

Element Materials Technology

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MEASUREMENT REPORT FCC Part 90

Applicant Name:

Apple Inc. One Apple Park Way Cupertino, CA 95014 United States

Date of Testing: 05/05/2023 - 07/31/2023 Test Report Issue Date: 8/11/2023 Test Site/Location: Element Materials Technology Morgan Hill, CA, USA Test Report Serial No.: 1C2305020014-07.BCG

FCC ID:BCG-A2986APPLICANT:Apple Inc.

Application Type: Model: EUT Type: FCC Classification: FCC Rule Part: Test Procedure(s):

Certification A2986, A2987 Watch PCS Licensed Transmitter Worn on Body (PCT) §2.1049, §90(S), §90(R) ANSI C63.26-2015, TIA-603-E-2016, KDB 971168 D01 v03r01,

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in §2.947. Test results reported herein relate only to the item(s) tested.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

RJ Ortanez Executive Vice President



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Mode	Bandwidth	Modulation	Tx Frequency Range [MHz]	Measurement	OBW [MHz]	Max. Power [mW]	Max. Power [dBm]	Emission Designator
	1.4 MHz	QPSK	814.7 - 823.3	Conducted	1.1049	354.813	25.50	1M10G7W
		16QAM	814.7 - 823.3	Conducted	1.1116	311.889	24.94	1M11D7W
	3 MHz	QPSK	815.5 - 822.5	Conducted	2.7311	354.813	25.50	2M73G7W
LTE Band 26		16QAM	815.5 - 822.5	Conducted	2.7302	311.889	24.94	2M73D7W
LTE Danu 20	5 MHz	QPSK	816.5 - 821.5	Conducted	4.5727	354.813	25.50	4M57G7W
		16QAM	816.5 - 821.5	Conducted	4.5528	309.742	24.91	4M55D7W
	10 MHz	QPSK	819.0	Conducted	9.1127	354.813	25.50	9M11G7W
		16QAM	819.0	Conducted	5.4217	304.089	24.83	5M42D7W
	5 MHz	QPSK	790.5 - 795.5	ERP	4.5814	0.432	-3.65	4M58G7W
LTE Band 14		16QAM	790.5 - 795.5	ERP	4.5710	0.379	-4.21	4M57D7W
	10 MHz	QPSK	793.0	ERP	9.1575	0.432	-3.65	9M16G7W
		16QAM	793.0	ERP	5.6649	0.378	-4.23	5M66D7W

EUT Overview

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1.0 INTRODUCTION

1.1 Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Innovation, Science and Economic Development Canada.

1.2 Element Materials Technology Test Location

These measurement tests were conducted at the Element facility located at 18855 Adams Court, Morgan Hill, CA 95037. The measurement facility is compliant with the test site requirements specified in ANSI C63.4-2014 and KDB 414788 D01 v01r01.

1.3 Test Facility / Accreditations

Measurements were performed at Element located in Morgan Hill, CA 95037, U.S.A.

- Element Materials Technology is an ISO 17025-2017 accredited test facility under the American Association for Laboratory Accreditation (A2LA) with Certificate number 2041.02 for Specific Absorption Rate (SAR), Hearing Aid Compatibility (HAC) testing, where applicable, and Electromagnetic Compatibility (EMC) testing for FCC and Innovation, Science, and Economic Development Canada rules.
- Element Washington DC LLC TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC 17065-2012 by A2LA (Certificate number 2041.03) in all scopes of FCC Rules and ISED Standards (RSS).
- Element Materials Technology Morgan Hill facility is a registered (22831) test laboratory with the site description on file with ISED.
- Element Washington DC LLC is a Recognized U.S. Certification Assessment Body (CAB # US0110) for ISED Canada as designated by NIST under the U.S. and Canada Mutual Recognition Agreements (MRAs)

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2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Apple Watch FCC ID: BCG-A2986**. The test data contained in this report pertains only to the emissions due to the EUT's licensed transmitters that operate under the provisions of Part.

Test Device Serial No.: HLXY14F4J1, H6H5Y6X1J6, KM6Q5256HG, DLCGVD000GU00000HU

2.2 Device Capabilities

This device contains the following capabilities:

850/1700/1900 WCDMA/HSPA, Multi-band LTE, 802.11b/g/n WLAN, 802.11a/n UNII, 802.15.4 ab-NB, Bluetooth (1x, EDR, HDR4, HDR8, LE1M, LE2M), NFC, UWB, 60.5GHz Transmitter.

			Antenna	a FCM		
Simultaneous Tx	WLAN	Bluetooth	802.15.4ab - NB	LTE/WCDMA	UNII	UWB
Config	802.11 b/g/n	BDR, EDR, HDR4/8, LE1/2M	O-QPSK	Mid/High Band	802.11 a/n	Ch.5/Ch.9
Config 1	✓	×	×	✓	×	\checkmark
Config 2	×	~	×	✓	*	✓
Config 3	×	✓	~	✓	×	×
Config 4	✓	×	✓	✓	×	×
Config 5	×	✓	×	✓	✓	×
Config 6	×	✓	×	✓	×	√
Config 7	✓	×	×	✓	×	×
Config 8	✓	×	✓	×	×	×
Config 9	✓	×	×	×	×	✓
Config 10	×	✓	×	×	✓	×
Config 11	×	√	×	✓	×	×
Config 12	×	✓	✓	×	×	×
Config 13	×	\checkmark	×	×	×	✓
Config 14	×	×	✓	✓	×	×
Config 15	×	×	×	✓	√	×
Config 16	×	×	×	✓	×	✓

 Table 2-1. Simultaneous Transmission Configurations

 \checkmark = Support; x = Not Support

All the above simultaneous transmission configurations have been tested and the worst case configuration was found to be config 5 and reported in RF UNII, RF Bluetooth and RF Part 27b test reports.

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2.3 Antenna Description

Following antenna gains provided by manufacturer were used for testing.

Band	Antenna Gain (dBi)
Danu	Antenna BCM
LTE Band 26	-25.9
LTE Band 14	-27.0

Table 2-2. Highest Antenna Gain

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2.4 Test Support Equipment

1	Apple Macbook	Model:	A1398	S/N:	FVFDHG8TP3XY
	w/AC/DC Adapter	Model:	A1435	S/N:	N/A
2	Apple USB-C cable	Model:	N/A	S/N:	N/A
	w/ Charging Dock	Model:	A2921	S/N:	DQ8137601FE08V22H
	w/ Cradle	Model:	N/A	S/N:	CYV203500YQE1EN01MP2K
				·	
3	Apple Magnetic Charger	Model:	A2515	S/N:	DLC217301Z91NR11B
	Apple Magnetic Charger	Model:	A2515	S/N:	DLC217301YM1NR112
4	Pathfinder Mocha X3100	Model:	920-13353-01	S/N:	DLCGMW0007D00000N7
	SiP Socket	Model:	X3100 P2 PF037	S/N:	DLCGQG000UT00000XJ
5	DC Power Supply	Model:	KPS3010D	S/N:	N/A
6	Store Sample Wristband	Model:	N/A	S/N:	DLC316300CU1QGKA2

 Table 2-3. Test Support Equipment

2.5 Test Configuration

The EUT was tested per the guidance of ANSI C63.26-2015, TIA-603-E-2016 and KDB 971168 D01 v03r01. See Section 7.0 of this test report for a description of the radiated and antenna port conducted emissions tests.

The worst case configuration was investigated for all combinations of various types of non-metal wristbands. The EUT was also investigated with and without wireless charger. The worst case configuration found was used for all testing.

For emissions from 1GHz – 18GHz, low, mid, and high channels were tested with highest power and worst case configuration. The emissions below 1GHz and above 18GHz were tested with the highest transmitting power and the worst case channel.

The EUT was manipulated through three orthogonal planes of X-orientation (flatbed), Y-orientation (landscape), and Z-orientation (portrait) during the testing. Only the worst case emissions were reported in this test report.

This device only supports 27RBs or less for 16-QAM uplink.

2.6 Software and Firmware

The test was conducted with firmware version watchOS 10.0 installed on the EUT.

2.7 EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and no modifications were made during testing.

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3.0 DESCRIPTION OF TESTS

3.1 Evaluation Procedure

The measurement procedures described in the document titled "Land Mobile FM or PM – Communications Equipment – Measurements and Performance Standards" (ANSI C63.26-2015 and TIA-603-E-2016) and "Procedures for Compliance Measurement of the Fundamental Emission Power of Licensed Wideband (> 1 MHz) Digital Transmission Systems" (KDB 971168 D01 v03r01) were used in the measurement of the EUT.

Deviation from Measurement Procedure.....None

3.2 Radiated Spurious Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. The test site inside the chamber is a 6m x 5.2m elliptical, obstruction-free area in accordance with Figure 5.7 of Clause 5 in ANSI C63.4-2014. Absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections for measurements above 1GHz. For measurements below 1GHz, the absorbers are removed. A raised turntable is used for radiated measurement. The turn table is a continuously rotatable, remote-controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm tall test table made of Styrodur is placed on top of the turn table. A Styrodur pedestal is placed on top of the test table to bring the total table height to 1.5m.

The equipment under test was transmitting while connected to its integral antenna and is placed on a turntable 3 meters from the receive antenna. The receive antenna height is adjusted between 1 and 4 meter height, the turntable is rotated through 360 degrees, and the EUT is manipulated through all orthogonal planes representative of its typical use to achieve the highest reading on the receive spectrum analyzer.

For radiated spurious emissions measurements and calculations, conversion method is used per the formulas in KDB 971168 Section 5.8.4. Field Strength (EIRP) is calculated using the following formulas:

 $E_{[dB\mu V/m]} = Measured amplitude level_{[dBm]} + 107 + Cable Loss_{[dB]} + Antenna Factor_{[dB/m]}$ And

 $EIRP_{[dBm]} = E_{[dB\muV/m]} + 20logD - 104.8$; where D is the measurement distance in meters.

All radiated measurements are performed in a chamber that meets the site requirements per ANSI C63.4-2014.

Per KDB 414788 D01 v01r01, radiated emission test sites other than open-field test sites (e.g., shielded anechoic chambers), may be employed for emission measurements below 30MHz if characterized so that the measurements correspond to those obtained at an open-field test site. To determine test site equivalency, a reference sample transmitting at 149kHz was measured on an open field test site (asphalt with no ground plane) and then measured in the 3m semi-anechoic chamber. A calibrated 60cm loop antenna was used while the reference device was rotated through the X, Y and Z axis in order to capture the worst case level. A maximum deviation of 2.77dB at 149kHz was measured when comparing the 3 meter semi-anechoic chamber to the open field site.

Radiated spurious emission levels are investigated with the receive antenna horizontally and vertically polarized per ANSI C63.26-2015 and TIA-603-E-2016.

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4.0 MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.23-2012. All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95% level of confidence. The measurement uncertainty shown below meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Contribution	Expanded Uncertainty (±dB)
Conducted Bench Top Measurements	1.77
Radiated Disturbance (<30MHz)	4.38
Radiated Disturbance (30MHz-1GHz)	4.75
Radiated Disturbance (1-18GHz)	5.20
Radiated Disturbance (>18GHz)	4.72

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5.0 TEST EQUIPMENT CALIBRATION DATA

Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST). Measurements antennas used during testing were calibrated in accordance to the requirements of ANSI C63.5-2017.

Manufacturer Model		lodel Description		Cal Interval	Cal Due	Serial Number
Agilent Technologies	N9030A	3Hz-44GHz PXA Signal Analyzer	6/21/2023	Annual	6/21/2024	MY49430244
ATM	180-442A-KF	20dB Nominal Gain Horn Antenna	11/1/2022	Annual	11/1/2023	T058701-01
ESPEC	SU-241	Tabletop Temperature Chamber	11/10/2022	Annual	11/10/2023	92009574
ETS-Lindgren	3117	Double Ridged Guide Antenna (1-18 GHz)	3/30/2023	Annual	3/30/2024	00218555
Keysight Technology	N9040B	UXA Signal Analyzer	3/10/2023	Annual	3/10/2024	MY57212015
Rohde & Schwarz	TS-PR18	Pre-Amplifier (1GHz - 18GHz)	6/2/2023	Annual	6/2/2024	100050
Rohde & Schwarz FSV40 Rohde & Schwarz ESW44 Rohde & Schwarz TS-PR8 Rohde & Schwarz CMW500		Signal Analyzer (10Hz-40GHz)	5/11/2023	Annual	5/11/2024	101619
		EMI Test Receiver	6/6/2023	Annual	6/6/2024	101668
		Pre-Amplifier (30MHz - 8GHz)	6/22/2023	Annual	6/22/2024	102356
		Wideband Radio Communication Tester	10/13/2022	Annual	10/13/2023	161616
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	12/16/2022	Annual	12/16/2023	164715
Rohde & Schwarz TS-PR1840 Rohde & Schwarz HFH2-Z2 Rohde & Schwarz ENV216		Pre-Amplifier (18GHz - 40GHz)	6/2/2023	Annual	6/2/2024	100050
		Loop Antenna	5/1/2023	Annual	5/1/2024	100519
		Two-Line V-Network	6/8/2023	Annual	6/8/2024	192052
Schwarzbeck	VULB 9162	Bilog Antenna (30MHz - 6GHz)	4/17/2023	Annual	4/17/2024	00304

Table 5-1. Test Equipment List

Notes:

1. For equipment listed above that has a calibration date or calibration due date that falls within the test date range, care was taken to ensure that this equipment was used after the calibration date and before the calibration due date.

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6.0 SAMPLE CALCULATIONS

Emission Designator

QPSK Modulation

Emission Designator = 8M62G7W

LTE BW = 8.62 MHz G = Phase Modulation 7 = Quantized/Digital Info W = Combination of Any

16QAM Modulation

Emission Designator = 8M45D7W

LTE BW = 8.45 MHz D = Amplitude/Angle Modulated 7 = Quantized/Digital Info W = Combination of Any

Spurious Radiated Emission

Example: Middle Channel LTE Mode 2nd Harmonic (1564 MHz)

The average spectrum analyzer reading at 3 meters with the EUT on the turntable was -81.0 dBm. The gain of the substituted antenna is 8.1 dBi. The signal generator connected to the substituted antenna terminals is adjusted to produce a reading of -81.0 dBm on the spectrum analzyer. The loss of the cable between the signal generator and the terminals of the substituted antenna is 2.0 dB at 1564 MHz. So 6.1 dB is added to the signal generator reading of -30.9 dBm yielding -24.80 dBm. The fundamental EIRP was 25.501 dBm so this harmonic was 25.501 dBm - (-24.80).

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7.0 TEST RESULTS

7.1 Summary

Company Name:	Apple Inc.
FCC ID:	BCG-A2986
FCC Classification:	PCS Licensed Transmitter Worn on Body (PCT)
Mode(s):	<u>LTE</u>

Test Condition	Test Description	FCC Part Section(s)	Test Limit	Test Result	Reference
	Occupied Bandwidth	2.1049	N/A	N/A	Section 7.2
	Conducted Band Edge / Spurious Emissions (LTE Band 14)	2.1051, 90.543(e)	On all frequencies between 769-775 MHz and 799-805 MHz, attenuation by a factor not less than 65 + 10 log(P) dB in a 6.25 kHz band segment, for mobile and portable stations. On any frequency between 775-788 MHz, above 805 MHz, and below 758 MHz, attenuation by at least 43 + 10 log(P) dB	PASS	Sections 7.3, 7.4
CONDUCTED	Conducted Band Edge / Spurious Emissions (LTE Band 26)	2.1051, 90.691(a)	-13 dBm for all out-of-band emissions except -30 dBm at Band Edge and for all out-of-band emissions within 37.5kHz of Block Edge	PASS	Sections 7.3, 7.4
	Frequency Stability (LTE Band 14)	2.1055	Fundamental emissions stay within authorized frequency block over the temperature and voltage range as tested.	PASS	Section 7.8
	Frequency Stability (LTE Band 26)	90.213	< 2.5 ppm	PASS	Section 7.8
	Conducted Power	2.1046, 90.635	< 100 Watts	PASS	Section 7.5
	Effective Radiated Power (LTE Band 14)	90.542(a)(7)	< 3 Watts max. ERP	PASS	Section 7.6
RADIATED	Radiated Spurious Emissions (LTE Band 14)	2.1053, 90.543(e)	> 43 + 10 log10 (P[Watts]) for all out-of-band emissions except emissions in the 1559 - 1610MHz band are subject to a limit of -40dBm/MHz for wideband signals	PASS	Section 7.7
RADIA IED	Radiated Spurious Emissions (LTE Band 26)	2.1053, 90.691(a)	-13 dBm for all out-of-band emissions except -30 dBm at Band Edge and for all out-of-band emissions within 37.5kHz of Block Edge	PASS	Section 7.7

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Table 7-1. Summary of Test Results

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Notes:

- 1. All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
- 2. The analyzer plots shown in Section 7.0 were taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables, directional couplers, and attenuators used as part of the system to maintain a link between the call box and the EUT at all frequencies of interest.
- 3. All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables, attenuators, and couplers.
- 4. For conducted spurious emissions, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is Element EMC Software Tool v1.1.

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7.2 Occupied Bandwidth §2.1049

Test Overview

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured. All modes of operation and all ports were investigated and the worst case configuration results are reported in this section.

Test Procedure Used

KDB 971168 D01 v03r01 - Section 4.2

Test Settings

- 1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 99% occupied bandwidth and the 26dB bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
- 2. RBW = 1 5% of the expected OBW
- 3. VBW ≥ 3 x RBW
- 4. Detector = Peak
- 5. Trace mode = max hold
- 6. Sweep = auto couple
- 7. The trace was allowed to stabilize
- 8. If necessary, steps 2 7 were repeated after changing the RBW such that it would be within
 - 1-5% of the 99% occupied bandwidth observed in Step 7

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

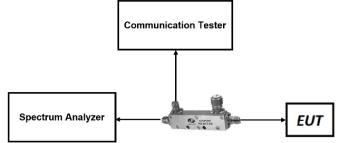


Figure 7-1. Test Instrument & Measurement Setup

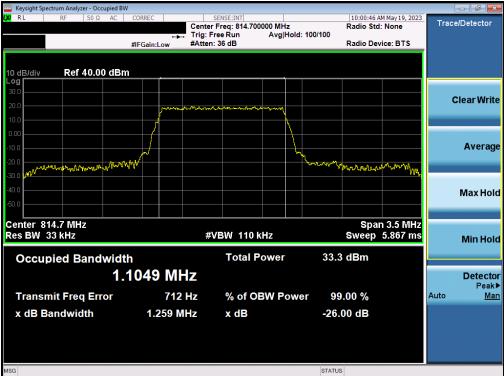
Test Notes

None.

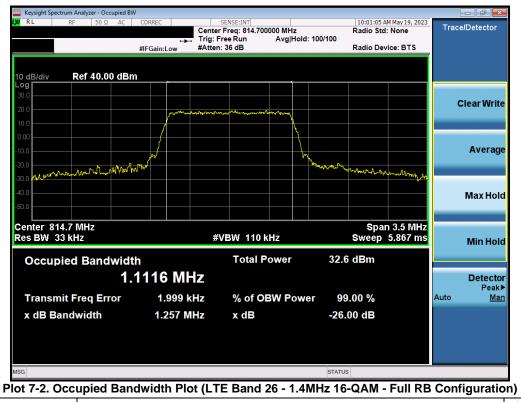
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LTE Band 26



Plot 7-1. Occupied Bandwidth Plot (LTE Band 26 - 1.4MHz QPSK - Full RB Configuration)

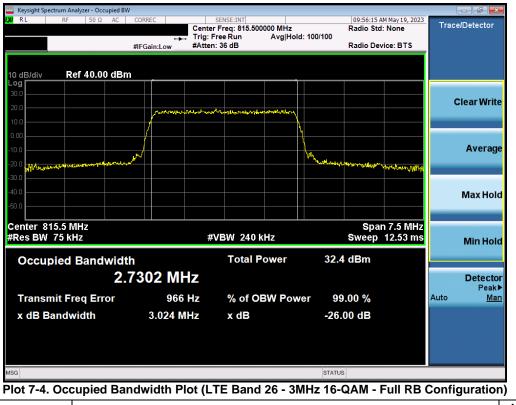


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	sight Spectrum An	alyzer - Oc	cupied BW											
<mark>lxi</mark> RL	RF	50 Ω	AC (ORRE	C		NSE:INT reg: 815.500	000 MHz			09:56:04 A	M May 19, 2023	Trac	ce/Detector
					+	Trig: Fre	e Run	Avg Hol	d: 100	00/100				
			#	IFGai	n:Low	#Atten: 3	6 dB				Radio Dev	vice: BTS		
10 dB Log F	i/div R	ef 40.0	0 dBm											
30.0														
20.0					darks to see all	And and a start of the start of	- the work on the	anary a laffe.						Clear Write
10.0														
0.00				/					Υ					
-10.0														Average
-20.0	here has not been	A strategie	لى مىلى بەر مە	4 ⁴					Jur ^a	Mary Mary	Warrand	and a strength		
-30.0														
-40.0														
-50.0														Max Hold
-30.0														
	ter 815.5 N											n 7.5 MHz		
#Res	3 BW 75 ki	Hz				#VE	#VBW 240 kHz Swee			Sweep	12.53 ms		Min Hold	
	ccupied	Rand	width				Total P	ower		33.3	dBm			
	ccupieu	Danu				-	Total	onor		00.0	d Bill			
			2.7	31	1 MI	1Z								Detector Peak►
Tr	ansmit Fr	eq Eri	ror		3.396 k	Hz	% of O	SW Pow	/er	99	.00 %		Auto	<u>Man</u>
	dB Bandw			3	.020 M	H7					26.00 dB			
		nettin			1020-10	11 12	A UB			-200				
100										OTATUO				
MSG										STATUS				

Plot 7-3. Occupied Bandwidth Plot (LTE Band 26 - 3MHz QPSK - Full RB Configuration)

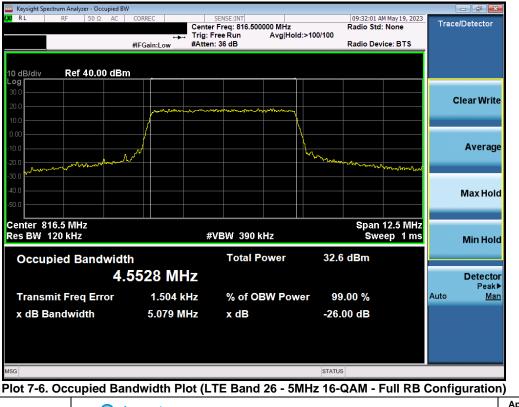


FCC ID: BCG-A2986	element	PART 90 MEASUREMENT REPORT	Approved by: Technical Manager	
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Plot 7-5. Occupied Bandwidth Plot (LTE Band 26 - 5MHz QPSK - Full RB Configuration)

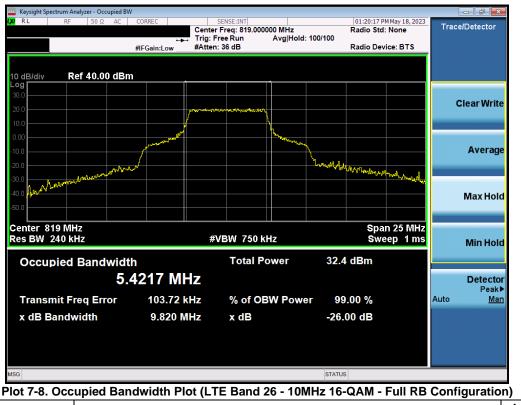


FCC ID: BCG-A2986	element	PART 90 MEASUREMENT REPORT	Approved by: Technical Manager	
Test Report S/N:	Test Dates:	EUT Type:	Dage 17 of 57	
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Plot 7-7. Occupied Bandwidth Plot (LTE Band 26 - 10MHz QPSK - Full RB Configuration)



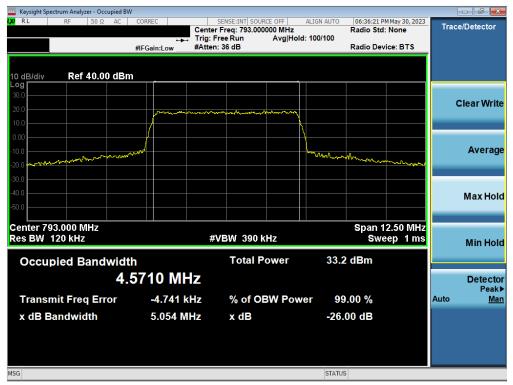
FCC ID: BCG-A2986	element)	PART 90 MEASUREMENT REPORT	Approved by: Technical Manager	
Test Report S/N:	Test Dates:	EUT Type:	Dama 40 af 57	
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LTE Band 14



Plot 7-9. Occupied Bandwidth Plot (LTE Band 14 - 5MHz QPSK - Full RB Configuration)



Plot 7-10. Occupied Bandwidth Plot (LTE Band 14 - 5MHz 16-QAM - Full RB Configuration)

FCC ID: BCG-A2986	🕒 element	PART 90 MEASUREMENT REPORT	Approved by: Technical Manager					
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🔤 Key	sight Spectrum	Analyzer - Oc	cupied BW									(
LXI RI	- RI	= 50 Ω	AC (ORREC			NSE:INT SOUR		ALIGN AUTO	07:25:08 P	M May 26, 2023	Trac	e/Detector
						Trig: Free			d: 100/100	Radio Stu	None		
			#	IFGain:	Low	#Atten: 3	6 dB			Radio Dev	ice: BTS		
10 dE	3/div	Ref 40.0	0 dBm										
Log 30.0													
20.0												(Clear Write
				\sim	200 - Carlo Carlo	n II Van Krywanski	and water work						
10.0				کر					V				
0.00			- A DUN	1									
-10.0	. In march	WWW. MUNICAN	ww.rafeystylet.in						Whaley m	hannahan			Average
-20.0	A CONTRACTOR OF THE									~ ~~~	Werk have		
-30.0													
-40.0													Max Hold
-50.0													
Con	ter 793.00									Enon 2	5.00 MHz		
	BW 240										ep 1 ms		
1000						#0000 / 50 KHZ Sweep 1					op i me		Min Hold
0	ccupie	d Band	width				Total P	ower	34.5	dBm			
			91	575	5 MH	7							Detector
			U . I	010		2							Peak►
T	ransmit l	Freq Er	ror	-19.	.482 kH	Z	% of O	BW Pov	ver 99	.00 %		Auto	<u>Man</u>
x	dB Band	width		10	.99 MH	7	x dB		-26.	00 dB			
MSG									STATUS				
Mod									STATUS				

Plot 7-11. Occupied Bandwidth Plot (LTE Band 14 - 10MHz QPSK - Full RB Configuration)



Plot 7-12. Occupied Bandwidth Plot (LTE Band 14 - 10MHz 16-QAM - Full RB Configuration)

FCC ID: BCG-A2986	element)	PART 90 MEASUREMENT REPORT	Approved by: Technical Manager	
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7.3 Spurious and Harmonic Emissions at Antenna Terminal §2.1051 §90.691(a) §90.543(e)

Test Overview

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation and all ports were investigated and the worst case configuration results are reported in this section.

The minimum permissible attenuation level of any spurious emission is $43 + 10 \log_{10}(P_{[Watts]})$, where P is the transmitter power in Watts.

Test Procedure Used

KDB 971168 D01 v03r01 - Section 6.0

Test Settings

- 1. Start frequency was set to 30MHz and stop frequency was set to 10GHz (separated into at least two plots per channel)
- 2. RBW \geq 100kHz
- 3. VBW \geq 3 x RBW
- 4. Detector = RMS
- 5. Trace mode = max hold
- 6. Sweep time = auto couple
- 7. The trace was allowed to stabilize

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

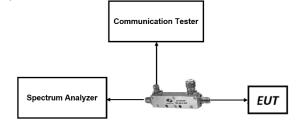


Figure 7-2. Test Instrument & Measurement Setup

Test Notes

Compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater for Part 90. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB below the transmitter power.

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LTE Band 26

Keysight Spectrum Analyzer - Swept SA					
RL RF 50Ω AC	CORREC PNO: Fast ↔→ IFGain:Low	SENSE:INT Trig: Free Run Atten: 30 dB	#Avg Type: RMS	10:11:55 AM May 19, 2023 TRACE 1 2 3 4 5 6 TYPE A WWWW DET A NNNNN	Frequency
0 dB/div Ref 20.00 dBm	IFGam:Low	Atten. 00 dB	Mkr	1 813.843 2 MHz -35.15 dBm	Auto Tur
^{og} Trace 1 Pass					Center Fre 422.000000 MH
0.00					Start Fr 30.000000 Mi
20.0				1,	Stop Fr 814.000000 M
40.0					CF Sto 78.400000 M <u>Auto</u> M
		an die personen alle ander and and and and and and		n an	Freq Offs 0
50.0 Start 30.0 MHz				0100 014.0 191112	Scale Typ
Start 30.0 MHz Res BW 100 kHz sg	#VBW 3	300 kHz	Sweep 3	7.33 ms (20001 pts)	Log

Plot 7-13. Conducted Spurious Plot (LTE Band 26 - 5MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)



Plot 7-14. Conducted Spurious Plot (LTE Band 26 - 5MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)

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Plot 7-15. Conducted Spurious Plot (LTE Band 26 - 5MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)

FCC ID: BCG-A2986	element	PART 90 MEASUREMENT REPORT	Approved by: Technical Manager	
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<u>-</u>			V2.1 11/9/2021	



		trum Analyz												
LXI RL		RF	50 Ω	AC	CORREC		SE	NSE:INT	#Avg Type	RMS	TRAC	MMay 18, 2023	F	requency
PAS	S				PNO: Fa IFGain:Lo		Trig: Fre Atten: 3				TYF DE			
10 dB	/div	Ref 20	.00 dE	3m						Mkr1	813.96 -29.	0 8 MHz 46 dBm		Auto Tune
Log 10.0 -	Trace	1 Pass												Center Freq 2.000000 MHz
0.00 -													3	Start Freq 0.000000 MHz
-20.0 -												1	81	Stop Freq 4.000000 MHz
-40.0 -													7 <u>Auto</u>	CF Step 8.400000 MHz Man
-60.0 -	i dittelana ilater													Freq Offset 0 Hz
-70.0 -														Scale Type
	: 30.0 BW 1	MHz 100 kHz			#	VBW	300 kHz	2	S	weep 37	Stop 8 7.33 ms (2	14.0 MHz 0001 pts)	Log	<u>Lin</u>
MSG										STATU	S			

Plot 7-16. Conducted Spurious Plot (LTE Band 26 - 10MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)



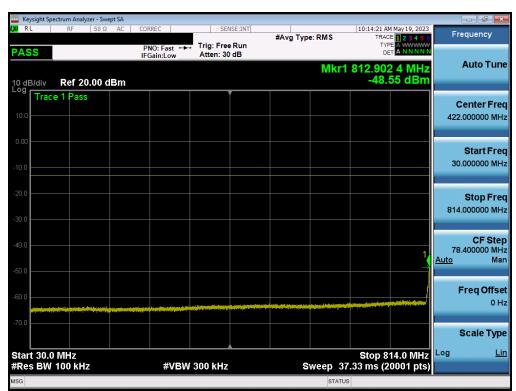
Plot 7-17. Conducted Spurious Plot (LTE Band 26 - 10MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)

FCC ID: BCG-A2986	element	PART 90 MEASUREMENT REPORT	Approved by: Technical Manager	
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Plot 7-18. Conducted Spurious Plot (LTE Band 26 - 10MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)



Plot 7-19. Conducted Spurious Plot (LTE Band 26 - 5MHz QPSK - RB Size 1, RB Offset 0 - High Channel)

FCC ID: BCG-A2986	element 🤤	PART 90 MEASUREMENT REPORT	Approved by: Technical Manager	
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		trum Analy												
lxi R	L	RF	50 Ω	AC	CORREC		SEN	ISE:INT	#Avg Typ	e: RMS	TRAC	May 19, 2023	Fr	equency
PAS	S				PNO: Fa IFGain:L	ist ↔→ ow	Trig: Free Atten: 30				TYP DE			
10 di	3/div	Ref 20).00 di	Зm						Mk	r1 824.0 -25.1	00 MHz 22 dBm		Auto Tune
Log	Trace	1 Pass	;											Center Freq
10.0													912	.000000 MHz
0.00													824	Start Freq
-20.0	.1													
-30.0	<u>}</u>												1.000	Stop Freq
-40.0													17	CF Step .600000 MHz
-50.0	Why.	λ											Auto	Man
-60.0		And the same	Sec. Martin and A	alark da a sa ta a	uniadas discoso est	be at he as we a bad	daman (Bast) and a bas		and an allocation and a street				I	F req Offset 0 Hz
-70.0														
													:	Scale Type
		100 GH 100 kH			#	VBW :	300 kHz			Sweep 8	Stop 1.00 3.533 ms (4	000 GHz 4001 pts)	Log	<u>Lin</u>
MSG										STATU	s			

Plot 7-20. Conducted Spurious Plot (LTE Band 26 - 5MHz QPSK - RB Size 1, RB Offset 0- High Channel)



Plot 7-21. Conducted Spurious Plot (LTE Band 26 - 5MHz QPSK - RB Size 1, RB Offset 0- High Channel)

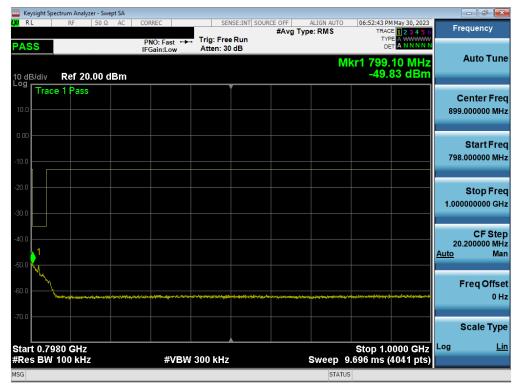
FCC ID: BCG-A2986	element	PART 90 MEASUREMENT REPORT	Approved by: Technical Manager	
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LTE Band 14



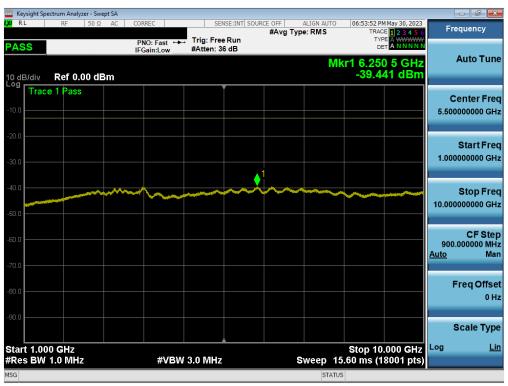
Plot 7-22. Conducted Spurious Plot (LTE Band 14 - 5MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)



Plot 7-23. Conducted Spurious Plot (LTE Band 14 - 5MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)

FCC ID: BCG-A2986	element 🤁	PART 90 MEASUREMENT REPORT	Approved by: Technical Manager
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Plot 7-24. Conducted Spurious Plot (LTE Band 14 - 5MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)



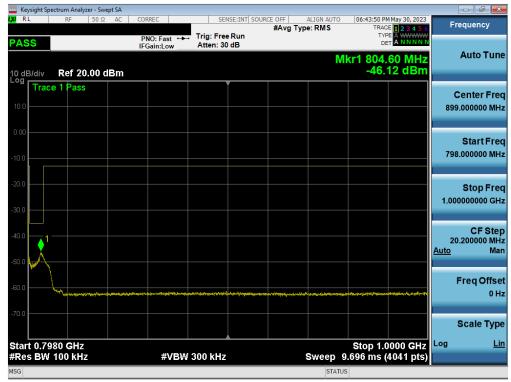
Plot 7-25. Conducted Spurious Plot (LTE Band 14 - 5MHz QPSK - RB Size 1, RB Offset 0 - High Channel)

FCC ID: BCG-A2986	element)	PART 90 MEASUREMENT REPORT	Approved by: Technical Manager	
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		ctrum Analy	zer - Swep	ot SA										
L <mark>XI</mark> RI		RF	50 Ω	AC	CORREC		SEI	NSE:INT SO		ALIGN AUT Type: RMS		5 PM May 30, 2023	F	requency
PAS	S				PNO: Fa IFGain:L		Trig: Free Atten: 30		#/.vg	Type. Kino				
10 dE	3/div	Ref 20).00 dl	Bm							Mkr1 77 -6	2.05 MHz 1.27 dBm		Auto Tune
Log 10.0	Trace	e 1 Pass	;											Center Freq 9.000000 MHz
0.00 -10.0													3(Start Freq 0.000000 MHz
-20.0 -30.0													78	Stop Freq 3.000000 MHz
-40.0 -50.0													7! <u>Auto</u>	CF Step 5.800000 MHz Man
-60.0					, pilage op a Philadenai		Ilerte		het for the state of the					Freq Offset 0 Hz
-70.0														Scale Type
	t 30.0 s BW	MHz 100 kH	z _		#	VBW	300 kHz			Sweep	Stop 36.38 ms	788.0 MHz (15161 pts)	Log	Lin
MSG											ATUS			

Plot 7-26. Conducted Spurious Plot (LTE Band 14 - 5MHz QPSK - RB Size 1, RB Offset 0 - High Channel)



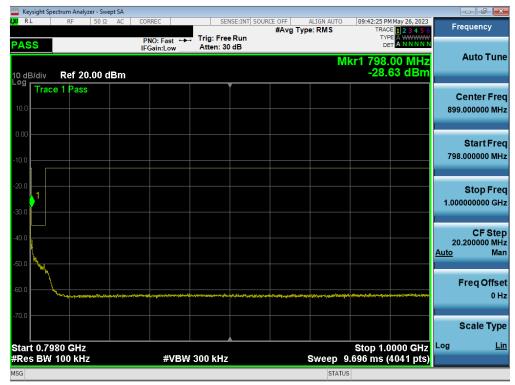
Plot 7-27. Conducted Spurious Plot (LTE Band 14 - 5MHz QPSK - RB Size 1, RB Offset 0 - High Channel)

FCC ID: BCG-A2986	element)	PART 90 MEASUREMENT REPORT	Approved by: Technical Manager	
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	ectrum Analyzer	- Swept SA									X
XIRL	RF !	50 Ω AC	CORREC		SENSE:IN	SOURCE OFF	ALIGN AUT		PM May 26, 2023	Frequen	cv
PASS			PNO: Fa IFGain:L		Trig: Free Run Atten: 30 dB	#AVg	g Type: RMS	T T	ACE 1 2 3 4 5 6 YPE A WWWWW DET A NNNNN		
10 dB/div Log	Ref 20.0	0 dBm						Mkr1 787 -29.3	7.95 MHz 303 dBm	Auto	Tune
10.0 Trace	e 1 Pass									Center 409.00000	
-10.0										Star 30.00000	t Freq 0 MHz
-20.0									1	Stop 788.00000	o Freq 10 MHz
-40.0										CF 75.80000 <u>Auto</u>	Step 0 MHz Man
-60.0										Freq	Offset 0 Hz
-70.0										Scale	Туре
Start 30.0 #Res BW			#	VBW 3	00 kHz		Sweep	Stop 36.38 ms (788.0 MHz 15161 pts)	Log	Lin
MSG							STA	TUS			

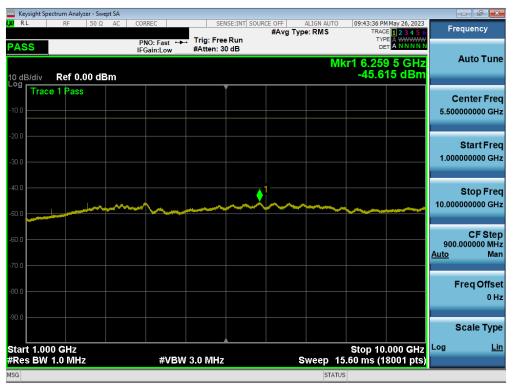
Plot 7-28. Conducted Spurious Plot (LTE Band 14 - 10MHz QPSK - RB Size 1, RB Offset 0)



Plot 7-29. Conducted Spurious Plot (LTE Band 14 - 10MHz QPSK - RB Size 1, RB Offset 0)

FCC ID: BCG-A2986	element)	PART 90 MEASUREMENT REPORT	Approved by: Technical Manager	
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Plot 7-30. Conducted Spurious Plot (LTE Band 14 - 10MHz QPSK - RB Size 1, RB Offset 0)

FCC ID: BCG-A2986	element	PART 90 MEASUREMENT REPORT	Approved by: Technical Manager	
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7.4 Band Edge Emissions at Antenna Terminal

§2.1051 §90.691(a) §90.543(e)

Test Overview

All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section. All ports were tested and only the worst case data were reported.

For LTE B26 operation under Part 90.691, the minimum permissible attenuation level of any spurious emission removed from the EA licensee's frequency block by greater than 37.5 kHz is $43 + 10\log_{10}(P_{[Watts]})$, where P is the transmitter power in Watts. The minimum permissible attenuation level of any spurious emission removed from the EA licensee's frequency block by up to and including 37.5 kHz is $50 + 10\log_{10}(P_{[Watts]})$, where P is the transmitter power in Watts.

Test Procedure Used

KDB 971168 D01 v03r01 - Section 6.0

Test Settings

- 1. Span was set large enough so as to capture all out of band emissions near the band edge
- 2. RBW = 100 kHz
- 3. VBW = 300 kHz
- 4. Detector = RMS
- 5. Trace mode = trace average
- 6. Sweep time = auto couple
- 7. The trace was allowed to stabilize

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

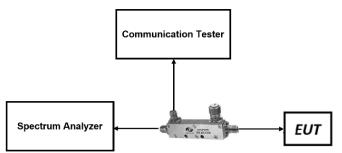


Figure 7-3. Test Instrument & Measurement Setup

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Test Notes

- 1. For channel edge emission, the signal analyzer's "ACP" measurement capability is used.
- 2. Per Part 90, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of 30 kHz may be employed to demonstrate compliance with the out-of-band emissions limit. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center.
- 3. For LTE Band 14 operation under Part 90.543, the power of any emission must be reduced below the mean output power (P) by at least 43 + 10log (P) dB measured in a 100 kHz bandwidth for frequencies less than 1 GHz, and in a 1 MHz bandwidth for frequencies greater than 1 GHz.
- 4. Additionally, for LTE Band 14 operation, on all frequencies between 769-775 MHz and 799-805 MHz, the power of any emission shall be attenuated by a factor not less than 65 + 10 log (P) dB in a 6.25 kHz band segment, for mobile and portable stations.

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LTE Band 26



Plot 7-31. Channel Edge Plot (LTE Band 26 - 1.4MHz QPSK - Low Channel)



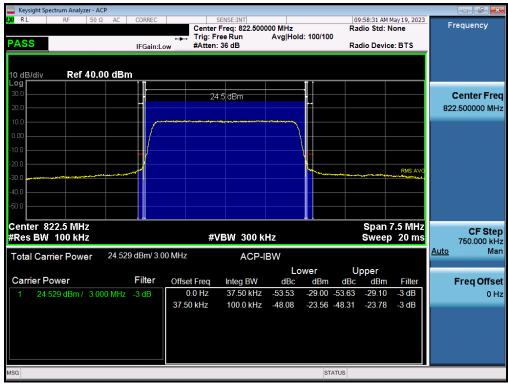
Plot 7-32. Channel Edge Plot (LTE Band 26 - 1.4MHz QPSK - High Channel)

FCC ID: BCG-A2986	element)	element PART 90 MEASUREMENT REPORT	
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keysight Spectrum Analyzer - ACP RL RF 50 Ω AC PASS	CORREC	Center F		000 MHz Avg Hold	i: 100/100	Rad	59:57 AM M io Std: N io Device		Fi	equency
0 dB/div Ref 40.00 dBm										
.0g 30.0 20.0		24.3	3 dBm							Center Fred
0.00					\ \					
20.0								RMS AVG		
40.0										
Center 815.5 MHz			BW 300 kl	47			Span 7 Sweep	7.5 MHz		CF Step 750.000 kH
Res BW 100 KHz		#VI	JAN JOOKI					20 1115		750.000 KH
Res BW 100 kHz Total Carrier Power 24.327	dBm/ 3.00		ACP-II					201115	<u>Auto</u>	750.000 KH Ma
Total Carrier Power 24.327		MHz	ACP-II	BW Lo	wer	Up	per			Ма
Total Carrier Power 24.327 Carrier Power	Filter	MHz Offset Freq	ACP-II	BW Lo dBc	dBm	Up dBc	o per dBm	Filter		Ma Freq Offse
Total Carrier Power 24.327	Filter -3 dB	MHz Offset Freq 0.0 Hz	ACP-II Integ BW 37.50 kHz	BW Lo dBc -53.35	dBm -29.03 -	Up dBc -52.70	per dBm -28.37	Filter -3 dB		Ma
Total Carrier Power 24.327 Carrier Power	Filter -3 dB	MHz Offset Freq	ACP-II	BW Lo dBc	dBm	Up dBc -52.70	per dBm -28.37	Filter		Ma Freq Offs

Plot 7-33. Channel Edge Plot (LTE Band 26 - 3MHz QPSK - Low Channel)



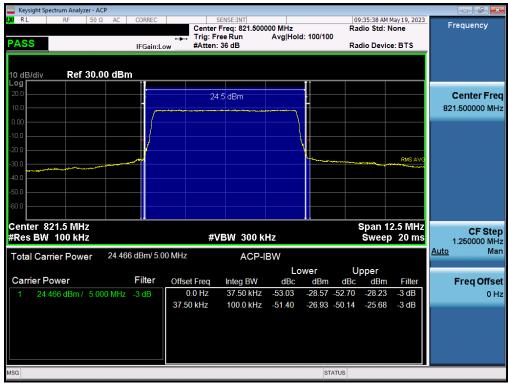
Plot 7-34. Channel Edge Plot (LTE Band 26 - 3MHz QPSK - High Channel)

FCC ID: BCG-A2986	element)	PART 90 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Dama 05 at 57
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Keysight Spectrum Analyzer - ACP							
LXX RL RF 50Ω AC CORREC	SENSE:INT	500000 MHz	09:52:05 AM May 19, 3 Radio Std: None	Frequency			
PASS IFGain:Lu	w #Atten: 36 dB	Avg Hold: 100/100	Radio Device: BTS				
10 dB/div Ref 30.00 dBm		* *					
20.0	24.4 dBm			Center Freq			
10.0	24,4 dbm			816.500000 MHz			
0.00							
-10.0							
-20.0		\\					
-30.0			RMS	AV6			
-40.0							
-50.0							
-60.0							
Center 816.5 MHz			Cnon 12 5 M				
#Res BW 100 kHz	#VBW 300) kHz	Span 12.5 M Sweep 20				
Total Carrier Power 24.367 dBm/ 5.0	0 MHz ACI	P-IBW		<u>Auto</u> Man			
		Lower	Upper				
Carrier Power Filter	Offset Freq Integ BW		dBc dBm Filt				
1 24.367 dBm / 5.000 MHz -3 dB	0.0 Hz 37.50 kH 37.50 kHz 100.0 kH						
	37.50 KHZ 100.0 KF	12 -30.08 -20.31 -	49.21 -24.64 -3.01				
MSG	ISG STATUS						

Plot 7-35. Channel Edge Plot (LTE Band 26 - 5MHz QPSK - Low Channel)



Plot 7-36. Channel Edge Plot (LTE Band 26 - 5MHz QPSK - High Channel)

FCC ID: BCG-A2986	element)	element PART 90 MEASUREMENT REPORT	
Test Report S/N:	Test Dates:	EUT Type:	Dama 00 at 57
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													_	
L <mark>XI</mark> RL	RF	50 Ω	AC	CORREC			NSE:INT eq: 819.000	000 MHz			:32:32 PM1 dio Std: N	May 18, 2023	Freq	uency
D A 00						Trig: Free	Run		d: 100/100	0				
PASS				IFGain:Lo	w	#Atten: 3	6 dB			Ra	dio Devic	e: BTS		
10 dB/div	Ref	30.00	dBm											
Log 20.0				1					1				-	
						24.5	dBm		i					nter Freq
10.0													819.0	00000 MHz
0.00														
-10.0														
-20.0														
-30.0														
-40.0												RMS AVG		
-50.0														
-60.0														
Center 81	9 MHz								4+		Span	25 MHz		
#Res BW		z				#VE	SW 300 k	Hz) 20 ms	2.5	CF Step
Total Carri	ier Pow	er	24.544	dBm/ 10.	00 MHz		ACP-I	BW					<u>Auto</u>	Man
								Lo	ower	U	pper			
Carrier Po	wer			Filter	Offset	Freq	Integ BW	dBc	dBm	dBc	dBm	Filter	Fr	eq Offset
1 24.5	44 dBm /	10.00	MHz	-3 dB	0.	0 Hz	37.50 kHz	-52.55	-28.01	-50.12	-25.57	-3 dB		0 Hz
					37.50	kHz	100.0 kHz	-49.19	-24.65	-48.18	-23.64	-3 dB		
MSG									ST	ATUS				
									01					

Plot 7-37. Channel Edge Plot (LTE Band 26 - 10MHz QPSK - Mid Channel)

FCC ID: BCG-A2986	element	PART 90 MEASUREMENT REPORT	Approved by: Technical Manager	
Test Report S/N:	Test Dates:	EUT Type:	D 07 (57	
1C2305020014-07.BCG	05/05/2023 - 07/31/2023	Watch	Page 37 of 57	
			1/2 4 44/0/2024	



LTE Band 14







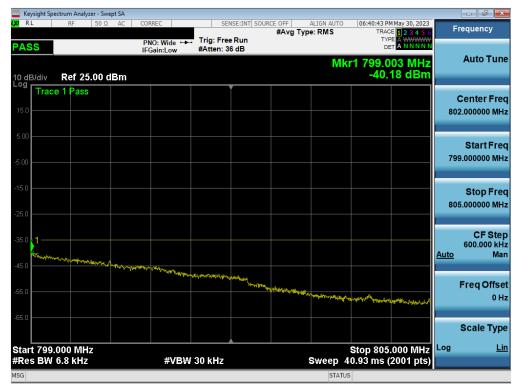
Plot 7-39. Lower Emission Mask Plot (LTE Band 14, 5MHz QPSK - RB Size 25)

FCC ID: BCG-A2986	element	PART 90 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Dogo 29 of 57
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	·		V2.1 11/9/2021



	pectrum Analyz												
RL	RF	50 Ω	AC	CORREC		SEI	NSE:INT SO		ALIGN AUTO		4 May 30, 2023	E	requency
ASS				PNO: W IFGain:L	ide ↔→ .ow	Trig: Free #Atten: 3		#Avg 1	ype: RMS	TRAC TYF DE	E 1 2 3 4 5 6 E A WWWW T A N N N N N		
0 dB/div	Ref 25	.00 di	Bm						Mk	r1 798.0 -23.	02 MHz 40 dBm		Auto Tun
IS.0	ce 1 Pass			^ ~									Center Fre 3.000000 MH
5.00						\						797	Start Fre 7.000000 MH
5.0						Ju Ju	1					799	Stop Fre 9.000000 Mi
5.0												<u>Auto</u>	CF Ste 200.000 kl Ma
5.0													Freq Offs 0
enter 7	98.000 M	Hz								Span 2	.000 MHz	Log	Scale Typ
	100 kHz			4	VBW	300 kHz			Sweep	.000 ms (1001 pts)		
G									STATU				





Plot 7-41. Upper Emission Mask Plot (LTE Band 14, 5MHz QPSK - RB Size 25)

FCC ID: BCG-A2986	element)	PART 90 MEASUREMENT REPORT	Approved by: Technical Manager	
Test Report S/N:	Test Dates:	EUT Type:	Dawa 00 at 57	
1C2305020014-07.BCG	05/05/2023 - 07/31/2023	Watch	Page 39 of 57	
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	t Spectrum	Analyzer - S	wept SA										×
LXI RL	R	50	Ω AC	CORREC		SEI	ISE:INT SOU		ALIGN AUTO		M May 26, 2023	F	requency
PASS				PNO: W IFGain:L	ide ↔ .ow	Trig: Free #Atten: 3		#Avg I	ype: RMS	TY	DE 1 2 3 4 5 6 PE A WWWWW A N N N N		
									M	(r1 788.0	00 MHz 84 dBm		Auto Tune
10 dB/div Log		f 25.00	dBm					_	_	-19.	04 UDIII		
Tr	ace 1 F	Pass											Center Freq
15.0													B.000000 MHz
15.6												/ 0	5.000000 WHZ
5.00							~		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~				
5.00													Start Freq
												78	4.000000 MHz
-5.00													
-15.0													Stop Freq
						1	а Q					79:	2.000000 MHz
-25.0				000-	~~~~~	\sim							
~~~	~~~~	$\sim\sim\sim\sim$		~~~~									CF Step
-35.0													800.000 kHz
												<u>Auto</u>	Man
-45.0													
													Freq Offset
-55.0													0 Hz
													UHZ
-65.0													
													Scale Type
													1 1.
Center					(5)	0001.11			•	Span 8	.000 MHz	Log	Lin
#Res B	W 100	KHZ			¢VB₩	300 kHz			sweep	1.000 ms (	1001 pts)		
MSG									STATU	IS			

Plot 7-42. Lower Band Edge Plot (LTE Band 14, 10MHz QPSK - RB Size 50)



Plot 7-43. Lower Emission Mask Plot (LTE Band 14, 10MHz QPSK - RB Size 50)

FCC ID: BCG-A2986	element)	PART 90 MEASUREMENT REPORT	Approved by: Technical Manager	
Test Report S/N:	Test Dates:	EUT Type:	Dama 40 at 57	
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Keysight Spectrum Analyzer	r - Swept SA					
X/RL RF	50 Ω AC CORRE	C S	ENSE:INT SOURCE O	FF ALIGN AUTO	09:28:59 PM May 26, 2023 TRACE 1 2 3 4 5 6	Frequency
PASS		:Wide +++ Trig:Fr in:Low #Atten:	ee Run	tvg Type. Kino		
10 dB/div Ref 25.0	00 dBm			Mkr	1 798.000 MHz -23.17 dBm	Auto Tune
^{og} Trace 1 Pass			Ť – –			Center Freq
15.0						798.000000 MHz
5.00	~~~~~~					Start Fred
5.00						797.000000 MHz
15.0		h				
25.0		Mr.M.	un 1	o ( 1		Stop Free 799.000000 MH;
25.0				a statement		
35.0						CF Step 200.000 kH Auto Mar
45.0						
55.0						Freq Offse 0 H
65.0						UH.
						Scale Type
Center 798.000 MH #Res BW 100 kHz	Iz	#VBW 300 kH	z	Sweep 1.	Span 2.000 MHz 000 ms (1001 pts)	Log <u>Lin</u>
ISG				STATUS		

Plot 7-44. Upper Band Edge Plot (LTE Band 14, 10MHz QPSK - RB Size 50)



Plot 7-45. Upper Emission Mask Plot (LTE Band 14, 10MHz QPSK - RB Size 50)

FCC ID: BCG-A2986	element)	PART 90 MEASUREMENT REPORT	Approved by: Technical Manager	
Test Report S/N:	Test Dates:	EUT Type:	Dama 44 af 57	
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# 7.5 Conducted Power Output Data §2.1046 §90.635

#### **Test Overview**

Conducted power measurements are performed to measure the average output power of the EUT. The averaging is to be performed only over duration of active transmissions at maximum output power level. The average measurements do not include averaging over periods when the transmitter is quiescent or when operating at reduced power level.

#### Test Procedures Used

KDB 971168 D01 v03r01

#### Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

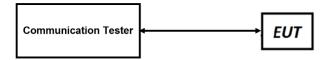


Figure 7-4. Conducted Power Measurement Setup

#### **Test Notes**

1. The EUT was tested in all possible test configurations. The worst case emissions are reported with the EUT modulations and channel bandwidth configurations shown in the tables below.

FCC ID: BCG-A2986	element	PART 90 MEASUREMENT REPORT	Approved by: Technical Manager	
Test Report S/N:	Test Dates:	EUT Type:	Dara 40 at 57	
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## Antenna BCM

Bandwidth	Modulation	Channel	Frequency [MHz]	RB Size/Offset	Conducted Power [dBm]	Conducted Power [mW]	Conducted Power Limit [dBm]	Margin [dB]
	QPSK	26697	814.7	1/0	25.26	335.738	50.00	-24.74
1.4 MHz	lz QFSR	26783	823.3	1 / 5	25.50	354.813	50.00	-24.50
	16-QAM	26783	823.3	1/0	24.94	311.889	50.00	-25.06
	QPSK	26705	815.5	1/0	25.35	342.768	50.00	-24.65
3 MHz	QFSK	26775	822.5	1 / 14	25.50	354.813	50.00	-24.50
	16-QAM	26775	822.5	1 / 14	24.94	311.889	50.00	-25.06
	QPSK	26715	816.5	1 / 24	25.09	322.849	50.00	-24.91
5 MHz	QFSK	26765	821.5	1 / 24	25.50	354.813	50.00	-24.50
	16-QAM	26765	821.5	1 / 0	24.91	309.742	50.00	-25.09
10 MHz	QPSK	26740	819.0	1 / 0	25.50	354.813	50.00	-24.50
	16-QAM	26740	819.0	1 / 25	24.83	304.089	50.00	-25.17

Table 7-2. Conducted Power Output Data (LTE Band 26)

FCC ID: BCG-A2986	element 🤁	PART 90 MEASUREMENT REPORT	Approved by: Technical Manager	
Test Report S/N:	Test Dates:	EUT Type:	Page 43 of 57	
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#### 7.6 Radiated Power (ERP) §2.1051 §90.691(a) §90.543(e)

#### Test Overview

Effective Radiated Power (ERP) measurements are calculated by adding highest antenna gain to maximum measured conducted output power. All measurements are performed as RMS average measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

#### **Test Procedures Used**

KDB 971168 D01 v03r01 – Section 5.2.1 ANSI C63.26-2015 TIA-603-E-2016 – Section 2.2.17

#### **Test Settings**

The relevant equation for determining the ERP from the conducted RF output power measured is:

ERP = PMeas - LC + GT

Where:

ERP = Effective Radiated Power (expressed in the same units as PMeas, typically dBW or dBm)

PMeas = measured transmitter output power or PSD, in dBW or dBm

LC = signal attenuation in the connecting cable between the transmitter and antenna in dB

GT = gain of the transmitting antenna, in dBd (ERP)

#### Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

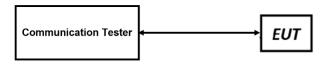


Figure 7-5. ERP Measurement Setup

FCC ID: BCG-A2986	element	PART 90 MEASUREMENT REPORT	Approved by: Technical Manager	
Test Report S/N:	Test Dates:	EUT Type:	Dava 44 at 57	
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#### **Test Notes**

- 1) The worst case emissions are reported with the modulations, RB sizes and offsets, and channel bandwidth configurations shown in the tables below.
- 2) This unit was tested with its standard battery.
- 3) The Level (dBm) readings in the table were taken with a correction table loaded into the base station simulator. The correction table was used to account for the signal attenuation in the connecting cable between the transmitter and antenna.
- 4) The Ant. Gains (GT) are listed in dBi.

FCC ID: BCG-A2986	element	PART 90 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Dama 45 at 57
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## 7.6.1 Antenna BCM - ERP

Bandwidth	Mod.	Frequency [MHz]	Ant. Gain [dBi]	RB Size/Offset	Conducted Power [dBm]	ERP [dBm]	ERP [mW]	ERP Limit [dBm]	Margin [dB]
		790.5	-27.00	1 / 24	25.45	-3.70	0.427	34.77	-38.47
5 MHz	QPSK	793.0	-27.00	1 / 12	25.50	-3.65	0.432	34.77	-38.42
		795.5	-27.00	1 / 0	25.46	-3.69	0.428	34.77	-38.46
	16-QAM	795.5	-27.00	1 / 12	24.94	-4.21	0.379	34.77	-38.98
10 MHz	QPSK	793.0	-27.00	1 / 0	25.50	-3.65	0.432	34.77	-38.42
	16-QAM	793.0	-27.00	1/0	24.92	-4.23	0.378	34.77	-39.00

Table 7-3. ERP Data (LTE Band 14)

FCC ID: BCG-A2986	element 🤁	PART 90 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Dama 40 af 57
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#### 7.7 Radiated Spurious Emissions §2.1053 §90(S).691(a) §90(R).543(e)

### Test Overview

Radiated spurious emissions measurements are performed using the field strength conversion method described in KDB 971168 with the EUT transmitting into an integral antenna. Measurements on signals operating below 1GHz are performed using horizontally and vertically polarized broadband hybrid antennas. Measurements on signals operating above 1GHz are performed using vertically and horizontally polarized broadband hybrid antennas. All measurements are performed while the EUT is operating at maximum power and at the appropriate frequencies.

#### **Test Procedures Used**

KDB 971168 D01 v03r01 - Section 5.8

ANSI C63.26-2015

TIA-603-E-2016 - Section 2.2.12

#### **Test Settings**

- 1. RBW = 100kHz for emissions below 1GHz and 1MHz for emissions above 1GHz
- 2. VBW  $\geq$  3 x RBW
- 3. Span = 1.5 times the OBW
- 4. No. of sweep points > 2 x span / RBW
- 5. Detector = RMS
- 6. Trace mode = Average (Max Hold for pulsed emissions)
- 7. The trace was allowed to stabilize

FCC ID: BCG-A2986	element	PART 90 MEASUREMENT REPORT	Approved by: Technical Manager
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#### Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

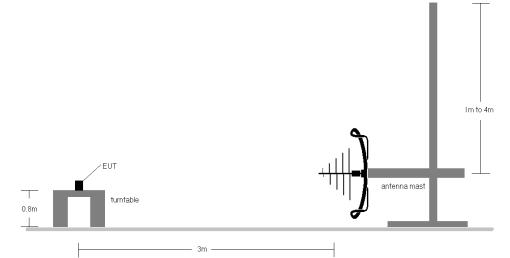
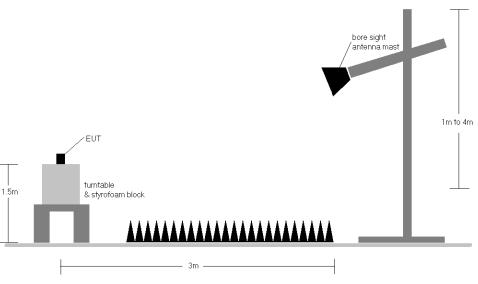
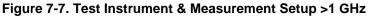


Figure 7-6. Test Instrument & Measurement Setup < 1GHz





FCC ID: BCG-A2986	element	PART 90 MEASUREMENT REPORT	Approved by: Technical Manager	
Test Report S/N:	Test Dates:	EUT Type:	Dama 40 of 57	
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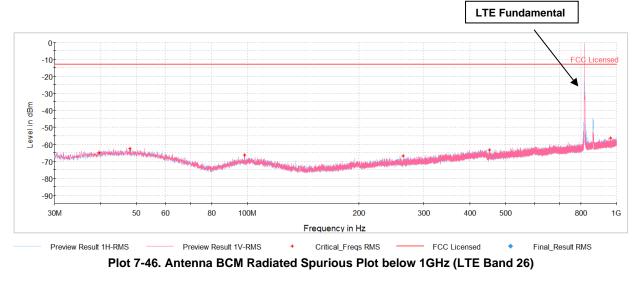


#### Test Notes

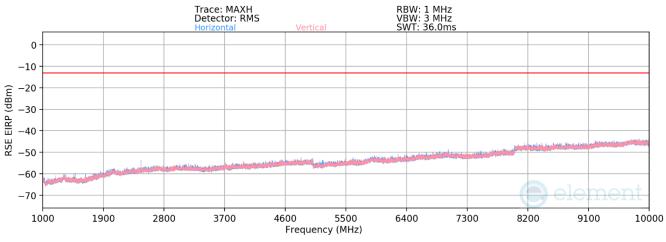
- Field strengths are calculated using the Measurement quantity conversions in KDB 971168 Section 5.8.4.
   a. E(dBµV/m) = Measured amplitude level (dBm) + 107 + Cable Loss (dB) + Antenna Factor (dB/m)
  - b. EIRP (dBm) = E(dB $\mu$ V/m) + 20logD 104.8; where D is the measurement distance in meters.
- 2. For LTE mode, the device was tested under all modulations, RB sizes and offsets, and channel bandwidth configurations and the worst case emissions are reported with 1 RB.
- 3. This unit was tested with its standard battery.
- 4. The EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The worst case setup is reported in the tables below.
- 5. The "-" shown in the following RSE tables are used to denote a noise floor measurement.

FCC ID: BCG-A2986	element	PART 90 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Dama 40 at 57
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## 7.7.1 Antenna BCM – Radiated Spurious Emission Measurements



Plot 7-47. Antenna BCM Radiated Spurious Plot above 1GHz (LTE Band 26)

FCC ID: BCG-A2986	element	PART 90 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Dama 50 at 57
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Bandwidth (MHz):	5
Frequency (MHz):	816.5
Modulation Signal:	QPSK
RB Config (Size / Offset):	1 / 12

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]		Margin [dB]
1633.0	н	222	264	-75.43	-4.13	27.44	-67.82	-13.00	-54.82
2449.5	н	102	337	-73.01	0.75	34.74	-60.52	-13.00	-47.52
3266.0	Н	-	-	-78.78	2.20	30.42	-64.84	-13.00	-51.84
4082.5	Н	-	-	-79.64	3.53	30.89	-64.36	-13.00	-51.36

Table 7-4. Antenna BCM Radiated Spurious Data (LTE Band 26 - Low Channel)

5
819.0
QPSK
1 / 12
6

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]		Margin [dB]
1638.0	Н	264	239	-77.47	-4.13	25.40	-69.86	-13.00	-56.86
2457.0	Н	102	344	-70.15	0.75	37.60	-57.66	-13.00	-44.66
3276.0	Н	-	-	-78.83	2.20	30.37	-64.89	-13.00	-51.89
4095.0	Н	-	-	-79.35	3.53	31.18	-64.07	-13.00	-51.07

Table 7-5. Antenna BCM Radiated Spurious Data (LTE Band 26 - Mid Channel)

Bandwidth (MHz):	5
Frequency (MHz):	821.5
Modulation Signal:	QPSK
RB Config (Size / Offset):	1 / 12

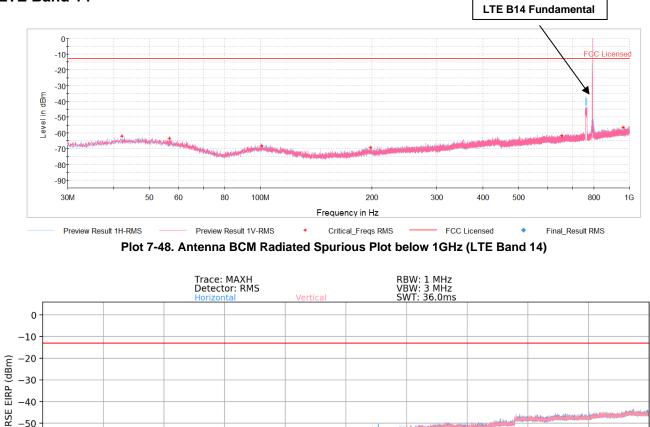
Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]		Margin [dB]
1643.0	Н	-	-	-77.75	-4.13	25.12	-70.14	-13.00	-57.14
2464.5	Н	109	350	-75.91	0.75	31.84	-63.42	-13.00	-50.42
3286.0	Н	-	-	-78.86	2.20	30.34	-64.92	-13.00	-51.92
4107.5	н	-	-	-79.34	3.53	31.19	-64.06	-13.00	-51.06

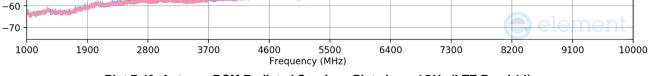
Table 7-6. Antenna BCM Radiated Spurious Data (LTE Band 26 - High Channel)

FCC ID: BCG-A2986	element	PART 90 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Dava 54 at 57
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### LTE Band 14





Plot 7-49. Antenna BCM Radiated Spurious Plot above 1GHz (LTE Band 14)

FCC ID: BCG-A2986	element	PART 90 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	
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Frequency (MHz): 79	90.5
Modulation Signal: Q	PSK
RB Config (Size / Offset): 1	/ 12

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]		Margin [dB]
1581.0	Н	160	285	-76.62	-4.10	26.28	-68.98	-40.00	-28.98
2371.5	Н	319	96	-78.49	0.93	29.44	-65.82	-13.00	-52.82
3162.0	Н	-	-	-78.50	2.08	30.58	-64.68	-13.00	-51.68
3952.5	Н	-	-	-79.28	3.16	30.88	-64.37	-13.00	-51.37

Table 7-7. Antenna BCM Radiated Spurious Data (LTE Band 14 - Low Channel)

Bandwidth (MHz):	5
Frequency (MHz):	793.0
Modulation Signal:	QPSK
RB Config (Size / Offset):	1 / 12

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]		Margin [dB]
1586.0	н	153	291	-75.67	-4.09	27.24	-68.01	-40.00	-28.01
2379.0	Н	-	-	-78.36	1.01	29.65	-65.60	-13.00	-52.60
3172.0	Н	-	-	-78.66	2.03	30.37	-64.89	-13.00	-51.89

Table 7-8. Antenna BCM Radiated Spurious Data (LTE Band 14 - Mid Channel)

Bandwidth (MHz):	5
Frequency (MHz):	795.5
Modulation Signal:	QPSK
RB Config (Size / Offset):	1 / 12

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]		Margin [dB]
1591.0	Н	-	-	-77.62	-4.08	25.30	-69.96	-40.00	-29.96
2386.5	Н	-	-	-78.52	1.03	29.51	-65.75	-13.00	-52.75
3182.0	Н	-	-	-78.95	2.00	30.05	-65.21	-13.00	-52.21

Table 7-9. Antenna BCM Radiated Spurious Data (LTE Band 14 - High Channel)

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## 7.8 Frequency Stability / Temperature Variation §2.1055 §90.213

#### **Test Overview and Limit**

Frequency stability testing is performed in accordance with the guidelines of ANSI C63.26-2015 and TIA-603-E-2016. The frequency stability of the transmitter is measured by:

- a.) **Temperature:** The temperature is varied from -30°C to +50°C in 10°C increments using an environmental chamber.
- b.) **Primary Supply Voltage:** The primary supply voltage is varied from 85% to 115% of the nominal value for non hand-carried battery and AC powered equipment. For hand-carried, battery-powered equipment, primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacturer.

For Band 26, the frequency stability of the transmitter shall be maintained within  $\pm 0.00025\%$  ( $\pm 2.5$  ppm) of the center frequency. For Band 14 the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

#### Test Procedure Used

ANSI C63.26-2015

TIA-603-E-2016

#### **Test Settings**

- 1. The carrier frequency of the transmitter is measured at room temperature (20°C to provide a reference).
- 2. The equipment is turned on in a "standby" condition for fifteen minutes before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.
- 3. Frequency measurements are made at 10°C intervals ranging from -30°C to +50°C. A period of at least one half-hour is provided to allow stabilization of the equipment at each temperature level.

#### Test Setup

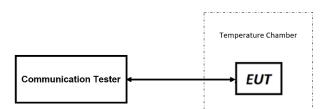


Figure 7-8. Test Instrument & Measurement Setup

#### **Test Notes**

None

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## Frequency Stability / Temperature Variation

LTE Band 26/5						
	Operating Frequency (Hz):		836,500,000			
	Ref. Voltage (VDC):		3.80			
	Deviation Limit:		± 0.00025% or 2.5 ppm			
Voltage (%)	Power (VDC)	Temp (°C)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)	
100 %	3.80	- 30	836,499,995	-5.26	-0.0000006	
		- 20	836,499,995	-4.85	-0.0000006	
		- 10	836,499,998	-1.96	-0.0000002	
		0	836,499,995	-4.84	-0.0000006	
		+ 10	836,500,010	9.87	0.0000012	
		+ 20 (Ref)	836,500,011	10.50	0.0000013	
		+ 30	836,499,997	-3.19	-0.0000004	
		+ 40	836,500,002	1.89	0.0000002	
		+ 50	836,500,013	13.06	0.0000016	
Battery Endpoint	3.40	+ 20	836,500,008	7.51	0.0000009	

Table 7-10. LTE Band 26 Frequency Stability Data

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LTE Band 14						
	Operating Band Lower Boundary (GHz)		0.7880			
	Ref. Voltage (VDC):		3.80			
Voltage (%)	Power (VDC)	Temp (°C)	Measured Freq. (GHz)	Freq. Delta from Operating Range (GHz)		
100 %	3.80	- 30	0.7882347	-0.0002347		
		- 20	0.7882352	-0.0002352		
		- 10	0.7882272	-0.0002272		
		0	0.7882311	-0.0002311		
		+ 10	0.7882700	-0.0002700		
		+ 20 (Ref)	0.7882422	-0.0002422		
		+ 30	0.7882354	-0.0002354		
		+ 40	0.7882352	-0.0002352		
		+ 50	0.7882342	-0.0002342		
Battery Endpoint	3.40	+ 20	0.7882591	-0.0002591		

Table 7-11. LTE Band 14 Lower Boundary Frequency Stability Data

LTE Band 14						
	Operating Band Upper Boundary (GHz) Ref. Voltage (VDC):		0.7980			
			3.80			
Voltage (%)	Power (VDC)	Temp (°C)	Measured Freq. (GHz)	Freq. Delta from Operating Range (GHz)		
	3.80	- 30	0.7977722	-0.0002278		
		- 20	0.7977699	-0.0002301		
		- 10	0.7977711	-0.0002289		
		0	0.7977679	-0.0002321		
100 %		+ 10	0.7977511	-0.0002489		
		+ 20 (Ref)	0.7977507	-0.0002493		
		+ 30	0.7977661	-0.0002339		
		+ 40	0.7977693	-0.0002307		
		+ 50	0.7977674	-0.0002326		
Battery Endpoint	3.40	+ 20	0.7977126	-0.0002874		

Table 7-12. LTE Band 14 Upper Boundary Frequency Stability Data

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## 8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **Apple Watch FCC ID: BCG-A2986** complies with all the requirements of Part 90 of the FCC rules.

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