



Test Report Serial Number:

45461655 R4.0

Test Report Date:

19 May 2021

Project Number:

1543

EMC Test Report - New Certification

Applicant:

SENDUM

Sendum Wireless Corporation

4500 Beedie St.

Burnaby, BC

V5J 5L2

Canada

FCC ID:

TS5-OM500A

Product Model Number / HVIN

OM500A

IC Registration Number

6234A-OM500A

Product Name / PMN

Omnalink OM500A

In Accordance With:

CFR Title 47, Part 22 Subpart H, 24 Subpart E, Part 27

Public Mobile Services

Personal Communications Services

Miscellaneous Wireless Communications Services

RSS-Gen, RSS-130, RSS-132, RSS-133, RSS-139

Equipment Operating in the Frequency Bands 617-652 MHz, 663-698 MHz, 698-756 MHz and 777-787 MHz

Cellular Telephone Systems Operating in the Bands 824-849 MHz and 869-894 MHz

2 GHz Personal Communications Services

Advanced Wireless Services (AWS)

Approved By:

Ben Hewson, President

Celltech Labs Inc.

21-364 Lougheed Rd.

Kelowna, BC, V1X 7R8

Canada



Test Lab Certificate: 2470.01



**Industry
Canada**

IC Registration 3874A-1



FCC Registration: CA3874

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1.0 DOCUMENT CONTROL

Revision History					
Samples Tested By:		Art Voss, P.Eng.	Date(s) of Evaluation:		20 - 26 April, 13 May, 2021
Report Prepared By:		Art Voss, P.Eng.	Report Reviewed By:		Ben Hewson
Report Revision	Description of Revision		Revised Section	Revised By	Revision Date
0.1	Draft Release		n/a	Art Voss	29 April 2021
1.0	Initial Release		n/a	Art Voss	29 April 2021
2.0	Revised per TCB Review		2, 7, 9	Art Voss	3 May 2021
3.0	Revised Application to New Certification		All	Art Voss	13 May 2021
4.0	Revised per TCB Review		2	Art Voss	19 May 2021

2.0 CLIENT AND DUT INFORMATION

Client Information	
Applicant Name (FCC)	Sendum Wireless Corporation
Applicant Address (FCC)	4500 Beedie St.
	Burnaby, BC, V5J 5L2
	Canada
Applicant Name (ISED)	Sendum Wireless Corporation
Applicant Address (ISED)	4500 Beedie St.
	Burnaby, BC, V5J 5L2
	Canada
DUT Information	
Device Identifier(s):	FCC ID: TS5-OM500A
	IC ID: 6234A-OM500A
Device Type:	Portable Digital Offender Monitor Anklet Transceiver
Device Model(s) / HVIN:	OM500A
Device Marketing Name / PMN:	Omnalink OM500A
Firmware Version ID Number / FVIN:	002.014
Host Marketing Name / HMN:	2002 0163
Test Sample Serial No.:	T/A Sample - Identical Prototype
Equipment Class (FCC):	Digital Transmission System (DTS)
	PCS Licensed Transmitter (PCB)
Equipment Class (ISED):	Spread Spectrum/Digital Device (2400-2483.5 MHz)
	Advanced Wireless Services (1710-1755 MHz)
	PCS Mobile (1850–1910 MHz)
	Cellular Mobile New Technologies (824–849 MHz)
	Mobile Broadband Service (MBS) (698–756 and 777–787 MHz)
Transmit Frequency Range:	DTS: 2412 - 2462MHz
	LTE Band 2: 1850 - 1910MHz
	LTE Band 4: 1710 - 1755MHz
	LTE Band 5: 824 - 849MHz
	LTE Band 12: 699 - 715MHz
Test Channels:	WiFi: 1- 11, LTE as per EARFCN

DUT Information		
Manuf. Max. Rated Output Power:	WiFi: 0.0469W (16.7dBm) Conducted	
	LTE Band 2: 0.081W (19.1dBm) Conducted	
	LTE Band 4: 0.216W (23.3dBm) Conducted	
	LTE Band 5: 0.167W (22.2dBm) Conducted	
	LTE Band 12: 0.183W (22.6dBm) Conducted	
Manuf. Max. Rated BW/Data Rate:	WiFi: 20MHz	
	LTE Band 2 & 4: 1.4, 3, 5, 10, 15, 20MHz	
	LTE Band 5 & 12: 1.4, 3, 5, 10MHz	
Antenna Make and Model:	PCB Single Ended Whip	
Antenna Type and Gain*:	Flex Foil**:	-2.65dBi - DTS
		-2.15dBi - LTE B2, B4
		0.6dBi - LTE 5 & B12
Modulation:	WiFi: CCCK, OFDM, MCS	
Modulation:	LTE: QPSK, 1QAM, 64QAM	
Emission Designator:	See Section 7.0	
DUT Power Source:	3VDC Alkaline	
DUT Dimensions [HxWxD] (mm)	H x W x D: 40mm x 85mm Dia.	
Deviation(s) from standard/procedure:	None	
Modification of DUT:	None	

* Information on Antenna Type and Gain provided by Applicant

** WiFi and LTE cannot simultaneously transmit

3.0 SCOPE

Preface:

This Certification Report was prepared on behalf of:

Sendum Wireless Corporation

„(the '*Applicant*')", in accordance with the applicable Federal Communications Commission (FCC) CFR 47 and Innovation, Scientific and Economic Development (ISED) Canada rules parts and regulations (the '*Rules*'). The scope of this investigation was limited to only the equipment, devices and accessories (the '*Equipment*') supplied by the *Applicant*. The tests and measurements performed on this *Equipment* were only those set forth in the applicable *Rules* and/or the Test and Measurement Standards they reference. The *Rules* applied and the Test and Measurement Standards used during this evaluation appear in the Normative References section of this report. The limits set forth in the technical requirements of the applicable *Rules* were applied to the measurement results obtained during this evaluation and, unless otherwise noted, these limits were used as the Pass/Fail criteria. The Pass/Fail statements made in this report apply to only the tests and measurements performed on only the *Equipment* tested during this evaluation. Where applicable and permissible, information including test and measurement data and/or results from previous evaluations of same or similar equipment, devices and/or accessories may be cited in this report.

Device:

The OM500A is an offender's ankle-worn tracking device consisting of an LTE and a WiFi transceiver. The OM500A integrates the certified modules indicated below. The LTE and WiFi modules do not simultaneously transmit.

WiFi Module

FCC ID: XF6-RS9113SB

IC ID: 8407A-RS9113SB

Manufacturer: Redpine Signals Inc.

Model/HVIN: RS9113SB

LTE Module

FCC ID: N7NWP76C

IC ID: 2417C-WP76C

Manufacturer: Sierra Wireless Inc.

Model/HVIN: WP7603

Application:

This is an application for a new certification.

Requirement:

Certification is required to 47 CFR Part 24 Subpart E, Part 22 Subpart H, Part 27, Part 15 Subpart C, ISED RSS-133, RSS-132, RSS-130 and RSS-247. As per FCC 47 CFR §2.1093 an RF Exposure (SAR) evaluation is required for this *Equipment* and the results of the RF Exposure (SAR) evaluation appear in a separate report.

Scope:

The scope of this investigation is to evaluate this *Equipment* to the requirements of the standards and procedures identified in this report but only so far as to verify that this *Equipment* operates within the limits of modular grants. Test result data from the modular approvals may be cited in this report.

4.0 TEST SUMMARY

TEST SUMMARY						
Section	Description of Test	Procedure Reference	Applicable Rule Part(s) FCC	Applicable Rule Part(s) ISED	Test Date	Result
7.0	Occupied Bandwidth - LTE	ANSI C63.26-2015	§2.1049	RSS-Gen (6.7)	21 Apr 2021	Pass
	Occupied Bandwidth - WiFi	FCC KDB 558074	§15.247	RSS-247	13 May 2021	
8.0	Conducted Power - LTE	ANSI C63.26-2015	§24.232(c) §22.913(a)(5) §27.50(c)(10) §27.50(d)(4)	RSS-133 6.4 RSS-132 5.4 RSS-130 4.6 RSS-139 6.5	22 Apr 2021	Pass
	Conducted Power - WiFi	FCC KDB 558074	§15.247	RSS-247	13 May 2021	
9.0	Conducted Spurious Emissions	ANSI C63.26-2015	§24.238(a) §22.917(a) §27.53(h)	RSS-133 6.5 RSS-132 5.5 RSS-139 6.6	25 Apr 2021	Pass
	Simultaneous Transmission*	FCC KDB 558074	§27.53(g) §15.247	RSS-130 4.7 RSS-247	13 May 2021	
10.0	Radiated Rx Spurious Emissions	ANSI C63.4: 2014	§2.1053 §15.109	RSS-Gen (7.4) ICES-003(6.2)	23 Apr 2021	Pass

* Under normal use, the WiFi and LTE transmitters do not simultaneously transmit

Test Station Day Log

Date	Ambient Temp (°C)	Relative Humidity (%)	Barometric Pressure (kPa)	Test Station	Tests Performed Section(s)
20 Apr 2021	22.0	16	102.6	EMC	7
21 Apr 2021	22.1	16	102.0	EMC	7, 8
22 Apr 2021	22.3	16	101.2	EMC	8
23 Apr 2021	10.0	30	101.4	OATS	10
24 Apr 2021	22.1	17	100.7	EMC	9
13 May 2021	22.0	16	100.3	EMC	9

EMC - EMC Test Bench

OATS - Open Area Test Site

LISN - LISN Test Area

IMM - Immunity Test Area

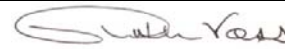
SAC - Semi-Anechoic Chamber

TC - Temperature Chamber

ESD - ESD Test Bench

RI - Radiated Immunity Chamber

I attest that the data reported herein is true and accurate within the tolerance of the Measurement Instrument Uncertainty; that all tests and measurements were performed in accordance with accepted practices or procedures; and that all tests and measurements were performed by me or by trained personnel under my direct supervision. The results of this investigation are based solely on the test sample(s) provided by the client which were not adjusted, modified or altered in any manner whatsoever, except as required to carry out specific tests or measurements. This test report has been completed in accordance with ISO/IEC 17025.



Art Voss, P.Eng.
Technical Manager
Celltech Labs Inc.

13 May 2021
Date



5.0 NORMATIVE REFERENCES

Normative References	
ISO/IEC 17025:2017	General requirements for the competence of testing and calibration laboratories
ANSI C63.4-2014	American National Standard of Procedures for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electric and Electronic Equipment in the Range of 9kHz to 40GHz
ANSI C63.26-2015	American National Standard of Procedures for Compliance Testing of Transmitters Used in Licensed Radio Services
CFR	Code of Federal Regulations Title 47: Telecommunication Part 2: Frequency Allocations and Radio Treaty Matters; General Rules and Regulations
CFR	Code of Federal Regulations Title 47: Telecommunication Part 22: Public Mobile Services Sub Part H: Cellular Radiotelephone Service
CFR	Code of Federal Regulations Title 47: Telecommunication Part 24: Personal Communications Services Sub Part E: Broadband PCS
CFR	Code of Federal Regulations Title 47: Telecommunication Part 27: Miscellaneous Wireless Communications Services Sub Part C: Technical Standards
CFR	Code of Federal Regulations Title 47: Telecommunication Part 15: Radio Frequency Devices Sub Part C (15.247) Intentional Radiators Operation within the Bands 902-928MHz, 2400-2483.5MHz and 5725-5850MHz
FCC KDB 558074 D01 v05r02	OET Major Guidance Publications, Knowledge Data Base Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS), Frequency Hopping Spread Spectrum and Hybrid System Devices Operating Under Section 15.247

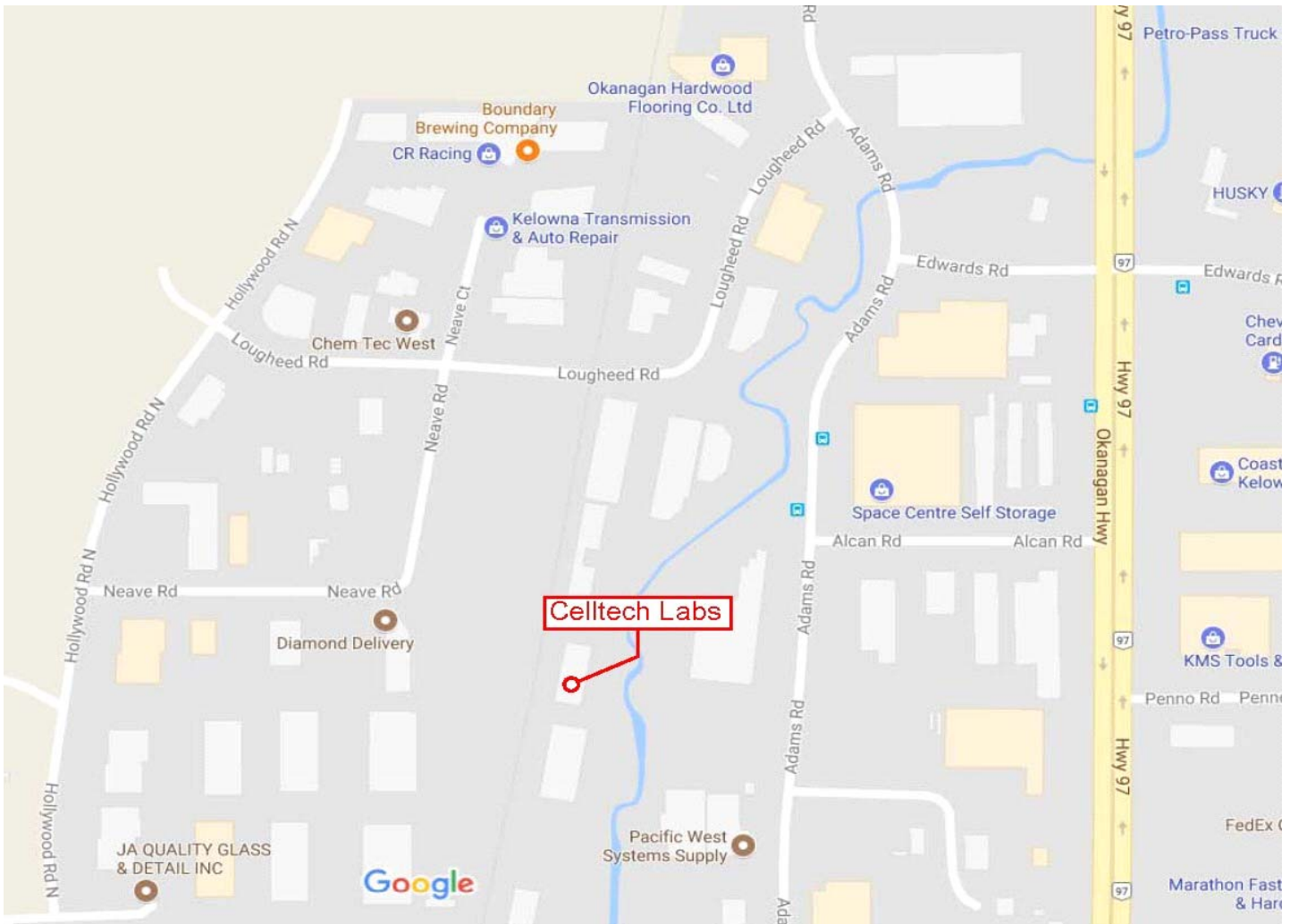
Normative References

ISED	Innovation, Science and Economic Development Canada RSS-Gen Issue 5A1: Spectrum Management and Telecommunications Radio Standards Specification March 2019 General Requirements and Information for the Certification of Radiocommunication Equipment
ISED	Innovation, Science and Economic Development Canada Spectrum Management and Telecommunications Radio Standards Specification RSS-130 Issue 2: Equipment Operating in the Frequency Bands 617-652 MHz, 663-698 MHz, Feb 2019 698-756 MHz and 777-787 MHz
ISED	Innovation, Science and Economic Development Canada Spectrum Management and Telecommunications Radio Standards Specification RSS-132 Issue 3: Cellular Telephone Systems Operating in the Bands 824-849 MHz and 869-894 MHz Jan 2013
ISED	Innovation, Science and Economic Development Canada Spectrum Management and Telecommunications Radio Standards Specification RSS-133 Issue 6A: 2 GHz Personal Communications Services Jan 2018
ISED	Innovation, Science and Economic Development Canada Spectrum Management and Telecommunications Radio Standards Specification SRSP-510 Issue 5: Technical Requirements for Personal Communications Services (PCS) in the Feb 2009 Bands 1850-1915 MHz and 1930-1995 MHz
ISED	Innovation, Science and Economic Development Canada Spectrum Management and Telecommunications Radio Standards Specification RSS-139 Issue 3: Advanced Wireless Services (AWS) Equipment Operating in the Bands Jul 2015 1710-1780 MHz and 2110-2180 MHz
ISED	Innovation, Science and Economic Development Canada Spectrum Management and Telecommunications Radio Standards Specification RSS-247 Issue 2: Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) Feb 2017 and Licensed-Exempt Local Area Network (LE_LAN) Devices

6.0 FACILITIES AND ACCREDITATIONS

Facility and Accreditation:

The facilities used to evaluate this device outlined in this report are located at 21-364 Lougheed Road, Kelowna, British Columbia, Canada V1X 7R8. The radiated emissions site (OATS) conforms to the requirements set forth in ANSI C63.4 and is filed and listed with the FCC under Test Firm Registration Number CA3874 and Innovation, Science and Economic Development Canada under Test Site File Number ISED 3874A-1. Celltech is accredited to ISO 17025, through accrediting body A2LA and with certificate 2470.01.



7.0 OCCUPIED BANDWIDTH

Test Procedure

Normative	FCC 47 CFR §2.1049, RSS-Gen (6.7)
References	ANSI C63.26 (5.4.4)

Requirement / Limits

47 CFR §2.1049	§ 2.1049 Measurements required: Occupied Bandwidth. 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...
RSS-Gen (6.7)	6.7 Occupied bandwidth (or 99% emission bandwidth) and x dB bandwidth The occupied bandwidth or the “99% emission bandwidth” is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.

General Procedure

C63.26 (5.4.4)	5.4.4 Occupied bandwidth—Power bandwidth (99%) measurement procedure The OBW is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission. The following procedure shall be used for measuring (99%) power bandwidth: - The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation products including the emission skirts (typically a span of $1.5 \times \text{OBW}$ is sufficient). - The nominal IF filter 3 dB bandwidth (RBW) shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be $\geq 3 \times \text{RBW}$. - Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation. - Set the trace mode to max-hold. - Use the 99% power bandwidth function of the instrument (if available) and report the measured bandwidth.
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Test Setup

Appendix A - Figure A.1

Measurement Procedure

The DUT was connected to the SA via a 30dB attenuator and the SA was configured as described above using the 99% Occupied Bandwidth function. The output power of the DUT was set to the manufacturer's highest output power setting at the nominal transmit frequency. The 99% Occupied Bandwidth was measured and recorded.

Table 7.1 – Summary of Occupied Bandwidth Measurements, LTE Band 2

See Appendix D for measurement Plots

Occupied Bandwidth Measurement Results							
Channel Frequency (MHz)	Nominal Channel BW (MHz)	EARFCN	Resource Blocks	RB Offset	Modulation	Measured Occupied Bandwidth (MHz)	Emission Designator
1880	1.4	18900	6	0	QPSK	1.08	1M08G7D
1880	1.4	18900	6	0	16QAM	1.09	1M09W7D
1880	1.4	18900	6	0	64QAM	1.08	1M08W7D
1880	3	18900	15	0	QPSK	2.67	2M67G7D
1880	3	18900	15	0	16QAM	2.68	2M68W7D
1880	3	18900	15	0	64QAM	2.68	2M68W7D
1880	5	18900	25	0	QPSK	4.48	4M48G7D
1880	5	18900	25	0	16QAM	4.48	4M48W7D
1880	5	18900	25	0	64QAM	4.50	4M50W7D
1880	10	18900	50	0	QPSK	8.94	8M94G7D
1880	10	18900	50	0	16QAM	8.94	8M94W7D
1880	10	18900	50	0	64QAM	8.94	8M94W7D
1880	15	18900	75	0	QPSK	13.36	13M3G7D
1880	15	18900	75	0	16QAM	13.36	13M3W7D
1880	15	18900	75	0	64QAM	13.36	13M3W7D
1880	20	18900	100	0	QPSK	17.80	17M8G7D
1880	20	18900	100	0	16QAM	17.80	17M8W7D
1880	20	18900	100	0	64QAM	17.80	17M8W7D
							Complies

Table 7.2 – Summary of Occupied Bandwidth Measurements, LTE Band 5

See Appendix D for measurement Plots

Occupied Bandwidth Measurement Results							
Channel Frequency (MHz)	Nominal Channel BW (MHz)	EARFCN	Resource Blocks	RB Offset	Modulation	Measured Occupied Bandwidth (MHz)	Emission Designator
836.5	1.4	20525	6	0	QPSK	1.15	1M15G7D
836.5	1.4	20525	6	0	16QAM	1.15	1M15W7D
836.5	1.4	20525	6	0	64QAM	1.14	1M14W7D
836.5	3	20525	15	0	QPSK	2.73	2M73G7D
836.5	3	20525	15	0	16QAM	2.72	2M72W7D
836.5	3	20525	15	0	64QAM	2.72	2M72W7D
836.5	5	20525	25	0	QPSK	4.48	4M48G7D
836.5	5	20525	25	0	16QAM	4.50	4M50W7D
836.5	5	20525	25	0	64QAM	4.50	4M50W7D
836.5	10	20525	50	0	QPSK	8.94	8M94G7D
836.5	10	20525	50	0	16QAM	8.94	8M94W7D
836.5	10	20525	50	0	64QAM	8.94	8M94W7D
							Complies

Table 7.3 – Summary of Occupied Bandwidth Measurements, LTE Band 12

See Appendix D for measurement Plots

Occupied Bandwidth Measurement Results							
Channel Frequency (MHz)	Nominal Channel BW (MHz)	EARFCN	Resource Blocks	RB Offset	Modulation	Measured Occupied Bandwidth (MHz)	Emission Designator
707.5	1.4	23095	6	0	QPSK	1.15	1M15G7D
707.5	1.4	23095	6	0	16QAM	1.15	1M15W7D
707.5	1.4	23095	6	0	64QAM	1.16	1M16W7D
707.5	3	23095	15	0	QPSK	2.72	2M72G7D
707.5	3	23095	15	0	16QAM	2.72	2M72W7D
707.5	3	23095	15	0	64QAM	2.72	2M72W7D
707.5	5	23095	25	0	QPSK	4.50	4M50G7D
707.5	5	23095	25	0	16QAM	4.50	4M50W7D
707.5	5	23095	25	0	64QAM	4.48	4M48W7D
707.5	10	23095	50	0	QPSK	8.94	8M94G7D
707.5	10	23095	50	0	16QAM	8.91	8M91W7D
707.5	10	23095	50	0	64QAM	8.94	8M94W7D
							Complies

Table 7.4 – Summary of Occupied Bandwidth Measurements, LTE Band 4

See Appendix D for measurement Plots

Occupied Bandwidth Measurement Results							
Channel Frequency (MHz)	Nominal Channel BW (MHz)	EARFCN	Resource Blocks	RB Offset	Modulation	Measured Occupied Bandwidth (MHz)	Emission Designator
1732.5	1.4	20175	6	0	QPSK	1.09	1M09G7D
1732.5	1.4	20175	6	0	16QAM	1.09	1M09W7D
1732.5	1.4	20175	6	0	64QAM	1.09	1M09W7D
1732.5	3	20175	15	0	QPSK	2.69	2M69G7D
1732.5	3	20175	15	0	16QAM	2.68	2M68W7D
1732.5	3	20175	15	0	64QAM	2.69	2M69W7D
1732.5	5	20175	25	0	QPSK	4.50	4M5G7D
1732.5	5	20175	25	0	16QAM	4.50	4M5W7D
1732.5	5	20175	25	0	64QAM	4.50	4M5W7D
1732.5	10	20175	50	0	QPSK	8.96	8M96G7D
1732.5	10	20175	50	0	16QAM	8.94	8M94W7D
1732.5	10	20175	50	0	64QAM	8.94	8M94W7D
1732.5	15	20175	75	0	QPSK	13.40	13M4G7D
1732.5	15	20175	75	0	16QAM	13.40	13M4W7D
1732.5	15	20175	75	0	64QAM	13.40	13M4W7D
1732.5	20	20175	100	0	QPSK	17.90	17M9G7D
1732.5	20	20175	100	0	16QAM	17.90	17M9W7D
1732.5	20	20175	100	0	64QAM	17.90	17M9W7D
							Complies

Table 7.5 – Summary of Occupied Bandwidth Measurements, WiFi

See Appendix D for measurement Plots

Occupied Bandwidth Measurement Results			
Channel Frequency (MHz)	Modulation	Measured Occupied Bandwidth (MHz)	Emission Designator
2412	QPSK	13.84	13M8G1D
2442	QPSK	13.84	13M8G1D
2462	QPSK	13.88	13M9G1D
			Complies

8.0 CONDUCTED POWER

Test Procedure

Normative	47 CFR §24.232, RSS-133 6.4, SRSP-510 5.1.2
References	ANSI C63.26 (5.2)

Requirement / Limits

47 CFR §24.232	§24.232 Power and antenna height limits. (c) Mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications. (d) Power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (e) of this section. In both instances, equipment employed must be authorized in accordance with the provisions of §24.51. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.
RSS-133	6.4 Transmitter Output Power and Equivalent Isotropically Radiated Power The equivalent isotropically radiated power (e.i.r.p.) for transmitters shall not exceed the limits given in SRSP-510. In addition, the transmitter's peak-to-average power ratio (PAPR) shall not exceed 13 dB for more than 0.1% of the time using a signal corresponding to the highest PAPR during periods of continuous transmission.
SRSP-510	5.1.2 Mobile Stations Mobile stations and hand-held portables are limited to 2 watts maximum e.i.r.p. The equipment shall employ means to limit the power to the minimum necessary for successful communication.

General Procedure

C63.26

5.2.4.4 General procedure for measuring average power of a broadband signal with a spectrum/signal analyzer or EMI receiver

5.2.4.4.1 General

The EUT is considered to transmit continuously if it can be configured to transmit at a burst duty cycle of greater than or equal to 98% throughout the duration of the measurement. If this condition can be achieved, then the following procedure can be used to measure the average output power of the EUT.

- Set span to $2 \times$ to $3 \times$ the OBW.
- Set RBW = 1% to 5% of the OBW.
- Set VBW $\geq$ RBW
- Set number of measurement points $\geq$ span/RBW
- Sweep time: AutoCouple
- Detector = power averaging (rms).
- If the EUT can be configured to transmit continuously, then set the trigger to free run.
- Trace average at least 100 traces in power averaging (rms) mode if sweep is set to auto-couple. To accurately determine the average power over multiple symbols, it can be necessary to increase the number of traces to be averaged above 100 or, if using a manually configured sweep time, increase the sweep time.
- Compute the power by integrating the spectrum across the OBW of the signal using the instrument's band or channel power measurement function, with the band/channel limits set equal to the OBW band edges. If the instrument does not have a band or channel power function, then sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.

Test Setup

Appendix A - Figure A.1

Measurement Procedure

The DUT was connected to the SA via a 30dB attenuator and the SA was configured as described above using the channel power function. The output power of the DUT was set to the manufacturer's highest output power setting at the nominal transmit frequency. The power was averaged over 100 traces and the measurement was recorded.

Table 8.1 – Summary of Conducted Power Measurements, LTE Band 2

See Appendix F for Conducted Power Measurement Plots

Conducted Power Measurement Results											
Channel Frequency (MHz)	Nominal Channel BW (MHz)	EARFCN	Resource Blocks	RB Offset	Modulation	Measured Conducted Power (dBm)	Dut Antenna Gain (dBi)	e.i.r.p. (dBm)	e.i.r.p. (W)	Limit (W)	Margin (dB)
1880	1.4	18900	6	0	QPSK	18.58	-2.15	16.43	0.044	2.00	16.6
1880	1.4	18900	6	0	16QAM	19.48		17.33	0.054		15.7
1880	1.4	18900	6	0	64QAM	18.44		16.29	0.043		16.7
1880	3	18900	15	0	QPSK	20.45		18.30	0.068		14.7
1880	3	18900	15	0	16QAM	19.37		17.22	0.053		15.8
1880	3	18900	15	0	64QAM	18.45		16.30	0.043		16.7
1880	5	18900	25	0	QPSK	20.71		18.56	0.072		14.5
1880	5	18900	25	0	16QAM	19.79		17.64	0.058		15.4
1880	5	18900	25	0	64QAM	18.84		16.69	0.047		16.3
1880	10	18900	50	0	QPSK	20.70		18.55	0.072		14.5
1880	10	18900	50	0	16QAM	18.71		16.56	0.045		16.5
1880	10	18900	50	0	64QAM	18.78		16.63	0.046		16.4
1880	15	18900	75	0	QPSK	20.67		18.52	0.071		14.5
1880	15	18900	75	0	16QAM	19.65		17.50	0.056		15.5
1880	15	18900	75	0	64QAM	18.74		16.59	0.046		16.4
1880	20	18900	100	0	QPSK	20.61		18.46	0.070		14.6
1880	20	18900	100	0	16QAM	19.70		17.55	0.057		15.5
1880	20	18900	100	0	64QAM	18.75		16.60	0.046		16.4
											Complies

Test Procedure

Normative	47 CFR §22.913, RSS-132 5.4
References	ANSI C63.26 (5.2)

Requirement / Limits

47 CFR §22.913	§22.913 Effective radiated power limits. (a)(5) The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 watts. (d) Power measurement. Measurement of the ERP of Cellular base transmitters and repeaters must be made using an average power measurement technique. The peak-to-average ratio (PAR) of the transmission must not exceed 13 dB. Power measurements for base transmitters and repeaters must be made in accordance with either of the following: (1) A Commission-approved average power technique
RSS-132	5.4 Transmitter Output Power and Equivalent Isotropically Radiated Power The transmitter output power shall be measured in terms of average power. The equivalent isotropically radiated power (e.i.r.p.) for mobile equipment shall not exceed 11.5 watts. In addition, the transmitter's peak-to-average power ratio (PAPR) shall not exceed 13 dB for more than 0.1% of the time using a signal corresponding to the highest PAPR during periods of continuous transmission.

Table 8.2 – Summary of Conducted Power Measurements, LTE Band 5

See Appendix F for Conducted Power Measurement Plots

Conducted Power Measurement Results											
Channel Frequency (MHz)	Nominal Channel BW (MHz)	EARFCN	Resource Blocks	RB Offset	Modulation	Measured Conducted Power (dBm)	Dut Antenna Gain (dBi)	e.i.r.p. (dBm)	e.i.r.p. (W)	Limit (W)	Margin (dB)
836.5	1.4	20525	6	0	QPSK	21.28	0.60	21.88	0.154	7.00	16.6
836.5	1.4	20525	6	0	16QAM	19.92		20.52	0.113		17.9
836.5	1.4	20525	6	0	64QAM	19.26		19.86	0.097		18.6
836.5	3	20525	15	0	QPSK	21.23		21.83	0.152		16.6
836.5	3	20525	15	0	16QAM	20.29		20.89	0.123		17.6
836.5	3	20525	15	0	64QAM	19.25		19.85	0.097		18.6
836.5	5	20525	25	0	QPSK	21.44		22.04	0.160		16.4
836.5	5	20525	25	0	16QAM	20.30		20.90	0.123		17.6
836.5	5	20525	25	0	64QAM	19.49		20.09	0.102		18.4
836.5	10	20525	50	0	QPSK	21.50		22.10	0.162		16.4
836.5	10	20525	50	0	16QAM	20.43		21.03	0.127		17.4
836.5	10	20525	50	0	64QAM	19.54		20.14	0.103		18.3
											Complies

Test Procedure

Normative	47 CFR §27.50(c), RSS-130 4.6
References	ANSI C63.26 (5.2)

Requirement / Limits

47 CFR §27.50	§27.50 Power limits and duty cycle. (c) The following power and antenna height requirements apply to stations transmitting in the 600 MHz band and the 698- 746 MHz band: (10) Portable stations (hand-held devices) in the 600 MHz uplink band and the 698-746 MHz band, and fixed and mobile stations in the 600 MHz uplink band are limited to 3 watts ERP. (11) Licensees may employ equipment operating in compliance with either the measurement techniques described in paragraph (b)(11) of this section or a Commission-approved average power technique. In both instances, equipment employed must be authorized in accordance with the provisions of §27.51.
RSS-130	4.6 Transmitter output power and effective radiated power (e.r.p.) 4.6.1 General The transmitter output power shall be measured in terms of average power. In addition, the peak-to-average power ratio (PAPR) of the transmitter shall not exceed 13 dB for more than 0.1% of the time and shall use a signal corresponding to the highest PAPR during periods of continuous transmission. 4.6.3 Frequency bands 698-756 MHz and 777-787 MHz The e.r.p. shall not exceed 30 watts for mobile equipment and outdoor fixed subscriber equipment. The e.r.p. shall not exceed 3 watts for portable equipment and indoor fixed subscriber equipment.

Table 8.3 – Summary of Conducted Power Measurements, LTE Band 12

See Appendix F for Conducted Power Measurement Plots

Conducted Power Measurement Results											
Channel Frequency (MHz)	Nominal Channel BW (MHz)	EARFCN	Resource Blocks	RB Offset	Modulation	Measured Conducted Power (dBm)	Dut Antenna Gain (dBi)	e.i.r.p. (dBm)	e.i.r.p. (W)	Limit (W)	Margin (dB)
707.5	1.4	23095	6	0	QPSK	21.29	0.60	21.89	0.155	3.00	12.9
707.5	1.4	23095	6	0	16QAM	20.23		20.83	0.121		13.9
707.5	1.4	23095	6	0	64QAM	19.44		20.04	0.101		14.7
707.5	3	23095	15	0	QPSK	21.29		21.89	0.155		12.9
707.5	3	23095	15	0	16QAM	20.38		20.98	0.125		13.8
707.5	3	23095	15	0	64QAM	19.42		20.02	0.100		14.8
707.5	5	23095	25	0	QPSK	21.55		22.15	0.164		12.6
707.5	5	23095	25	0	16QAM	20.45		21.05	0.127		13.7
707.5	5	23095	25	0	64QAM	19.65		20.25	0.106		14.5
707.5	10	23095	50	0	QPSK	21.50		22.10	0.162		12.7
707.5	10	23095	50	0	16QAM	20.55		21.15	0.130		13.6
707.5	10	23095	50	0	64QAM	19.58		20.18	0.104		14.6
											Complies

Test Procedure

Normative	47 CFR §27.50(d), RSS-139 6.5
References	ANSI C63.26 (5.2)

Requirement / Limits	
47 CFR §27.50	§27.50 Power limits and duty cycle. (d) The following power and antenna height requirements apply to stations transmitting in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz and 2180-2200 MHz bands: (4) Fixed, mobile, and portable (hand-held) stations operating in the 1710-1755 MHz band and mobile and portable stations operating in the 1695-1710 MHz and 1755-1780 MHz bands are limited to 1 watt EIRP.
RSS-139	6.5 Transmitter Output Power The equivalent isotropically radiated power (e.i.r.p.) for mobile and portable transmitters shall not exceed one watt. The e.i.r.p. for fixed and base stations in the band 1710-1780 MHz shall not exceed one watt.

Table 8.4 – Summary of Conducted Power Measurements, LTE Band 4

See Appendix F for Conducted Power Measurement Plots

Conducted Power Measurement Results											
Channel Frequency (MHz)	Nominal Channel BW (MHz)	EARFCN	Resource Blocks	RB Offset	Modulation	Measured Conducted Power (dBm)	Dut Antenna Gain (dBi)	e.i.r.p. (dBm)	e.i.r.p. (W)	Limit (W)	Margin (dB)
1732.5	1.4	20175	6	0	QPSK	19.39	-2.15	17.24	0.053	1.00	12.8
1732.5	1.4	20175	6	0	16QAM	18.67		16.52	0.045		13.5
1732.5	1.4	20175	6	0	64QAM	17.44		15.29	0.034		14.7
1732.5	3	20175	15	0	QPSK	19.51		17.36	0.054		12.6
1732.5	3	20175	15	0	16QAM	18.35		16.20	0.042		13.8
1732.5	3	20175	15	0	64QAM	17.80		15.65	0.037		14.4
1732.5	5	20175	25	0	QPSK	19.43		17.28	0.053		12.7
1732.5	5	20175	25	0	16QAM	18.20		16.05	0.040		14.0
1732.5	5	20175	25	0	64QAM	17.49		15.34	0.034		14.7
1732.5	10	20175	50	0	QPSK	19.41		17.26	0.053		12.7
1732.5	10	20175	50	0	16QAM	18.44		16.29	0.043		13.7
1732.5	10	20175	50	0	64QAM	17.56		15.41	0.035		14.6
1732.5	15	20175	75	0	QPSK	19.42		17.27	0.053		12.7
1732.5	15	20175	75	0	16QAM	18.39		16.24	0.042		13.8
1732.5	15	20175	75	0	64QAM	17.52		15.37	0.034		14.6
1732.5	20	20175	100	0	QPSK	19.45		17.30	0.054		12.7
1732.5	20	20175	100	0	16QAM	18.32		16.17	0.041		13.8
1732.5	20	20175	100	0	64QAM	17.46		15.31	0.034		14.7
											Complies

Test Procedure

Normative Reference	FCC 47 CFR §2.1046, §15.247(b)(3), RSS-Gen (6.1.2), RSS-247 (5.4)(d), KDB 558074 (8.3.2), ANSI C63.10 (11.9.2.2.2)
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Limits

47 CFR §15.247(b)(3)	(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following: (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power.
RSS-247 (5.4)(d)	5.4 Transmitter output power and equivalent isotropically radiated power (e.i.r.p.) Devices shall comply with the following requirements, where applicable: d) For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e). As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power.

Table 8.5 – Summary of Conducted Power Measurements, WiFi

See Appendix F for Conducted Power Measurement Plots

§15.247(b)(3) Channel Output Power (RMS)						
Frequency	BW	Modulation	Measured Power [E _{Meas}]	Measured Power [E _{Meas}]	Limit	Margin
(MHz)	(MHz)		(dBm)	(W)	(W)	(dB)
2412.0	13	QPSK	13.47	0.022	1.0	16.5
2442.0			14.56	0.029		15.4
2462.0			13.35	0.022		16.7
Result:					Complies	

(1) The output power is factory set to maximum

$$\text{Margin} = 10 \cdot \log(\text{Limit} / E_{\text{meas}})$$

RSS-247 (5.4)(d) Channel EIRP (RMS)									
Frequency	BW	Modulation	Measured Power	Antenna Gain	Cable Loss	EIRP	EIRP	Limit	Margin
(MHz)	(MHz)		[E _{Meas}] (dBm)	[G _T] (dBi)	[L _C] (dB)	(dBm)	(W)	(W)	(dB)
2412.0	13	QPSK	13.47	-2.65	0.5	11.32	0.014	4.0	24.7
2442.0			14.56			12.41	0.017		23.6
2462.0			13.35			11.20	0.013		24.8
Result:								Complies	

$$\text{EIRP (dBm)} = E_{\text{Meas}} + G_T + L_C$$

$$\text{Margin} = \text{Limit} - \text{EIRP in dB}$$

(1) The output power is factory set to maximum

9.0 CONDUCTED SPURIOUS EMISSIONS

Test Procedure

Normative	47 CFR §24.238, RSS-133
References	ANSI C63.26 (5.2)

Requirement / Limits

47 CFR §24.238	§24.238 Emission limitations for Broadband PCS equipment. (a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB. (b) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. 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. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 MHz or 1 percent of emission bandwidth, as specified). 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 emissions are attenuated at least 26 dB below the transmitter power.
RSS-133	2.3 Definition of Bandwidth Emission bandwidth is, for the purpose of this document, defined as the width of the signal between two points, one below the carrier frequency and one above the carrier frequency, outside of which all emissions are attenuated at least 20 dB below the transmitter power (i.e. -20 dBc), when measured with a resolution bandwidth of approximately 1% of the occupied bandwidth. In lieu of the -20 dBc bandwidth, the occupied bandwidth may be used. 6.5.1 Out-of-Block Emissions Equipment shall comply with the limits in (i) and (ii) below. (i) In the 1.0 MHz bands immediately outside and adjacent to the equipment's operating frequency block, the emission power per any 1% of the emission bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10} p(\text{watts})$. (ii) After the first 1.0 MHz, the emission power in any 1 MHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10} p(\text{watts})$. If the measurement is performed using 1% of the emission bandwidth, power integration over 1.0 MHz is required.

Test Procedure

Normative	47 CFR §22.917, RSS-132
References	ANSI C63.26 (5.2)

Requirement / Limits

47 CFR §22.917	§22.917 Emission limitations for cellular equipment. (a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB. (b) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a reference bandwidth as follows: (1) In the spectrum below 1 GHz, instrumentation should employ a reference bandwidth of 100 kHz or greater. 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. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy, provided that the measured power is integrated over the full required reference bandwidth (i.e., 100 kHz or 1 percent of emission bandwidth, as specified). 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 emissions are attenuated at least 26 dB below the transmitter power.
RSS-133	5.5 Transmitter Unwanted Emissions Mobile and base station equipment shall comply with the limits in (i) and (ii) below. (i) In the first 1.0 MHz band immediately outside and adjacent to each of the sub-bands specified in Section 5.1, the power of emissions per any 1% of the occupied bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10} p$ (watts). (ii) After the first 1.0 MHz immediately outside and adjacent to each of the sub-bands, the power of emissions in any 100 kHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10} p$ (watts). If the measurement is performed using 1% of the occupied bandwidth, power integration over 100 kHz is required.

Test Procedure

Normative	47 CFR §27.53, RSS-130
References	ANSI C63.26 (5.2)

Requirement / Limits	
47 CFR §27.53	§27.53 Emission limits. (g) For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least $43 + 10 \log (P)$ dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.
RSS-130	4.7 Transmitter unwanted emissions 4.7.1 General unwanted emissions limits The unwanted emissions in any 100 kHz bandwidth on any frequency outside the low frequency edge and the high frequency edge of each frequency block range(s), shall be attenuated below the transmitter power, P (dBW), by at least $43 + 10 \log_{10} p$ (watts), dB. However, in the 100 kHz band immediately outside of the equipment's frequency block range, a resolution bandwidth of 30 kHz may be employed.

Table 9.1 – Summary of Conducted Spurious Emissions Measurements

See Appendix I for Conducted Spurious Emissions Measurement Plots

Conducted Spurious Measurement Results									
Channel Frequency (MHz)	Nominal Channel BW (MHz)	EARFCN	Resource Blocks	RB Offset	Modulation	Emission Frequency (MHz)	Measured Emission (dBm)	Limit (dBm)	Margin (dB)
1880	1.4	18900	1	3	QPSK	-	ND	-13.00	-
1880	1.4	18900	1	3	QPSK	-	ND		-
1880	1.4	18900	1	3	QPSK	-	ND		-
1880	1.4	18900	1	3	QPSK	-	ND		-
1880	1.4	18900	1	3	QPSK	-	ND		-
1880	1.4	18900	1	3	QPSK	-	ND		-
1732.5	1.4	20175	1	3	QPSK	-	ND		-
1732.5	1.4	20175	1	3	QPSK	-	ND		-
1732.5	1.4	20175	1	3	QPSK	-	ND		-
1732.5	1.4	20175	1	3	QPSK	-	ND		-
1732.5	1.4	20175	1	3	QPSK	-	ND		-
1732.5	1.4	20175	1	3	QPSK	-	ND		-
1732.5	1.4	20175	1	3	QPSK	-	ND		-
836.5	1.4	20525	1	3	QPSK	-	ND		-
836.5	1.4	20525	1	3	QPSK	1674.0	-43.17		30.2
836.5	1.4	20525	1	3	QPSK	-	ND		-
836.5	1.4	20525	1	3	QPSK	1673.0	-39.44		26.4
707.5	1.4	23095	1	3	QPSK	-	ND		-
707.5	1.4	23095	1	3	QPSK	1414.0	-41.77		28.8
707.5	1.4	23095	1	3	QPSK	-	ND		-
707.5	1.4	23095	1	3	QPSK	1414.0	-35.63	22.6	
									Complies

Margin = Limit - Band Edge Emission

ND: None Detected. Noise Floor Measurement

Table 9.2 – Summary of Conducted Spurious Emissions Measurements – Simultaneous Transmission

See Appendix I for Conducted Spurious Emissions Measurement Plots

Simultaneous Transmission Spurious Emissions to 25GHz*										
LTE Channel Frequency (MHz)	Nominal Channel BW (MHz)	EARFCN	Resource Blocks	RB Offset	Modulation	WiFi Channel Frequency (MHz)	Emission Frequency (MHz)	Measured Emission (dBm)	Limit (dBm)	Margin (dB)
1880	1.4	18900	1	3	QPSK	2442.0	-	ND	-13.00	-
1732.5	1.4	20175	1	3	QPSK		-	ND		-
836.5	1.4	20525	1	3	QPSK		1673.0	-39.44		26.4
707.5	1.4	23095	1	3	QPSK		1414.0	-35.63		22.6
										Complies

Margin = Limit - Band Edge Emission

ND: None Detected. Noise Floor Measurement

* Under normal operating conditions, the WiFi and LTE transmitters do not simultaneously transmit. This analysis was conducted for the purposes of satisfying the co-located transmitter requirements.

10.0 RADIATED RX SPURIOUS EMISSIONS

Test Procedure

Normative Reference	FCC 47 CFR §15.109, ICES-003(6.2) ANSI C64.4-2014
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Limits

47 CFR §15.109	(a) Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values: 30-88MHz: 40dBuV/m 88-216MHz: 43.5dBuV/m 216-960MHz: 46dBuV/m > 960MHz: 54dBuV/m
ICES-003(6.2.1)	6.2.1 - Radiated Emissions Limits Below 1 GHz Class B: ITE that does not meet the conditions for Class A operation shall comply with the Class B radiated limits set out in Table 5 determined at a distance of 3 metres. 30-88MHz: 40dBuV/m 88-216MHz: 43.5dBuV/m 216-960MHz: 46dBuV/m > 960MHz: 54dBuV/m

Test Setup	Appendix A	Figure A.1
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Measurement Procedure

The DUT was set up as per ANSI C63.4:2014. Emissions were scanned between 30MHz and 1000MHz. The turntable was rotated 360 degrees and the antenna was elevated to 4m to optimize the measured emissions.

Table 10.1 – Summary of Radiated Rx Spurious Emissions

See Appendix J for Radiated Measurement Plots

§15.109, ICES-003 (6.2)							
Emission Frequency (MHz)	Antenna Polarization	Measured Emission [E_{Meas}] (dBuV)	Cable Loss [L_C] (dB)	Antenna Correction [ACF] (dB)	Corrected Emission [E_{Corr}] (W)	Limit @3m [Limit] (dBuV/m)	Margin [Margin] (dB)
* 856.5 MHz	Horizontal	41.66			41.66	56.9	15.2
* 727.0 MHz	Vertical	39.45			39.45	56.9	17.5
- GHz	Horizontal	ND			-	60.0	-
- GHz	Vertical	ND			-	60.0	-
** 3-20 GHz	Horizontal	ND			-	60.0	-
** 3-20 GHz	Vertical	ND			-	60.0	-
Results:						Complies	

* Measurement Compensated for Cable Loss and Antenna Correction Factor

$$E_{\text{Corr}} = E_{\text{Meas}} + L_C + \text{AFC}$$

$$\text{Margin} = \text{Limit} - E_{\text{Corr}}$$

** Emissions Shown are Noise Floor

ND = None Detected

APPENDIX A – TEST SETUP DRAWINGS AND CONDITIONS

Table A.1 – Conducted Measurement Setup and Environmental

Equipment List				
Asset Number	Manufacturer	Model Number	Serial Number	Description
00241	R&S	FSU40	100500	Spectrum Analyzer
00263	Koaxis	KP10-1.00M-TD	263	1m Armoured Cable

Figure A.1 – Test Setup – Conducted Measurements

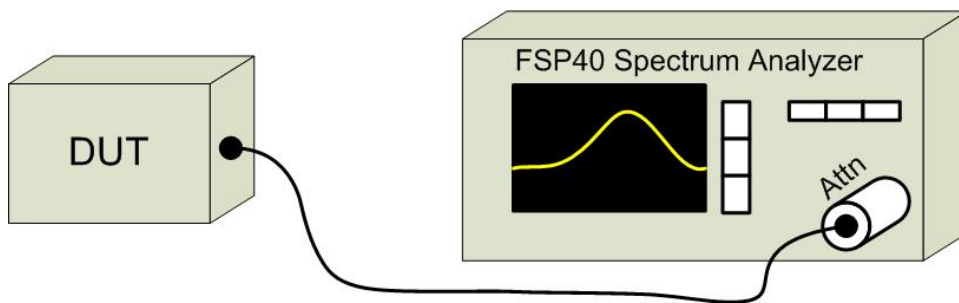


Table A.2 – Radiated Emissions Measurement Equipment and Environmental

Equipment List				
Asset Number	Manufacturer	Model Number	Serial Number	Description
00050	Chase	CBL-6111A	1607	Bilog Antenna
00034	ETS	3115	6267	Double Ridged Guide Horn
00035	ETS	3115	6276	Double Ridged Guide Horn
00085	EMCO	6502	9203-2724	Loop Antenna
00161	Waveline Inc.	889		Standard Gain Horn 18-26GHz
00162	Waveline Inc.	889		Standard Gain Horn 18-26GHz
00165	Waveline Inc.	801-KF		Waveguide Adapter 18-26GHz
00166	Waveline Inc.	801-KF		Waveguide Adapter 18-26GHz
00333	HP	85685A	3010A01095	RF Preselector
00049	HP	85650A	2043A00162	Quasi-peak Adapter
00051	HP	8566B	2747A05510	Spectrum Analyzer
00241	R&S	FSU40	100500	Spectrum Analyzer
00265	Miteq	JS32-00104000-58-5P	1939850	Microwave L/N Amplifier
00071	EMCO	2090	9912-1484	Multi-Device Controller
00072	EMCO	2075	0001-2277	Mini-mast
00073	EMCO	2080	0002-1002	Turn Table
00263	Koaxis	KP10-1.00M-TD	263	1m Armoured Cable
00263B	Koaxis	KP10-1.00M-TD	263B	1m Armoured Cable
00275	TMS	LMR400	n/a	25m Cable
00278	TILE	34G3	n/a	TILE Test Software

Figure A.2 – Test Setup Radiated Measurements 30MHz – 1GHz

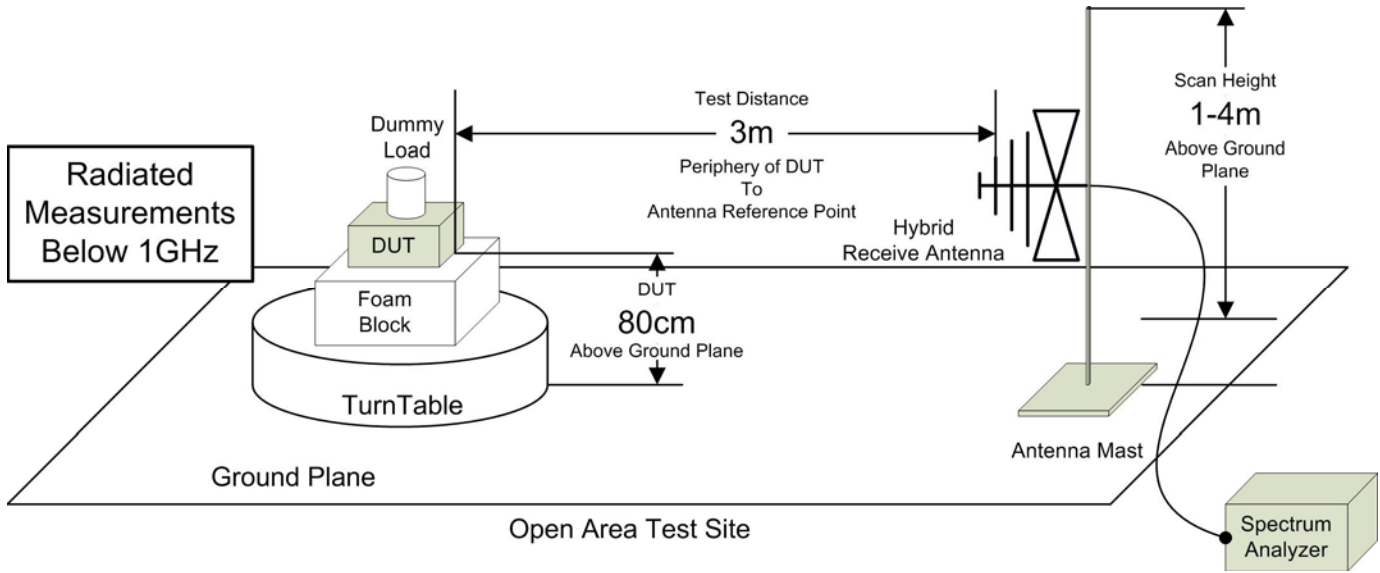


Figure A.3 – Test Setup Radiated Measurements 30 – 1000MHz, Signal Substitution

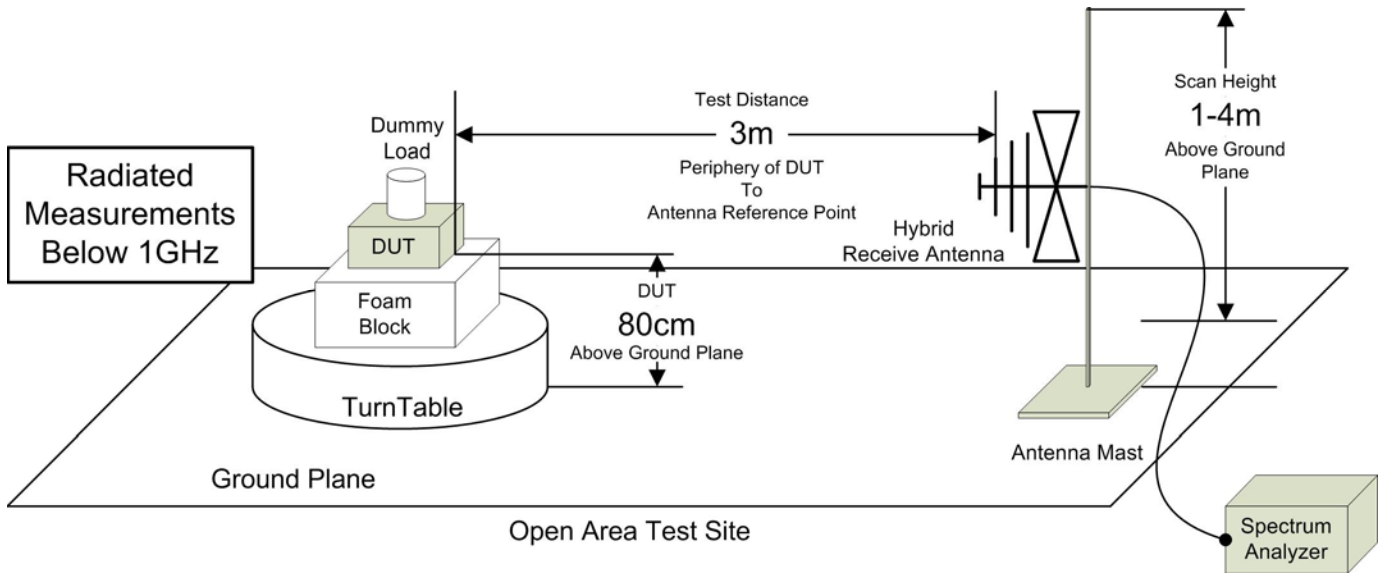


Figure A.4 – Test Setup Radiated Measurements 1 – 18GHz

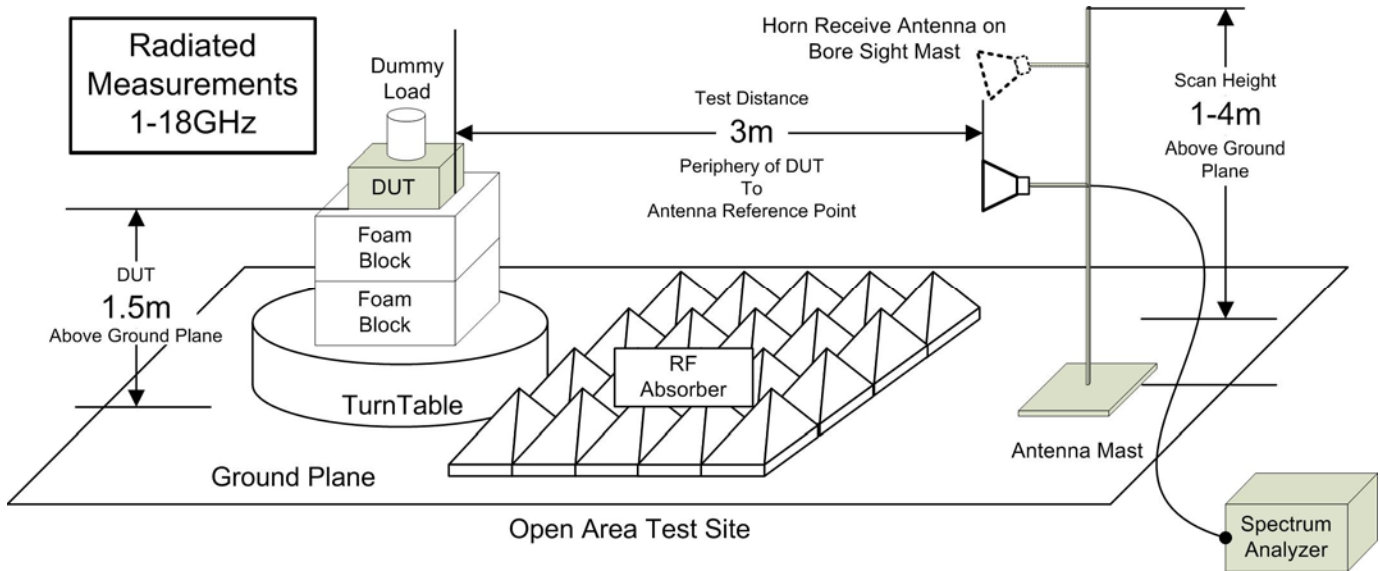
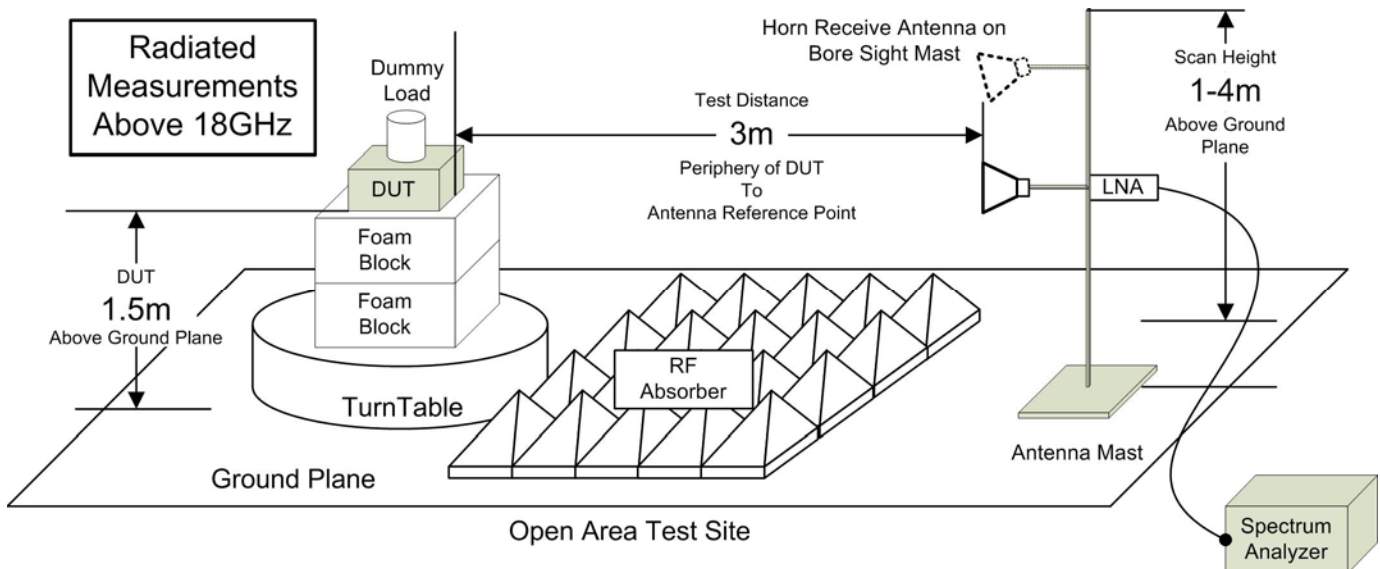


Figure A.5 – Test Setup Radiated Measurements 18 - 26GHz



APPENDIX B – EQUIPMENT LIST AND CALIBRATION

Equipment List							
Asset Number	Manufacturer	Model Number	Serial Number	Description	Last Calibrated	Calibration Interval	Calibration Due
00050	Chase	CBL-6111A	1607	Bilog Antenna	3 Jan 2019	Triennial	3 Jan 2022
00034	ETS	3115	6267	Double Ridged Guide Horn	26 Nov 2018	Triennial	26 Nov 2021
00035	ETS	3115	6276	Double Ridged Guide Horn	22 Mar 2019	Triennial	21 Mar 2022
00161	Waveline Inc.	889		Standard Gain Horn 18-26GHz	NCR	n/a	NCR
00165	Waveline Inc.	801-KF		Waveguide Adapter 18-26GHz	NCR	n/a	NCR
00333	HP	85685A	3010A01095	RF Preselector	23 Jun 2020	Triennial	30 Jun 2023
00049	HP	85650A	2043A00162	Quasi-peak Adapter	23 Jun 2020	Triennial	23 Jun 2023
00051	HP	8566B	2747A05510	Spectrum Analyzer	23 Jun 2020	Triennial	23 Jun 2023
00223	HP	8901A	3749A07154	Modulation Analyzer	27 Dec 2017	Triennial	27 Dec 2020
00241	R&S	FSU40	100500	Spectrum Analyzer	15 May 2018	Triennial	15 May 2021
00071	EMCO	2090	9912-1484	Multi-Device Controller	n/a	n/a	n/a
00072	EMCO	2075	0001-2277	Mini-mast	n/a	n/a	n/a
00073	EMCO	2080	0002-1002	Turn Table	n/a	n/a	n/a
00263	Koaxis	KP10-1.00M-TD	263	1m Armoured Cable	COU	n/a	COU
00263B	Koaxis	KP10-1.00M-TD	263B	1m Armoured Cable	COU	n/a	COU
00264	Koaxis	KP10-7.00M-TD	264	7m Armoured Cable	COU	n/a	COU
00275	TMS	LMR400	n/a	25m Cable	COU	n/a	COU
00278	TILE	34G3	n/a	TILE Test Software	NCR	n/a	NCR

NCR: No Calibration Required

COU: Calibrate On Use

APPENDIX C – MEASUREMENT INSTRUMENT UNCERTAINTY

CISPR 16-4 Measurement Uncertainty (U_{LAB})

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence interval using a coverage factor of $k=2$

Radiated Emissions 30MHz - 200MHz

$U_{LAB} = 5.14\text{dB}$ $U_{CISPR} = 6.3\text{dB}$

Radiated Emissions 200MHz - 1000MHz

$U_{LAB} = 5.90\text{dB}$ $U_{CISPR} = 6.3\text{dB}$

Radiated Emissions 1GHz - 6GHz

$U_{LAB} = 4.80\text{dB}$ $U_{CISPR} = 5.2\text{dB}$

Radiated Emissions 6GHz - 18GHz

$U_{LAB} = 5.1\text{dB}$ $U_{CISPR} = 5.5\text{dB}$

Power Line Conducted Emissions 9kHz to 150kHz

$U_{LAB} = 2.96\text{dB}$ $U_{CISPR} = 3.8\text{dB}$

Power Line Conducted Emissions 150kHz to 30MHz

$U_{LAB} = 3.12\text{dB}$ $U_{CISPR} = 3.4\text{dB}$

If the calculated uncertainty U_{lab} is **less** than U_{CISPR} then:

- | | |
|---|---|
| 1 | Compliance is deemed to occur if NO measured disturbance exceeds the disturbance limit |
| 2 | Non-Compliance is deemed to occur if ANY measured disturbance EXCEEDS the disturbance limit |

If the calculated uncertainty U_{lab} is **greater** than U_{CISPR} then:

- | | |
|---|--|
| 3 | Compliance is deemed to occur if NO measured disturbance, increased by ($U_{lab} - U_{CISPR}$), exceeds the disturbance limit |
| 4 | Non-Compliance is deemed to occur if ANY measured disturbance, increased by ($U_{lab} - U_{CISPR}$), EXCEEDS the disturbance limit |

Other Measurement Uncertainties (U_{LAB})

RF Conducted Emissions 9kHz - 40GHz

$U_{LAB} = 1.0\text{dB}$ $U_{CISPR} = \text{n/a}$

Frequency/Bandwidth 9kHz - 40GHz

$U_{LAB} = 0.1\text{ppm}$ $U_{CISPR} = \text{n/a}$

Temperature

$U_{LAB} = 1^{\circ}\text{C}$ $U_{CISPR} = \text{n/a}$

END OF REPORT

APPENDIX D – OCCUPIED BANDWIDTH MEASUREMENT PLOTS

APPENDIX F – CONDUCTED POWER MEASUREMENT PLOTS

APPENDIX I – CONDUCTED SPURIOUS EMISSIONS MEASUREMENT PLOTS

APPENDIX J – RADIATED RX SPURIOUS EMISSIONS MEASUREMENT PLOTS

