15.205/15.209	ANSI C63.10 2013	Clause 4.9	PASS



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Remark:

This test report (Report No.: ZR/2020/8007403) is base on the original test report (Report No.: ZR/2020/8001703) issued on 2020-08-31.

Review this report and original report, this report just changing the parts according to the declaration letter from client.

According to the declaration from the applicant, the models: **V2027** and **V2028** are identical in specifications, only different according to the declaration letter from client.

Considering to the difference, pre-scan were performed on the sample in this report to find the items which can be influential to the result in the original test report for fully retest.

Therefore in this report only radiated spurious emissions were performed based on the worst case of the original report with report number ZR/2020/8001703 and other test data in this report are base on the previous report with report number ZR/2020/8001703.



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3 General Information

3.1 Client Information

Applicant:	vivo Mobile Communication Co., Ltd.	
Address of Applicant:	#283,BBK Road,Wusha,Chang'An, DongGuan City, China	
Manufacturer:	vivo Mobile Communication Co., Ltd.	
Address of Manufacturer:	#283,BBK Road,Wusha,Chang'An,DongGuan City,China	

3.2 Test Location

Company:	SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch
Address:	No. 1 Workshop, M-10, Middle section, Science & Technology Park, Shenzhen, Guangdong, China
Post code:	518057
Telephone:	+86 (0) 755 2601 2053
Fax:	+86 (0) 755 2671 0594
E-mail:	ee.shenzhen@sgs.com

3.3 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

• CNAS (No. ĆNAS LŽ929)

CNAS has accredited SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab to ISO/IEC 17025:2017 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

• A2LA (Certificate No. 3816.01)

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

• VCCI

The 3m Fully-anechoic chamber for above 1GHz, 10m Semi-anechoic chamber for below 1GHz, Shielded Room for Mains Port Conducted Interference Measurement and Telecommunication Port Conducted Interference Measurement of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-20026, R-14188, C-12383 and T-11153 respectively.

• FCC –Designation Number: CN1178

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized as an accredited testing laboratory.

Designation Number: CN1178. Test Firm Registration Number: 406779.

• Industry Canada (IC)

Two 3m Semi-anechoic chambers and the 10m Semi-anechoic chamber of SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab have been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 4620C-1, 4620C-2, 4620C-3.



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3.4 General Description of EUT

EUT Description:	Mobile phone
Model No.:	V2028
Trade Mark:	vivo
Hardware Version:	MP_0.1
Software Version:	PD2042F_EX_A_3.3.8
Operation Frequency:	2400MHz~2483.5MHz fc = 2402 MHz + N * 2 MHz, where: -fc = "Operating Frequency" in MHz, -N = "Channel Number" with the range from 0 to 39.
Bluetooth Version:	Bluetooth V5.0 LE(not support 2M)
Modulation Type:	GFSK
Number of Channel:	40
Sample Type:	⊠ Portable Device,
Antenna Type:	External, 🛛 Integrated
Antenna Gain:	-1dBi
Power Supply:	AC/DC Adapter; Battery; PoE:; Other:

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

Remark:

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In section 15.31(m), regards to the operating frequency range over 10 MHz, the lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Channel	Frequency
The lowest channel (CH0)	2402MHz
The middle channel (CH19)	2440MHz
The highest channel (CH39)	2480MHz



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3.5 Test Environment

Operating Environment			
Temperature:	25.0 °C		
Humidity:	50 % RH		
Atmospheric Pressure:	101.32 KPa		

3.6 Description of Support Units

The EUT has been tested independent unit.



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4 Test results and Measurement Data

4.1 Antenna Requirement

Standard requirement:	47 CFR Part 15C Section 15.203 /247(c)

15.203 requirement:

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, 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.

15.247(b) (4) requirement:

The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is -1dBi.



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-			1	
Test Requirement:	47 CFR Part 15C Section 15	5.207		
Test Method:	ANSI C63.10: 2013			
Test Frequency Range:	150kHz to 30MHz			
	Frequency range (MHz)	Limit (dBuV)		
		Quasi-peak	Average	
l insite	0.15-0.5	66 to 56*	56 to 46*	
Limit:	0.5-5	56	46	
	5-30	60	50	
	* Decreases with the logarith	nm of the frequency.		
Test Procedure:	 The mains terminal disturbance voltage test was conducted in a shielded room. The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50µH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded. The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane. The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10: 2013 on conducted measurement. 			
Test Setup:	Shielding Room	_	Ist Receiver	

4.2 AC Power Line Conducted Emissions

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Test Mode: Transmitting with GFSK modulation. Charge +Transmitting mode.	
Instruments Used:	Refer to section 5.10 for details.
Test Results:	Pass



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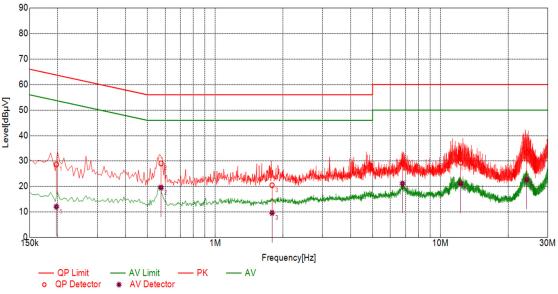
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Measurement Data

An initial pre-scan was performed on the live and neutral lines with peak detector.

Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.

Live line:



Test Graph

Final	Final Data List								
NO.	Freq. [MHz]	Factor [dB]	QP Value	QP Limit	QP Margin	AV Value	AV Limit	AV Margin	Туре
1	0.1973	10.10	28.58	63.73	35.15	11.97	53.73	41.76	L
2	0.5752	10.10	28.96	56.00	27.04	19.47	46.00	26.53	L
3	1.7896	10.10	20.38	56.00	35.62	9.57	46.00	36.43	L
4	6.7945	10.10	28.96	60.00	31.04	21.06	50.00	28.94	L
5	12.3247	10.10	29.29	60.00	30.71	21.00	50.00	29.00	L
6	24.1736	10.11	33.24	60.00	26.76	22.54	50.00	27.46	L

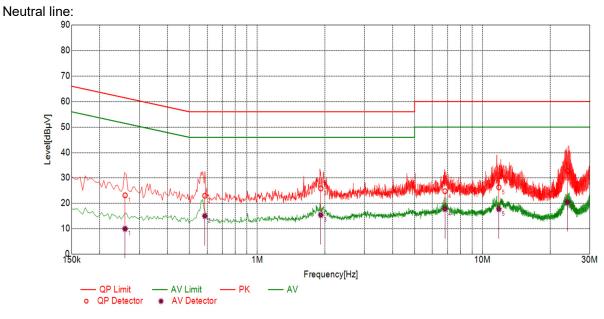


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Test Graph

Final Data List									
NO.	Freq. [MHz]	Factor [dB]	QP Value	QP Limit	QP Margin	AV Value	AV Limit	AV Margin	Туре
1	0.2591	10.10	23.06	61.46	38.40	9.91	51.46	41.55	Ν
2	0.5857	10.10	22.90	56.00	33.10	14.96	46.00	31.04	Ν
3	1.9178	10.10	25.78	56.00	30.22	15.34	46.00	30.66	Ν
4	6.8231	10.10	24.67	60.00	35.33	17.66	50.00	32.34	Ν
5	11.8355	10.10	26.18	60.00	33.82	17.65	50.00	32.35	Ν
6	23.8748	10.11	32.68	60.00	27.32	20.39	50.00	29.61	Ν

Remarks:

1. The following Quasi-Peak and Average measurements were performed on the EUT:

2. Final Test Level =Receiver Reading + LISN Factor + Cable Loss.



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4.3 Duty Cycle

SG

4.3.1	Test Results		
Test Mode		TX Freq. [MHz]	Duty cycle [%]
BLE_1M	(CH0, CH19, CH39	61.86

4.3.1 Test Plots

4.3.1.1 **BLE_1M**

gilent Spectrum Analyzer - Sw	vept SA				
	Ω AC	SENSE:INT	ALIGN AUT		Marker
larker 3 1.29800 m	าร	Tain Frank Dam	Avg Type: Log-Pv	VI TRACE 12345 C	Marker
	PNO: Fast ↔ IFGain:Low	Trig: Free Run #Atten: 40 dB		DET P N N N N	
	IFGain:LUW	PACEN: 40 GB			Marker Tab
Ref Offset 1	dB			Mkr3 1.298 ms	<u>On</u> C
0 dB/div Ref 30.00	dBm			4.68 dBm	
og					
20.0					Marker Count
0.0		<mark>2</mark>	3		[Off
	<u>-+ / /</u>	Y			
0.0					Coup
0.0					Marke
0.0					0n <u>(</u>
0.0	الم ويعرب ال	l have	au	and the state of the	
0.0 <mark>W</mark>	Aller water of the	here a		ALM. MANANA ANA	
0.0					
0.0					
enter 2.440000000				Span 0 Hz	
es BW 3.0 MHz	VBW	3.0 MHz	Sweep	2.000 ms (1001 pts)	
KR MODE TRC SCL	X	Y	FUNCTION FUNCTION WID	TH FUNCTION VALUE	
1 N 1 t	674.0 µs	4.79 dBm			
2 N 1 t 3 N 1 t	1.060 ms	4.81 dBm			
<mark>3 N 1 t</mark>	1.298 ms	4.68 dBm			All Markers C
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Test Requirement: 47 CFR Part 15C Section 15.247 (b)(3) Test Method: ANSI C63.10 :2013 Section 11.9.1.1 Spectrum Analyzer E.U.T 6 Test Setup: Non-Conducted Table **Ground Reference Plane** Limit: 30dBm Test Mode: Transmitting with GFSK modulation. Instruments Used: Refer to section 5.10 for details. Test Results: Pass

4.4 Conducted Output Power

4.4.1 Test Results

Measurement Data of Peak Power:

GFSK_1M mode							
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result				
Lowest	3.85	30.00	Pass				
Middle	4.99	30.00	Pass				
Highest	5.38	30.00	Pass				



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4.4.2 Test plots:

4.4.2.1 GFSK 1M Lowest Channel



4.4.2.2 GFSK 1M_Middle Channel





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4.4.2.3 GFSK 1M_Highest Channel





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4.5 DTS (6 dB) Bandwidth & 99% Occupied Bandwidth

Test Requirement:	47 CFR Part 15C Section 15.247 (a)(2)			
Test Method:	ANSI C63.10: 2013 Section 11.8 Option 2			
Test Setup:	Spectrum Analyzer E.U.T Non-Conducted Table Ground Reference Plane			
Limit:	≥ 500 kHz			
Test Mode:	Transmitting with GFSK modulation.			
Instruments Used:	Refer to section 5.10 for details.			
Test Results:	Pass			

4.5.1 Test Results

S

Mode	Test99% OccupiedChannelBandwidth (MHz)		6dB Emission Bandwidth (MHz)	Limit (kHz)	Result
	Lowest	1.03	1.06	≥500	Pass
GFSK_1M	Middle	1.03	1.05	≥500	Pass
	Highest	1.03	1.05	≥500	Pass



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4.5.2 Test plots







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GFSK 1M Middle Channel

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04:33:44 PM Apr 24, 2020 Radio Std: None ALIGN AUTC Peak Search Marker 1 2.4400 GHz Center Freq: 2.440000000 GHz Avg|Hold:>10/10 Trig: Free Run #Atten: 40 dB Radio Device: BTS #IFGain:Low Mkr1 2.44 GHz 1.8698 dBm Ref Offset 1 dB Ref 30.00 dBm 10 dB/div og Center 2.44 GHz #Res BW 30 kHz Span 3 MHz #VBW 100 kHz #Sweep 100 ms **Total Power** 11.1 dBm **Occupied Bandwidth** 1.0301 MHz **Transmit Freg Error** 10.476 kHz **OBW Power** 99.00 % x dB Bandwidth 596.1 kHz x dB -6.00 dB **I**STATUS ent Spectrum Analyzer - Occupied BW 04:16:19 PM Apr 24, 2020 Radio Std: None ALIGN A Peak Search Center Freq: 2.440000000 GHz Trig: Free Run Avg|Hol Marker 1 2.4400 GHz Avg|Hold:>10/10 #IFGain:Low #Atten: 40 dB Radio Device: BTS 2.440003 GH: Mkr1 Ref Offset 1 dB Ref 30.00 dBm 4.6572 dBm 10 dB/div og Center 2.44 GHz #Res BW 100 kHz Span 3 MHz #Sweep 100 ms #VBW 300 kHz **Total Power** 11.3 dBm **Occupied Bandwidth** 1.0530 MHz 3.304 kHz **OBW Power** 99.00 % **Transmit Freq Error** x dB Bandwidth 665.0 kHz x dB -6.00 dB **I**STATUS ASG



4.5.2.2

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ALIGN AUTC

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Peak Search

04:34:13 PM Apr 24, 2020 Radio Std: None Marker 1 2.4800 GHz Center Freq: 2.480000000 GHz Avg|Hold:>10/10 Trig: Free Run #Atten: 40 dB Radio Device: BTS #IFGain:Low 2.479997 GHz 2.2862 dBm Mkr1 Ref Offset 1 dB Ref 30.00 dBm 10 dB/div og Center 2.48 GHz #Res BW 30 kHz Span 3 MHz #VBW 100 kHz #Sweep 100 ms **Total Power** 11.6 dBm **Occupied Bandwidth** 1.0296 MHz **Transmit Freg Error** 9.986 kHz **OBW Power** 99.00 % x dB Bandwidth 595.8 kHz x dB -6.00 dB **I**STATUS

GFSK 1M_Highest Channel





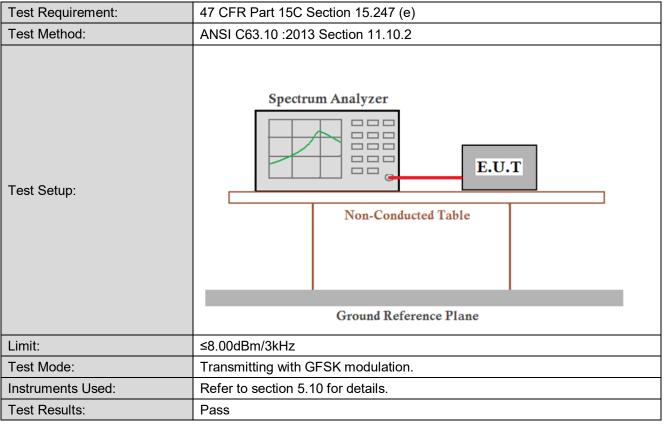
4.5.2.3

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4.6 Power Spectral Density



4.6.1 Test Results

Mode	Test Channel	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
	Lowest	-11.07	≤8.00	Pass
GFSK 1M	Middle	-10.40	≤8.00	Pass
_	Highest	-9.87	≤8.00	Pass



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4.6.2 Test plots

4.6.2.1 GFSK 1M Lowest Channel



4.6.2.2 GFSK 1M_Middle Channel





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4.6.2.3 GFSK 1M_Highest Channel





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4.7 Band-edge for RF Conducted Emissions

SG

Test Requirement:	47 CFR Part 15C Section 15.247 (d)			
Test Method:	ANSI C63.10: 2013 Section 11.13			
Test Setup:	Spectrum Analyzer E.U.T Non-Conducted Table			
	Ground Reference Plane			
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is 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.			
Test Mode:	Transmitting with GFSK modulation.			
Instruments Used:	Refer to section 5.10 for details.			
Test Results:	Pass			



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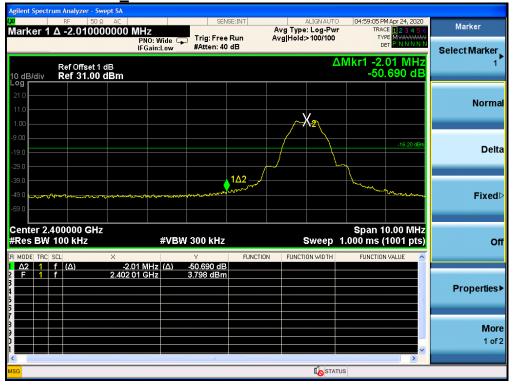
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4.7.1 Test plots

4.7.1.1 GFSK 1M Lowest Channel





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4.7.1.2 GFSK 1M_Highest Channel





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4.8 Spurious RF Conducted Emissions

SG

Test Requirement:	47 CFR Part 15C Section 15.247 (d)				
Test Method:	ANSI C63.10: 2013 Section 11.11				
Test Setup:	Spectrum Analyzer E.U.T Non-Conducted Table Ground Reference Plane				
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is 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.				
Test Mode:	Transmitting with GFSK modulation.				
Instruments Used:	Refer to section 5.10 for details.				
Test Results:	Pass				



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4.8.1 **Test plots:**

4.8.1.1 GFSK 1M Lowest Channel

04:50:20 PM Apr 24, 2020 Peak Search Avg Type: Log-Pwr Avg|Hold:>10/10 Marker 1 Δ 22.180018666667 GHz Trig: Free Run TYP PNO: Fast 😱 IFGain:Low DET Atten: 40 dB Next Peak ΔMkr1 22.180 0 GHz Ref Offset 1 dB Ref 30.00 dBm -37.891 dB 10 dB/div Log Next Pk Right <u>X2</u> Next Pk Left 1Δ Marker Delta Start 30 MHz Stop 25.00 GHz #Res BW 100 kHz #VBW 300 kHz #Sweep 2.500 s (30001 pts) Mkr→CF FUNCTION FUNCTION WIDTH FUNCTION VALU Δ2 1 f (Δ) F 1 f -37.891 dB 3.478 dBm 22.180 0 GHz (Δ) 2.402 2 GHz Mkr→RefLvl More 1 of 2 **I**STATUS





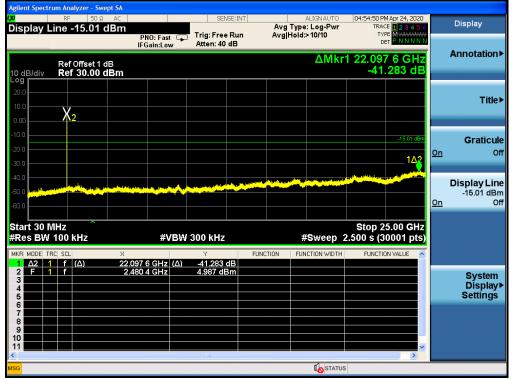


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4.8.1.3 GFSK 1M_Highest Channel



Remark:

Scan from 9kHz to 25GHz, the disturbance between 9KHz to 30MHz was very low, and the above harmonics were the highest point could be found when testing, The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.



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Test Requirement:	47 CFR Part 15C Section 15.209 and 15.205									
Test Method:	ANSI C63.10 :2013 Sec	ANSI C63.10 :2013 Section 11.12								
Test Site:	Measurement Distance:	Measurement Distance: 3m or 10m (Semi-Anechoic Chamber)								
	Frequency	Detector	RBW	VBW	Remark					
	0.009MHz-0.090MHz	Peak	10kHz	30kHz	Peak					
	0.009MHz-0.090MHz	Average	10kHz	30kHz	Average					
	0.090MHz-0.110MHz	Quasi-peak	10kHz	30kHz	Quasi-peak					
Pagaivar Satur	0.110MHz-0.490MHz	Peak	10kHz	30kHz	Peak					
Receiver Setup:	0.110MHz-0.490MHz	Average	10kHz	30kHz	Average					
	0.490MHz -30MHz	Quasi-peak	10kHz	30kHz	Quasi-peak					
	30MHz-1GHz	Quasi-peak	100 kHz	300kHz	Quasi-peak					
	Above 1GHz	Peak	1MHz	3MHz	Peak					
	Above IGHZ	Peak	1MHz	10Hz	Average					
	Frequency	Field strength	Limit	Remark	Measurement					
		(microvolt/meter)	(dBuV/m)	Remark	distance (m)					
	0.009MHz-0.490MHz	2400/F(kHz)	-	-	300					
	0.490MHz-1.705MHz	24000/F(kHz)	-	-	30					
	1.705MHz-30MHz	30	-	-	30					
	30MHz-88MHz	100	40.0	Quasi-peak	3					
Limit:	88MHz-216MHz	150	43.5	Quasi-peak	3					
	216MHz-960MHz	200	46.0	Quasi-peak	3					
	960MHz-1GHz	500	54.0	Quasi-peak	3					
	Above 1GHz	500	54.0	Average	3					
	Remark: 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.									

4.9 Radiated Spurious Emission

SG

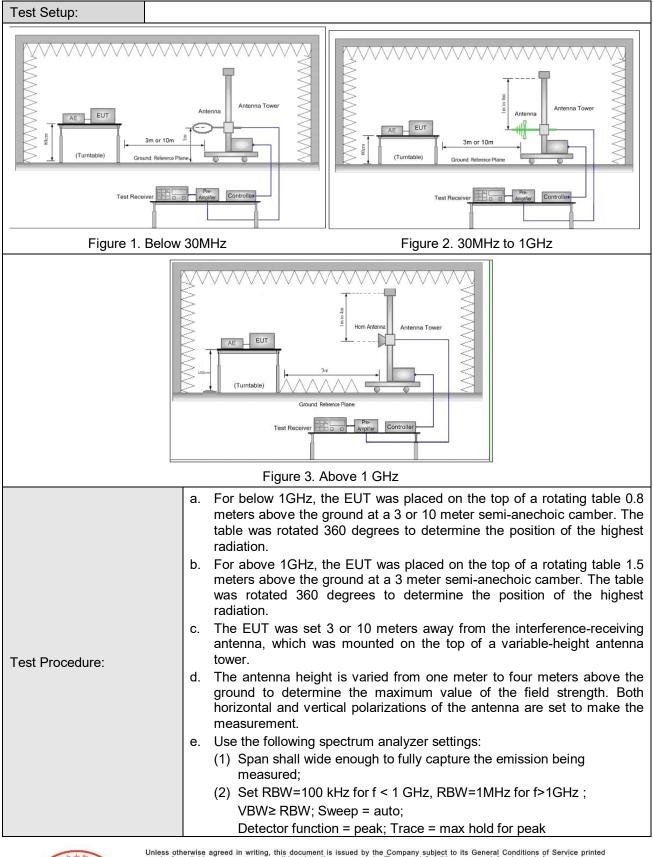


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	(3) For average measurement: use duty cycle correction factor method per 15.35(c).		
	Duty cycle = On time/100 milliseconds On time = N 1 *L 1 +N 2 *L 2 ++N n-1 *LN n-1 +N n *L n		
	Where N 1 is number of type 1 pulses, L 1 is length of type 1 pulses, etc.		
	Average Emission Level = Peak Emission Level + 20*log(Duty cycle)		
	f. 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 (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.		
	 g. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. 		
	h. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.		
	i. Test the EUT in the lowest channel (2402MHz),the middle channel (2440MHz),the Highest channel (2480MHz)		
	 j. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case. k. Repeat above procedures until all frequencies measured was complete. 		
	Transmitting with GFSK modulation.		
Exploratory Test Mode:	Charge + Transmitting mode.		
	Transmitting with GFSK modulation.		
Final Test Mode:	Pretest the EUT at Charge + Transmitting mode,		
	For below 1GHz part, through pre-scan, the worst case is the lowest channel. Only the worst case is recorded in the report.		
Instruments Used:	Refer to section 5.10 for details.		
Test Results:	Pass		



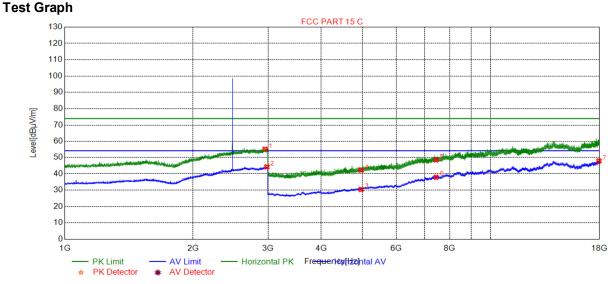
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Suspected List

Suspe	Suspected List							
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2952.98	55.26	9.67	74.00	18.74	150	140	Horizontal
2	2980.49	44.19	9.54	54.00	9.81	150	291	Horizontal
3	4960.00	30.42	-17.47	54.00	23.58	150	264	Horizontal
4	4960.00	42.19	-17.47	74.00	31.81	150	210	Horizontal
5	7440.00	48.43	-9.35	74.00	25.57	150	292	Horizontal
6	7440.00	37.83	-9.35	54.00	16.17	150	91	Horizontal
7	17934.5	47.76	0.70	54.00	6.24	150	91	Horizontal

Final Data List



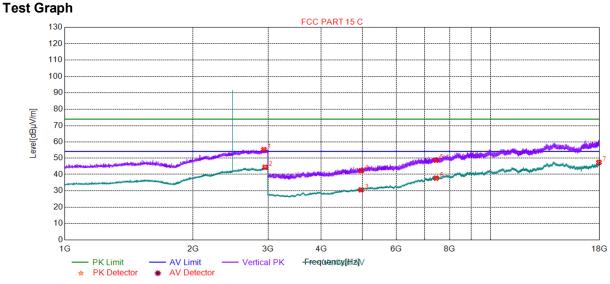
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Suspected List

Suspe	uspected List							
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2933.48	55.42	9.50	74.00	18.58	150	108	Vertical
2	2953.48	44.37	9.66	54.00	9.63	150	301	Vertical
3	4960.00	30.59	-17.47	54.00	23.41	150	347	Vertical
4	4960.00	42.21	-17.47	74.00	31.79	150	45	Vertical
5	7440.00	48.66	-9.35	74.00	25.34	150	342	Vertical
6	7440.00	37.73	-9.35	54.00	16.27	150	140	Vertical
7	17938.3	47.32	0.70	54.00	6.68	150	342	Vertical

Final Data List

Remark:

1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Final Test Level = Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor

- 2) Scan from 9kHz to 25GHz, the disturbance between 9KHz to 30MHz was very low, and the above harmonics were the highest point could be found when testing, The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.
- 3) As shown in this section, for frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. So, only the peak measurements were shown in the report.
- 4) All Modes have been tested, but only the worst case data displayed in this report.



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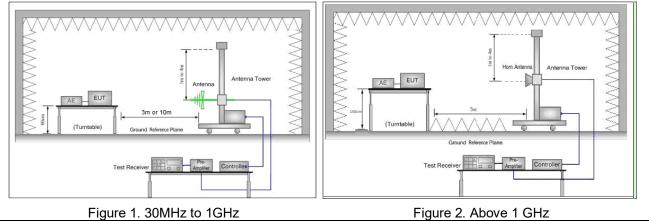
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Restricted bands around fundamental frequency 4.10

Test Requirement:	47 CFR Part 15C Sectio	47 CFR Part 15C Section 15.209 and 15.205					
Test Method:	ANSI C63.10: 2013 Sect	ANSI C63.10: 2013 Section 11.12					
Test Site:	Measurement Distance:	Measurement Distance: 3m or 10m (Semi-Anechoic Chamber)					
	Frequency	Limit (dBuV/m @3m)	Remark				
	30MHz-88MHz	40.0	Quasi-peak Value				
	88MHz-216MHz	43.5	Quasi-peak Value				
Limit:	216MHz-960MHz	46.0	Quasi-peak Value				
	960MHz-1GHz	54.0	Quasi-peak Value				
	Above 1GHz	54.0	Average Value				
	Above IGHZ	74.0	Peak Value				

Test Setup:

S



	a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters						
	above the ground at a 3 or 10 meter semi-anechoic camber. The table was						
	rotated 360 degrees to determine the position of the highest radiation.						
	b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters						
	above the ground at a 3 meter semi-anechoic camber. The table was rotated						
	360 degrees to determine the position of the highest radiation.						
	c. The EUT was set 3 or 10 meters away from the interference-receiving antenna,						
	which was mounted on the top of a variable-height antenna tower.						
	d. The antenna height is varied from one meter to four meters above the ground to						
	determine the maximum value of the field strength. Both horizontal and vertical						
Test Procedure:	polarizations of the antenna are set to make the measurement.						
	e. 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.						
	f. The test-receiver system was set to Peak Detect Function and Specified						
	Bandwidth with Maximum Hold Mode.						
	g. Place a marker at the end of the restricted band closest to the transmit						
	frequency to show compliance. Also measure any emissions in the restricted						
	bands. Save the spectrum analyzer plot. Repeat for each power and modulation						
	for lowest and highest channel						
	h. Test the EUT in the lowest channel, the Highest channel						
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	results shown in this test report refer only to the sample(s) tested and such	h sample(s) are retained for 30 days only.	
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	 The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case. Repeat above procedures until all frequencies measured was complete.
Exploratory Test Mode:	Transmitting with GFSK modulation. Charge + Transmitting mode.
Final Test Mode:	Transmitting with GFSK modulation. Pretest the EUT at Charge + Transmitting mode. Only the worst case is recorded in the report.
Instruments Used:	Refer to section 5.10 for details.
Test Results:	Pass



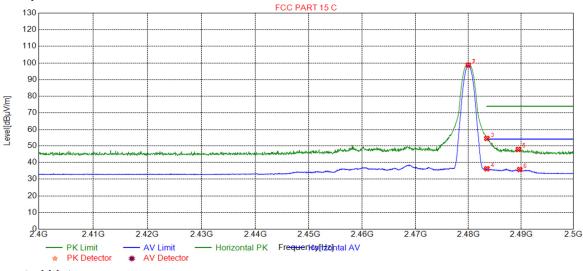
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4.10.1 Test plots 4.10.1.1 BLE 1M_Channel 39

Test Graph



Suspected List

Suspe	Suspected List							
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2480.00	98.73	8.01	0.00	-98.73	150	63	Horizontal
2	2480.00	98.67	8.01	0.00	-98.67	150	63	Horizontal
3	2483.50	54.41	8.01	74.00	19.59	150	52	Horizontal
4	2483.50	36.26	8.01	54.00	17.74	150	63	Horizontal
5	2489.49	47.84	8.02	74.00	26.16	150	79	Horizontal
6	2489.74	35.80	8.02	54.00	18.20	150	63	Horizontal

Final Data List

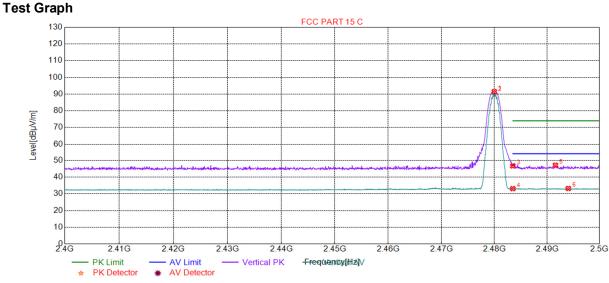


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4.10.1.2 BLE 1M_Channel 39

Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2480.00	91.50	8.01	0.00	-91.50	150	172	Vertical
2	2480.00	90.90	8.01	0.00	-90.90	150	172	Vertical
3	2483.50	46.73	8.01	74.00	27.27	150	177	Vertical
4	2483.50	33.12	8.01	54.00	20.88	150	172	Vertical
5	2491.59	47.18	8.02	74.00	26.82	150	346	Vertical
6	2494.04	33.23	8.02	54.00	20.77	150	50	Vertical

Final Data List

Remark:

The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Final Test Level = Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor All Modes have been tested, but only the worst case data displayed in this report.



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5 Measurement Uncertainty (95% confidence levels, k=2)

No.	Item	Measurement Uncertainty		
1	Total RF power, conducted	±0.75dB		
2	RF power density, conducted	±2.84dB		
3	Spurious emissions, conducted	±0.75dB		
4	Radiated Spurious emission test	±4.5dB (30MHz-1GHz)		
	Radiated Spundus emission test	±4.8dB (1GHz-25GHz)		
5	Conduct emission test	±3.12 dB(9KHz- 30MHz)		
6	Temperature test	±1°C		
7	Humidity test	±3%		
8	DC and low frequency voltages	±0.5%		



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6 Equipment List

Conducted Emission							
	Manufacturer	Model No.	Inventory No.	Cal. date	Cal.Duedate		
Test Equipment				(yyyy-mm- dd)	(yyyy-mm- dd)		
Shielding Room	ZhongYu Electron	GB-88	SEM001-06	2020/5/10	2023/5/9		
LISN	Rohde & Schwarz	ENV216	SEM007-01	2020/7/14	2021/7/14		
LISN	ETS-LINDGREN	Feb-16	SEM007-02	2020/4/1	2021/3/31		
Measurement Software	AUDIX	e3 V5.4.1221d	N/A	N/A	N/A		
Coaxial Cable	SGS	N/A	SEM024-01	2020/6/12	2021/6/11		
2 Line ISN	Fischer Custom Communications Inc.	FCC-TLISN- T2-02	EMC0122	2020/2/11	2021/2/10		
EMI Test Receiver	Rohde & Schwarz	ESCI	SEM004-02	2020/3/2	2021/3/1		

RF conducted test							
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date	Cal.Duedate		
				(yyyy-mm- dd)	(yyyy-mm- dd)		
DC Power Supply	Agilent Technologies Inc	66311B	W009-09	2020/7/15	2021/7/15		
Signal Analyzer	Rohde & Schwarz	FSV	W025-05	2020/1/3	2021/1/2		
Coaxial Cable	SGS	N/A	SEM031-01	2020/6/12	2021/6/11		
Attenuator	Weinschel Associates	WA41	SEM021-09	N/A	N/A		
Signal Generator	KEYSIGHT	N5173B	SEM006-05	2020/7/14	2021/7/14		
Temperature Chamber	GIANT FORCE	ICT-150-40- CP-AR	W027-03	2019/10/27	2020/10/27		
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2020/7/14	2021/7/14		



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RE in Chamber								
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date (yyyy-mm- dd)	Cal.Due date (yyyy-mm- dd)			
3m Semi-Anechoic Chamber	AUDIX	N/A	SEM001- 02	2018/3/13	2021/3/12			
Measurement Software	AUDIX	e3V8.2014-6-27	N/A	N/A	N/A			
Coaxial Cable	SGS	N/A	SEM026- 01	2020/6/12	2021/6/11			
EXA Signal Analyzer (10Hz-26.5GHz)	Agilent Technologies Inc	N9010A	SEM004- 09	2020/3/12	2021/3/11			
BiConiLog Antenna (26- 3000MHz)	ETS-Lindgren	3142C	SEM003- 01	2020/6/27	2023/6/26			
Horn Antenna (0.8- 18GHz)	Rohde & Schwarz	HF907	SEM003- 07	2018/4/13	2021/4/12			
Pre-amplifier(0.1- 1.3GHz)	HP	8447D	SEM005- 02	2020/7/14	2021/7/14			
Low Noise Amplifier(100MHz- 18GHz)	Black Diamond Series	BDLNA-0118- 352810	SEM005- 05	2020/9/3	2021/9/2			
Horn Antenna (15- 40GHz)	Schwarzbeck	BBHA 9170	SEM003- 15	2017/10/17	2020/10/16			
Pre-amplifier(18-26GHz)	Rohde & Schwarz	CH14-H052	SEM005- 17	2020/3/2	2021/3/1			
Band filter	N/A	N/A	SEM023- 01	N/A	N/A			
	RI	E in Chamber						
To at Environment			Inventory	Cal. date	Cal.Due date			
Test Equipment	Manufacturer	Model No.	No.	(yyyy-mm- dd)	(yyyy-mm- dd)			
3m Semi-Anechoic Chamber	ETS-LINDGREN	N/A	SEM001- 01	2020/8/5	2023/8/4			
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A			
Coaxial Cable	SGS	N/A	SEM025- 01	2020/6/12	2021/6/11			
MXE EMI Receiver (20Hz-8.4GHz)	Agilent Technologies	N9038A	SEM004- 05	2020/7/14	2021/7/14			
BiConiLog Antenna (26- 3000MHz)	ETS-LINDGREN	3142C	SEM003- 01	2020/6/27	2023/6/26			
Pre-amplifier (0.1- 1.3GHz)	Agilent Technologies	8447D	SEM005- 01	2020/3/2	2021/3/1			



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RE in Chamber							
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. Date (yyyy-mm- dd)	Cal. Due date (yyyy- mm-dd)		
10m Semi-Anechoic Chamber	SAEMC	FSAC1018	SEM001-03	2018/3/31	2021/3/30		
EMI Test Receiver (9k- 7GHz)	Rohde & Schwarz	ESR	SEM004-03	2020/3/2	2021/3/1		
Trilog-Broadband Antenna(25M-2GHz)	Schwarzbeck	VULB9168	SEM003-18	2020/3/15	2022/3/14		
Pre-amplifier (9k-1GHz)	Sonoma	310N	SEM005-03	2020/3/12	2021/3/11		
Loop Antenna (9kHz- 30MHz)	ETS-Lindgren	6502	SEM003-08	2020/8/21 2020/8/22	2021/8/20 2023/8/21		
Measurement Software	AUDIX	e3 V8.2014-6- 27	N/A	N/A	N/A		
Coaxial Cable	SGS	N/A	SEM029-01	2020/6/12	2021/6/11		

7 Photographs - EUT Constructional Details

Refer to Appendix A - Photographs of Set-Up for ZR/2020/80074.

The End



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