













LTE Band 38



















Page 83 of 132

Report No.: 170615001RFM-3

5.6 Spurious emissions at antenna terminals

Test Requirement: FCC 47 CFR Part 2.1053

LTE Band 4: FCC 47 CFR Part 27.53(h)(1) LTE Band 7 & Band 41: FCC 47 CFR Part 27.53(m)(4)

Test Method: Limit: ANSI/TIA/EIA-603-D 2010 & KDB 971168 D01v02r02 FCC 47 CFR Part 27.53(a)(4): For mobile and portable stations operating in the 2305-2315 MHz and 2350-2360 MHz bands:

(i) By a factor of not less than: $43 + 10 \log (P) dB$ on all frequencies between 2305 and 2320 MHz and on all frequencies between 2345 and 2360 MHz that are outside the licensed band(s) of operation, not less than 55 + 10 log (P) dB on all frequencies between 2320 and 2324 MHz and on all frequencies between 2341 and 2345 MHz, not less than 61 + 10 log (P) dB on all frequencies between 2324 and 2328 MHz and on all frequencies between 2337 and 2341 MHz, and not less than 67 + 10 log (P) dB on all frequencies between 2328 and 2337 MHz;

(ii) By a factor of not less than $43 + 10 \log (P) dB$ on all frequencies between 2300 and 2305 MHz, 55 + 10 log (P) dB on all frequencies between 2296 and 2300 MHz, 61 + 10 log (P) dB on all frequencies between 2292 and 2296 MHz, 67 + 10 log (P) dB on all frequencies between 2288 and 2292 MHz, and 70 + 10 log (P) dB below 2288 MHz;

(iii) By a factor of not less than 43 + 10 log (P) dB on all frequencies between 2360 and 2365 MHz, and not less than 70 + 10 log (P) dB above 2365 MHz.

FCC 47 CFR Part 27.53(h)(1): Except as otherwise specified below, for operations 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 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least 43 + 10 log10 (P) dB. The emission limit equal to -13 dBm.

FCC 47 CFR Part 27.53(h)(3): Measurement procedure. (i) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's 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 emissions are attenuated at least 26 dB below the transmitter power.

(ii) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges, both upper and lower, as the design permits.

(iii) The measurements of emission power can be expressed in peak or average values, provided they are expressed in the same parameters as the transmitter power.

FCC 47 CFR Part 27.53(m)(4): For mobile digital stations, the attenuation factor shall be not less than 40 + 10 log (P) dB on all frequencies between the channel edge and 5 megahertz from the channel edge, 43 + 10 log (P) dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and 55 + 10 log (P) dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less that 43 + 10 log (P) dB on all frequencies between 2490.5 MHz and 2496 MHz and 55 + 10 log (P) dB at or below 2495 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference

Page 84 of 132

complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

	FCC 47 CFR Part 27.53(m)(6): Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz 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; for mobile digital stations, in the 1 megahertz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least two percent may be employed, except when the 1 megahertz band is 2495-2496 MHz, in which case a resolution bandwidth of at least one percent 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 megahertz or 1 percent of emission bandwidth, as specified; or 1 megahertz or 2 percent for mobile digital stations, except in the band 2495-2496 MHz). 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. With respect to television operations, measurements must be made of the separate visual and aural operating powers at sufficiently frequent intervals to ensure compliance with the rules.
Test Procedure:	The EUT makes a phone call to the communication simulator. All measurements were done at low, middle and high operational frequency range. b. Measuring frequency range is from 9 kHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower. Set RBW & VBW to 100 kHz for the measurement below 1 GHz, and 1 MHz for the measurement above 1 GHz.
	Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.
Test Setup:	Refer to section 4.1.1(2) for details.
Instruments Used:	Refer to section 3 for details
Test Mode:	Link mode
Test Results:	Pass

The test plot as follows:

Spurious Emission Test Data (9 KHz ~ 30 MHz):

The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.



Spurious Emission Test Data (Above 30MHz):

LTE Band 4























LTE Band 7

















LTE Band 38

















Report No.: 170615001RFM-3

Field strength of spurious radiation 5

i est Requirement:	LTE Band 4: FCC 47 CFR Part 27.53(h)(1) LTE Band 7 & Band 38: FCC 47 CFR Part 27.53(m)(4)
Test Method: Limit:	ANSI/TIA/EIA-603-D 2010 & KDB 971168 D01v02r02 FCC 47 CFR Part 27.53(a)(4): For mobile and portable stations operating in the 2305-2315 MHz and 2350-2360 MHz bands: (i) By a factor of not less than: 43 + 10 log (P) dB on all frequencies between 2305 and 2320 MHz and on all frequencies between 2345 and 2360 MHz that are outside the licensed band(s) of operation, not less than 55 + 10 log (P) dB on all frequencies between 2320 and 2324 MHz and on all frequencies between 2341 and 2345 MHz, not less than 61 + 10 log (P) dB on all frequencies between 2324 and 2328 MHz and on all frequencies between 2337 and 2341 MHz, and not less than 67 + 10 log (P) dB on all frequencies between 2328 and 2337 MHz; (ii) By a factor of not less than 43 + 10 log (P) dB on all frequencies between 2300 and 2305 MHz, 55 + 10 log (P) dB on all frequencies between 2296 and 2300 MHz, 61 + 10 log (P) dB on all frequencies between 2292 and 2296 MHz, 67 + 10 log (P) dB on all frequencies between 2288 and 2292 MHz, and 70 + 10 log (P) dB below 2288 MHz; (iii) By a factor of not less than 43 + 10 log (P) dB on all frequencies between 2360 and 2305 MHz, 65 + 10 log (P) dB on all frequencies between 2292 and 2296 MHz, 67 + 10 log (P) dB on all frequencies between 2296 and 2300 MHz, 61 + 10 log (P) dB on all frequencies between 2292 MHz, and 70 + 10 log (P) dB below 2288 MHz; (iii) By a factor of not less than 43 + 10 log (P) dB on all frequencies between 2360 and 2365 MHz, 67 + 10 log (P) dB on all frequencies between 2365 MHz, 67 + 10 log (P) dB on all frequencies between 2292 MHz, and 70 + 10 log (P) dB below 2288 MHz;
	FCC 47 CFR Part 27.53(a)(5): 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 channel blocks at 2305, 2310, 2315, 2320, 2345, 2350, 2355, and 2360 MHz, a resolution bandwidth of at least 1 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). 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.
	FCC 47 CFR Part 27.53(h)(1): Except as otherwise specified below, for operations 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 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least 43 + 10 log10 (P) dB. The emission limit equal to -13 dBm.
	FCC 47 CFR Part 27.53(m)(4) : For mobile digital stations, the attenuation factor shall be not less than $40 + 10 \log (P) dB$ on all frequencies between the channel edge and 5 megahertz from the channel edge, $43 + 10 \log (P) dB$ on all frequencies between 5 megahertz and X megahertz from the channel edge, and 55 + 10 log (P) dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less that 43 + 10 log (P) dB on all frequencies between 2490.5 MHz and 2496 MHz and 55 + 10 log (P) dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

FR Part 27.53(m)(6): Measurement procedure. Complian rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one

	rust	Page 100 of 132	Report No : 170615001RFM-3
		Page 100 of 132	Report No.: 170015001RFM-3
	percent of the of may be emploimmediately ou of at least two 2495-2496 MH be employed. A measurement required meass bandwidth, as except in the b width of the sig one above the attenuated at h operating power rules.	emission bandwidth of the fu oyed; for mobile digital s utside and adjacent to the fro- percent may be employed, z, in which case a resolution A narrower resolution bandwi accuracy provided the meas surement bandwidth (i.e. 1 specified; or 1 megahertz o band 2495-2496 MHz). The nal between two points, one e carrier center frequency, east 26 dB below the transme easurements must be made ers at sufficiently frequent in	Indamental emission of the transmitter tations, in the 1 megahertz bands equency block a resolution bandwidth except when the 1 megahertz band is bandwidth of at least one percent may idth is permitted in all cases to improve sured power is integrated over the full megahertz or 1 percent of emission or 2 percent for mobile digital stations, emission bandwidth is defined as the below the carrier center frequency and outside of which all emissions are hitter power. With respect to television the of the separate visual and aural itervals to ensure compliance with the
Test Procedure:	 Scan up to The techni antenna su determine 	10 th harmonic, find the max que used to find the Spuriou ubstitution method. Substituti the actual ERP/EIRP emissi	imum radiation frequency to measure. Is Emissions of the transmitter was the ion method was performed to on levels of the EUT.
	Test procedure 1) The EUT w fully Anech maximum tuned to th	e as below: /as powered ON and placed noic Chamber. The antenna d length. Modulation mode and e frequency of the transmitte	on a 1.5m high table at a 3 meter of the transmitter was extended to its d the measuring receiver shall be er under test.
	2) The EUT w	vas set 3 meters (above 18G	Hz the distance is 1 meter) away
	from the in variable-he	terference-receiving antenna eight antenna tower.	a, which was mounted on the top of a
	display by	raising and lowering from 1n	n to 4m the receive antenna and by
	rotating thr	ough 360° the turntable. Afte	er the fundamental emission was
	4) Steps 1) to vertical and	l, a field strength measureme 3) were performed with the d horizontal polarization.	ent was made. EUT and the receive antenna in both
	5) The transm center of th of the trans	nitter was then removed and ne antenna was approximate smitter.	replaced with another antenna. The bly at the same location as the center
	6) A signal at a non-radia horizontally a maximur was adjust	the disturbance was fed to t ating cable. With both the su y polarized, the receive anter n reading at the test receiver ed until the measured field s	he substitution antenna by means of bstitution and the receive antennas nna was raised and lowered to obtain r. The level of the signal generator strength level in step 3) is obtained for
	7) The output	conditions.	antenna was then measured
	8) Steps 6) ar	nd 7) were repeated with bot	h antennas polarized.
	9) Calculate p	ower in dBm by the following	g formula:
	ERP(dl EIRP(d EIRP=I where:	Bm) = Pg(dBm) – cable loss IBm) = Pg(dBm) – cable loss ERP+2.15dB	(dB) + antenna gain (dBd) s (dB) + antenna gain (dBi)
	Pg is the g	generator output power into t	he substitution antenna.
	11) The radiati EUT opera case.	on measurements are perfor tion mode, and found the X	med in X, Y, Z axis positioning for axis positioning which it is worse

12) Repeat above procedures until all frequencies measured was complete.



Report No.: 170615001RFM-3

Receiver Setup:	Frequency	Detector	RBW	VBW	Remark		
	0.009MHz-30MHz	Peak	10kHz	30kHz	Peak		
	30MHz-1GHz	Peak	100kHz	300kHz	Peak		
	Above 1GHz	Peak	1MHz	3MHz	Peak		
Fest Setup: Refer to section 4.1.2 for details.							

Test Setu Instruments Used: Refer to section 3 for details **Test Mode:** Link mode Pass **Test Results:**

Test Data:

Spurious Emission Test Data (9 KHz ~ 30 MHz)

The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

Spurious Emission Test Data (Above 18 GHz)

The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.





Page 102 of 132

Spurious Emission Test Data (30 MHz ~ 1 GHz)

LTE Band 4

























Uni@nTrust Page 108 of 132

LTE Band 7









Uni@nTrust Page 110 of 132





Uni@nTrust Page 111 of 132





Uni@nTrust Page 112 of 132

LTE Band 38



















Page 116 of 132

Spurious Emission Test Data (1 GHz ~ 18 GHz)

LTE Band 4













Uni@nTrust Page 119 of 132





Uni@nTrust Page 120 of 132









Uni@nTrust Page 122 of 132

LTE Band 7





Uni@nTrust Page 123 of 132





Uni@nTrust Page 124 of 132









Uni@nTrust Page 126 of 132 Report No.: 170615001RFM-3

LTE Band 38



















Page 130 of 132

5.8 Frequency stability

Test Requirement: Test Method: Limit:	FCC 47 CFR Part 2.1055 & Part 24.235 ANSI/TIA/EIA-603-D 2010 & KDB 971168 D01v02r02 The frequency stability shall be sufficient to ensure that the fundamental
	emission stays within the authorized frequency block.
Test Procedure:	 Use CMW 500 or CMU 200 with Frequency Error measurement capability. a) Temp. =-20° to +50°C b) Voltage =low voltage, 3.4Vdc, Normal, 3.85Vdc and High voltage, 4.4Vdc.
Test Setup:	 2) Frequency Stability vs Temperature: The EUT is place inside a temperature chamber. The temperature is set to 20°C and allowed to stabilize. After sufficient soak time, the transmitting frequency error is measured. The temperature is increased by 10 degrees, allowed to stabilize and soak, and then the measurement is repeated. This is repeated until +50°C is reached. 3) Frequency Stability vs Voltage: The peak frequency error is recorded (worst-case). Refer to section 4.1.1(3) for details.
Instruments Used:	Refer to section 3 for details
Test Mode:	Link mode
Test Results: Test Data:	Pass
I TE Band 4	

Modulation	Channel/ Frequency (MHz)	Voltage (Vdc)	Temperature (°C)	Deviation (Hz)	Deviation (ppm)	Limit (ppm)	Pass/ Fail				
LTE Band 4; Channel Bandwidth: 20 MHz											
		3.4		36	0.021	± 2.5	PASS				
		3.85	Normal	32	0.018	± 2.5	PASS				
		4.4	4	35	0.020	± 2.5	PASS				
			50	38	0.022	± 2.5	PASS				
	001751		40	36	0.021	± 2.5	PASS				
QPSK	20175/ 1732.5	20175/ 1732.5		30	32	0.018	± 2.5	PASS			
						3.85	20	32	0.018	± 2.5	PASS
					5.65	10	35	0.020	± 2.5	PASS	
					0	36	0.021	± 2.5	PASS		
			-10	38	0.022	± 2.5	PASS				
			-20	41	0.024	± 2.5	PASS				



LTE Band 7

Modulation	Channel/ Frequency (MHz)	Voltage (Vdc)	Temperature (℃)	Deviation (Hz)	Deviation (ppm)	Limit (ppm)	Pass/ Fail		
LTE Band 7; Channel Bandwidth: 20 MHz									
		3.4		-25	-0.010	± 2.5	PASS		
		3.85	Normal	-23	-0.009	± 2.5	PASS		
	21100/ 2535	4.4		-26	-0.010	± 2.5	PASS		
		3.85	50	-29	-0.011	± 2.5	PASS		
			40	-27	-0.011	± 2.5	PASS		
QPSK			30	-24	-0.009	± 2.5	PASS		
			20	-24	-0.009	± 2.5	PASS		
			10	-23	-0.009	± 2.5	PASS		
			0	-23	-0.009	± 2.5	PASS		
			-10	7	0.003	± 2.5	PASS		
			-20	12	0.005	± 2.5	PASS		

LTE Band 38

Modulation	Channel/ Frequency (MHz)	Voltage (Vdc)	Temperature (°C)	Deviation (Hz)	Deviation (ppm)	Limit (ppm)	Pass/ Fail													
LTE Band 7; Channel Bandwidth: 20 MHz																				
		3.4		-16	-0.006	± 2.5	PASS													
		3.85	Normal	-14	-0.005	± 2.5	PASS													
		4.4		-17	-0.007	± 2.5	PASS													
	38000/ 2595		50	-20	-0.008	± 2.5	PASS													
		38000/ 2595	38000/ 2595	00000/											00000/	40	-17	-0.007	± 2.5	PASS
QPSK					30	-15	-0.006	± 2.5	PASS											
					2.95	20	-13	-0.005	± 2.5	PASS										
				3.65	10	-11	-0.004	± 2.5	PASS											
			0	4	0.002	± 2.5	PASS													
			-10	9	0.003	± 2.5	PASS													
			-20	12	0.005	± 2.5	PASS													



APPENDIX 1 PHOTOGRAPHS OF TEST SETUP

See test photographs attached in Appendix 1 for the actual connections between Product and support equipment.

APPENDIX 2 PHOTOGRAPHS OF EUT CONSTRUCTIONAL DETAILS

Refer to Appendix 2 for EUT external and internal photographs.

*** End of Report ***

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