FCC CFR47 PART 96 SUBPART E

WWAN

CERTIFICATION TEST REPORT

FOR

LTE Outdoor CPE

MODEL NUMBER : SLC-120T42OGA

FCC ID: V7MESLC-120T42OGA

REPORT NUMBER: 4788755803-E1V2

ISSUE DATE: MAY 07, 2018

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ACCREDITED
Testing Laboratory

TL-637

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	04/22/19	Initial issue	Hoonpyo Lee
V2	05/07/19	Updated about the TCB's question	Hoonpyo Lee

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SEOWON INTECH CO., LTD

EUT DESCRIPTION: LTE Outdoor CPE

MODEL NUMBER: SLC-120T42OGA

SERIAL NUMBER: KRSD184910468-00025 (RADIATED);
KRSD184910468-00024 (CONDUCTED)

DATE TESTED: APR 09, 2019 - MAY 07, 2019

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 96E	Pass

UL Korea, Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Korea, Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Korea, Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Korea, Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by IAS, any agency of the Federal Government, or any agency of any government.

Approved & Released For
UL Korea, Ltd. By:

SungGil Park
Suwon Lab Engineer
UL Korea, Ltd.

Tested By:

Hoonpyo Lee
Suwon Lab Engineer
UL Korea, Ltd.

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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with following methods.

1. FCC CFR 47 Part 2.
2. FCC CFR 47 Part 96.
3. ANSI TIA-603-E, 2016
4. ANSI C63.26-2015
5. KDB 940660 D01 Part 96 CBRS v01
6. KDB 971168 D01 Power Meas License Digital Systems v03r01

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do,16675, Korea. Line conducted emissions are measured only at the 218 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

218 Maeyeong-ro
☒ Chamber 1
☐ Chamber 2
☐ Chamber 3

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4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

EIRP = PSA reading with EUT worst orientation (dBm) + Path loss (dB) – cable loss(between the SG and substitution antenna) + Substitution Antenna Factor (dBi)

ERP = PSA reading with EUT worst orientation (dBm) + Path loss (dB) – cable loss(between the SG and substitution antenna)

(Path loss = Signal generator output – PSA reading with substitution antenna)

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4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	2.32 dB
Radiated Disturbance, Below 1GHz	3.86 dB
Radiated Disturbance, Above 1 GHz	5.97 dB

Uncertainty figures are valid to a confidence level of 95%.

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5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a LTE Outdoor CPE.
This test report addresses the WWAN operational mode.

5.2. TDD reference test frequencies for CA in operating band 48

Test frequencies for CA 48C

Range	CC-Combo / N_{RB_agg} [RB]	CC1 Note1			CC2 Note1		
		BW [RB]	$N_{UL/DL}$	$f_{UL/DL}$ [MHz]	BW [RB]	$N_{UL/DL}$	$f_{UL/DL}$ [MHz]
Low	25+100	25	55273	3553.3	100	55390	3565
		100	55340	3560	25	55457	3571.7
	50+100	50	55295	3555.5	100	55439	3569.9
		100	55340	3560	50	55484	3574.4
	75+100	75	55318	3557.8	100	55489	3574.9
		100	55340	3560	75	55511	3577.1
	100+100	100	55340	3560	100	55538	3579.8
Mid	25+100	25	55898	3615.8	100	56015	3627.5
		100	55965	3622.5	25	56082	3634.2
	50+100	50	55896	3615.6	100	56040	3630
		100	55941	3620.1	50	56085	3634.5
	75+100	75	55893	3615.3	100	56064	3632.4
		100	55916	3617.6	75	56087	3634.7
	100+100	100	55891	3615.1	100	56089	3634.9
High	25+100	25	56523	3678.3	100	56640	3690
		100	56590	3685	25	56707	3696.7
	50+100	50	56496	3675.6	100	56640	3690
		100	56541	3680.1	50	56685	3694.5
	75+100	75	56469	3672.9	100	56640	3690
		100	56491	3675.1	75	56662	3692.2
	100+100	100	56442	3670.2	100	56640	3690
Note 1: Carriers in increasing frequency order.							

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5.3. MAXIMUM OUTPUT POWER

The transmitter has a maximum average radiated EIRP output powers as follows:

LTE Band 43

LTE Band 43 (Frequency range: 3600 – 3700 MHz) is covered by LTE Band 48 (Frequency range: 3550 – 3700 MHz) due to overlapping frequency range, same maximum tune-up limit and same channel bandwidth.

LTE Band 48

FCC Part 96						
Antenna Gain (dBi)		10.59				
Band	Frequency Range	BandWidth	Modulation	Conducted Power	EIRP Power	
	[MHz]	[MHz]		Avg [dBm]	[dBm]	[mW]
Band 48	3550 – 3700	20	QPSK	9.91	20.50	112.20
			16QAM	9.97	**20.56**	**113.76**
			64QAM	9.96	20.55	113.50
		15	QPSK	9.76	20.35	108.39
			16QAM	9.82	20.41	109.90
			64QAM	9.52	20.11	102.57
		10	QPSK	9.66	20.25	105.93
			16QAM	9.88	20.47	111.43
			64QAM	9.43	20.02	100.46
		5	QPSK	9.35	19.94	98.63
			16QAM	9.44	20.03	100.69
			64QAM	9.43	20.02	100.46

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LTE Band 48 (Uplink CA)

Part 96					
Antenna Gain (dBi)		10.59			
Bandwidth (MHz)	Frequency Range (MHz)	Modulation	OUTPUT POWER		
			Conducted Average (dBm)	EIRP Average (dBm)	
				dBm	mW
5 + 20	3550 - 3700	QPSK	10.18	20.77	119.40
		16QAM	10.41	21.00	125.89
		64QAM	10.35	20.94	124.17
20 + 5		QPSK	10.49	21.08	128.23
		16QAM	10.51	21.10	128.82
		64QAM	10.38	20.97	125.03
10 + 20		QPSK	10.58	21.17	130.92
		16QAM	10.41	21.00	125.89
		64QAM	10.34	20.93	123.88
20 + 10		QPSK	10.66	21.25	133.35
		16QAM	10.72	21.31	135.21
		64QAM	10.70	21.29	134.59
15+20		QPSK	10.56	21.15	130.32
		16QAM	10.60	21.19	131.52
		64QAM	10.59	21.18	131.22
20+15		QPSK	10.59	21.18	131.22
		16QAM	10.58	21.17	130.92
		64QAM	10.68	21.27	133.97
20+20		QPSK	**10.77**	**21.36**	**136.77**
		16QAM	10.35	20.94	124.17
		64QAM	10.34	20.93	123.88

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5.4. RF OUTPUT POWER VERIFICATION (CONDUCTED AND EIRP)

RULE PART(S)

FCC: §2.1046

TEST PROCEDURE

TIA-603-E Clause 2.2.17
KDB 971168 Section 5.6

ERP/EIRP = PMeas + GT − LC
where: ERP/EIRP = effective or equivalent radiated power, respectively (expressed in the same units as PMeas, typically dBW or dBm);
PMeas = measured transmitter output power or PSD, in dBm or dBW;
GT = gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP);
LC = signal attenuation in the connecting cable between the transmitter and antenna, in dB.2

RESULTS

The below tables contain the highest of all configurations average conducted and ERP/EIRP output powers as follows:

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OUTPUT POWER FOR LTE BAND 48 (BW 20MHz) – Single

Antenna Gain (dBi)			10.59							
BW (MHz)	Mode	RB Allocation	RB offset	Total Average Power (dBm)			EIRP Average Power (dBm e.i.r.p)			Maximum EIRP Limit (dBm/10MHz)
				55340	55990	56640	55340	55990	56640	
				3560 MHz	3625 MHz	3690 MHz	3560 MHz	3625 MHz	3690 MHz	
20 MHz	QPSK	1	0	8.50	9.46	9.60	19.09	20.05	20.19	23.0
		1	49	8.23	9.06	9.36	18.82	19.65	19.95	
		1	99	8.56	9.51	**9.91**	19.15	20.10	**20.50**	
		50	0	8.13	9.15	9.12	18.72	19.74	19.71	
		50	25	8.26	9.02	9.26	18.85	19.61	19.85	
		50	49	8.25	9.02	9.34	18.84	19.61	19.93	
		100	0	8.15	9.15	9.31	18.74	19.74	19.90	
	16QAM	1	0	8.65	9.62	9.89	19.24	20.21	20.48	
		1	49	8.31	9.20	9.32	18.90	19.79	19.91	
		1	99	9.05	9.63	**9.97**	19.64	20.22	**20.56**	
		50	0	8.21	9.21	9.31	18.80	19.80	19.90	
		50	25	8.24	9.12	9.29	18.83	19.71	19.88	
		50	49	8.23	9.12	9.45	18.82	19.71	20.04	
		100	0	8.10	9.14	9.38	18.69	19.73	19.97	
	64QAM	1	0	8.92	9.62	9.92	19.51	20.21	20.51	
		1	49	8.57	9.42	9.65	19.16	20.01	20.24	
		1	99	9.01	9.60	**9.96**	19.60	20.19	**20.55**	
		50	0	8.19	9.17	9.19	18.78	19.76	19.78	
		50	25	8.19	9.12	9.22	18.78	19.71	19.81	
		50	49	8.18	9.12	9.43	18.77	19.71	20.02	
		100	0	8.08	9.16	9.39	18.67	19.75	19.98	

OUTPUT POWER FOR LTE BAND 48 (BW 15MHz) – Single

Antenna Gain (dBi)			10.59							
BW (MHz)	Mode	RB Allocation	RB offset	Conducted Average Power (dBm)			EIRP Average Power (dBm e.i.r.p)			Maximum EIRP Limit (dBm/10MHz)
				55340	55990	56640	55340	55990	56640	
				3557.5 MHz	3625 MHz	3692.5 MHz	3557.5 MHz	3625 MHz	3692.5 MHz	
15 MHz	QPSK	1	0	8.59	9.26	9.47	19.18	19.85	20.06	23.0
		1	37	8.34	9.08	9.39	18.93	19.67	19.98	
		1	74	8.57	9.25	**9.76**	19.16	19.84	**20.35**	
		36	0	8.30	9.13	9.29	18.89	19.72	19.88	
		36	18	8.37	9.24	9.34	18.96	19.83	19.93	
		36	35	8.17	9.07	9.22	18.76	19.66	19.81	
		75	0	8.20	9.23	9.40	18.79	19.82	19.99	
	16QAM	1	0	8.57	9.43	9.61	19.16	20.02	20.20	
		1	37	8.38	9.16	9.42	18.97	19.75	20.01	
		1	74	8.64	9.32	**9.82**	19.23	19.91	**20.41**	
		36	0	8.36	9.11	9.22	18.95	19.70	19.81	
		36	18	8.44	9.19	9.39	19.03	19.78	19.98	
		36	35	8.25	9.03	9.27	18.84	19.62	19.86	
		75	0	8.27	9.20	9.47	18.86	19.79	20.06	
	64QAM	1	0	8.09	8.81	9.24	18.68	19.40	19.83	
		1	37	7.99	8.67	9.05	18.58	19.26	19.64	
		1	74	8.29	9.25	**9.52**	18.88	19.84	**20.11**	
		36	0	8.27	9.10	9.33	18.86	19.69	19.92	
		36	18	8.29	9.23	9.39	18.88	19.82	19.98	
		36	35	8.28	9.10	9.41	18.87	19.69	20.00	
		75	0	8.25	9.20	9.41	18.84	19.79	20.00	

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OUTPUT POWER FOR LTE BAND 48 (BW 10MHz) – Single

Antenna Gain (dBi)			10.59							
BW (MHz)	Mode	RB Allocation	RB offset	Total Average Power (dBm)			EIRP Average Power (dBm e.i.r.p)			Limit (dBm/10MHz)
				55340	55990	56640	55340	55990	56640	
				3555 MHz	3625 MHz	3695 MHz	3555 MHz	3625 MHz	3695 MHz	
10 MHz	QPSK	1	0	8.26	9.07	9.33	18.85	19.66	19.92	23.0
		1	24	8.20	8.69	9.06	18.79	19.28	19.65	
		1	49	8.47	9.26	**9.66**	19.06	19.85	**20.25**	
		25	0	7.97	9.09	9.28	18.56	19.68	19.87	
		25	12	8.21	8.95	9.38	18.80	19.54	19.97	
		25	24	8.17	9.05	9.28	18.76	19.64	19.87	
		50	0	8.11	9.13	9.39	18.70	19.72	19.98	
	16QAM	1	0	8.44	9.29	9.54	19.03	19.88	20.13	
		1	24	8.44	8.90	9.41	19.03	19.49	20.00	
		1	49	8.69	9.50	**9.88**	19.28	20.09	**20.47**	
		25	0	8.05	9.09	9.36	18.64	19.68	19.95	
		25	12	8.29	9.02	9.44	18.88	19.61	20.03	
		25	24	8.25	9.17	9.37	18.84	19.76	19.96	
		50	0	8.22	9.22	9.47	18.81	19.81	20.06	
	64QAM	1	0	7.88	8.62	8.88	18.47	19.21	19.47	
		1	24	7.82	8.33	8.77	18.41	18.92	19.36	
		1	49	8.41	9.12	**9.43**	19.00	19.71	**20.02**	
		25	0	8.07	9.09	9.25	18.66	19.68	19.84	
		25	12	8.32	8.92	9.42	18.91	19.51	20.01	
		25	24	8.27	9.02	9.24	18.86	19.61	19.83	
		50	0	8.17	9.04	9.40	18.76	19.63	19.99	

OUTPUT POWER FOR LTE BAND 48 (BW 5MHz) – Single

Antenna Gain (dBi)			10.59							
BW (MHz)	Mode	RB Allocation	RB offset	Total Average Power (dBm)			EIRP Average Power (dBm e.i.r.p)			Limit (dBm/10MHz)
				55340	55990	56640	55340	55990	56640	
				3552.5 MHz	3625 MHz	3697.5 MHz	3552.5 MHz	3625 MHz	3697.5 MHz	
5 MHz	QPSK	1	0	7.87	8.52	9.01	18.46	19.11	19.60	23.0
		1	12	7.62	8.62	9.09	18.21	19.21	19.68	
		1	24	8.12	8.92	**9.35**	18.71	19.51	**19.94**	
		12	0	8.02	8.88	8.97	18.61	19.47	19.56	
		12	6	7.94	8.80	9.30	18.53	19.39	19.89	
		12	11	7.86	8.73	9.22	18.45	19.32	19.81	
		25	0	7.81	8.67	9.18	18.40	19.26	19.77	
	16QAM	1	0	7.75	8.66	9.07	18.34	19.25	19.66	
		1	12	7.50	8.82	9.28	18.09	19.41	19.87	
		1	24	8.34	9.16	**9.44**	18.93	19.75	**20.03**	
		12	0	8.33	9.08	9.41	18.92	19.67	20.00	
		12	6	7.89	8.93	9.31	18.48	19.52	19.90	
		12	11	7.81	8.85	9.34	18.40	19.44	19.93	
		25	0	7.73	8.76	9.14	18.32	19.35	19.73	
	64QAM	1	0	7.55	8.43	8.68	18.14	19.02	19.27	
		1	12	7.29	8.38	8.87	17.88	18.97	19.46	
		1	24	8.24	9.15	**9.43**	18.83	19.74	**20.02**	
		12	0	7.83	8.46	9.02	18.42	19.05	19.61	
		12	6	7.94	8.79	9.16	18.53	19.38	19.75	
		12	11	7.85	8.71	9.19	18.44	19.30	19.78	
		25	0	7.85	8.70	9.07	18.44	19.29	19.66	

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OUTPUT POWER FOR LTE BAND 48 (5.0MHz + 20.0MHz & 20 MHz + 5.0MHz) - CA 48C

Antenna Gain [dBi]		10.59						Total Power			
Bandwidth	PCC Frequency [MHz]	SCC Frequency [MHz]	Modulation	PCC RB Size	PCC RB Offset	SCC RB Size	SCC RB Offset	Conducted Average [dBm]	Conducted Power + Ant. Gain [dBm]	EIRP Limit [dBm/10MHz]	Margin [dB]
5 MHz / 20 MHz	3553.3	3565	QPSK	1	24	1	0	9.74	20.33	23.00	2.67
				25	0	100	0	9.33	19.92	23.00	3.08
			16QAM	1	24	1	0	10.10	20.69	23.00	2.31
				25	0	100	0	9.32	19.91	23.00	3.09
			64QAM	1	24	1	0	9.71	20.30	23.00	2.70
				25	0	100	0	9.26	19.85	23.00	3.15
	3615.8	3627.5	QPSK	1	24	1	0	**10.18**	**20.77**	23.00	2.23
				25	0	100	0	10.11	20.70	23.00	2.30
			16QAM	1	24	1	0	10.39	20.98	23.00	2.02
				25	0	100	0	10.06	20.65	23.00	2.35
			64QAM	1	24	1	0	**10.35**	**20.94**	23.00	2.06
				25	0	100	0	10.02	20.61	23.00	2.39
	3678.3	3690	QPSK	1	24	1	0	10.09	20.68	23.00	2.32
				25	0	100	0	9.79	20.38	23.00	2.62
			16QAM	1	24	1	0	**10.41**	**21.00**	23.00	2.00
				25	0	100	0	9.83	20.42	23.00	2.58
			64QAM	1	24	1	0	10.12	20.71	23.00	2.29
				25	0	100	0	9.81	20.40	23.00	2.60
20 MHz / 5 MHz	3560	3571.7	QPSK	1	99	1	0	9.05	19.64	23.00	3.36
				100	0	25	0	8.93	19.52	23.00	3.48
			16QAM	1	99	1	0	9.07	19.66	23.00	3.34
				100	0	25	0	8.97	19.56	23.00	3.44
			64QAM	1	99	1	0	9.06	19.65	23.00	3.35
				100	0	25	0	8.95	19.54	23.00	3.46
	3622.5	3634.2	QPSK	1	99	1	0	10.16	20.75	23.00	2.25
				100	0	25	0	9.91	20.50	23.00	2.50
			16QAM	1	99	1	0	10.22	20.81	23.00	2.19
				100	0	25	0	9.99	20.58	23.00	2.42
			64QAM	1	99	1	0	10.20	20.79	23.00	2.21
				100	0	25	0	9.98	20.57	23.00	2.43
	3685	3696.7	QPSK	1	99	1	0	**10.49**	**21.08**	23.00	1.92
				100	0	25	0	10.27	20.86	23.00	2.14
			16QAM	1	99	1	0	**10.51**	**21.10**	23.00	1.90
				100	0	25	0	10.29	20.88	23.00	2.12
			64QAM	1	99	1	0	**10.38**	**20.97**	23.00	2.03
				100	0	25	0	10.27	20.86	23.00	2.14

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OUTPUT POWER FOR LTE BAND 48 (10.0MHz + 20.0MHz & 20MHz + 10MHz) - CA 48C

Antenna Gain [dBi]		10.59						Output Power			
Bandwidth	PCC Frequency [MHz]	SCC Frequency [MHz]	Modulation	PCC RB Size	PCC RB Offset	SCC RB Size	SCC RB Offset	Conducted Average [dBm/10MHz]	Conducted Power + Ant. Gain [dBm/10MHz]	EIRP Limit [dBm/10MHz]	Margin [dB]
10 MHz / 20 MHz	3555.5	3569.9	QPSK	1	49	1	0	9.92	20.51	23.00	2.49
				50	0	100	0	9.31	19.90	23.00	3.10
			16QAM	1	49	1	0	10.03	20.62	23.00	2.38
				50	0	100	0	9.46	20.05	23.00	2.95
			64QAM	1	49	1	0	9.58	20.17	23.00	2.83
				50	0	100	0	9.34	19.93	23.00	3.07
	3615.6	3630	QPSK	1	49	1	0	**10.58**	**21.17**	23.00	1.83
				50	0	100	0	10.19	20.78	23.00	2.22
			16QAM	1	49	1	0	10.40	20.99	23.00	2.01
				50	0	100	0	10.12	20.71	23.00	2.29
			64QAM	1	49	1	0	10.32	20.91	23.00	2.09
				50	0	100	0	10.08	20.67	23.00	2.33
	3675.6	3690	QPSK	1	49	1	0	10.37	20.96	23.00	2.04
				50	0	100	0	9.98	20.57	23.00	2.43
			16QAM	1	49	1	0	**10.41**	**21.00**	23.00	2.00
				50	0	100	0	10.19	20.78	23.00	2.22
			64QAM	1	49	1	0	**10.34**	**20.93**	23.00	2.07
				50	0	100	0	10.08	20.67	23.00	2.33
20 MHz / 10 MHz	3560	3574.4	QPSK	1	99	1	0	9.41	20.00	23.00	3.00
				100	0	50	0	9.21	19.80	23.00	3.20
			16QAM	1	99	1	0	9.44	20.03	23.00	2.97
				100	0	50	0	9.35	19.94	23.00	3.06
			64QAM	1	99	1	0	9.30	19.89	23.00	3.11
				100	0	50	0	9.20	19.79	23.00	3.21
	3620.1	3634.5	QPSK	1	99	1	0	10.55	21.14	23.00	1.86
				100	0	50	0	10.06	20.65	23.00	2.35
			16QAM	1	99	1	0	10.53	21.12	23.00	1.88
				100	0	50	0	10.40	20.99	23.00	2.01
			64QAM	1	99	1	0	10.51	21.10	23.00	1.90
				100	0	50	0	10.38	20.97	23.00	2.03
	3680.1	3694.5	QPSK	1	99	1	0	**10.66**	**21.25**	23.00	1.75
				100	0	50	0	10.30	20.89	23.00	2.11
			16QAM	1	99	1	0	**10.72**	**21.31**	23.00	1.69
				100	0	50	0	10.32	20.91	23.00	2.09
			64QAM	1	99	1	0	**10.70**	**21.29**	23.00	1.71
				100	0	50	0	10.31	20.90	23.00	2.10

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OUTPUT POWER FOR LTE BAND 48 (15.0MHz + 20.0MHz & 20MHz + 15MHz) - CA 48C

Antenna Gain [dBi]		10.59						Output Power			
Bandwidth	PCC Frequency [MHz]	SCC Frequency [MHz]	Modulation	PCC RB Size	PCC RB Offset	SCC RB Size	SCC RB Offset	Conducted Average [dBm/10MHz]	Conducted Power + Ant. Gain [dBm/10MHz]	EIRP Limit [dBm/10MHz]	Margin [dB]
15 MHz / 20 MHz	3557.8	3574.9	QPSK	1	74	1	0	9.83	20.42	23.00	2.58
				75	0	100	0	9.27	19.86	23.00	3.14
			16QAM	1	74	1	0	9.85	20.44	23.00	2.56
				75	0	100	0	9.25	19.84	23.00	3.16
			64QAM	1	74	1	0	9.82	20.41	23.00	2.59
				75	0	100	0	9.27	19.86	23.00	3.14
	3615.3	3632.4	QPSK	1	74	1	0	10.54	21.13	23.00	1.87
				75	0	100	0	10.31	20.90	23.00	2.10
			16QAM	1	74	1	0	10.59	21.18	23.00	1.82
				75	0	100	0	10.32	20.91	23.00	2.09
			64QAM	1	74	1	0	10.28	20.87	23.00	2.13
				75	0	100	0	10.21	20.80	23.00	2.20
	3672.9	3690	QPSK	1	74	1	0	**10.56**	**21.15**	23.00	1.85
				75	0	100	0	9.79	20.38	23.00	2.62
			16QAM	1	74	1	0	**10.60**	**21.19**	23.00	1.81
				75	0	100	0	9.81	20.40	23.00	2.60
			64QAM	1	74	1	0	**10.59**	**21.18**	23.00	1.82
				75	0	100	0	9.83	20.42	23.00	2.58
20 MHz / 15 MHz	3560	3577.1	QPSK	1	99	1	0	9.42	20.01	23.00	2.99
				100	0	75	0	9.06	19.65	23.00	3.35
			16QAM	1	99	1	0	9.32	19.91	23.00	3.09
				100	0	75	0	9.07	19.66	23.00	3.34
			64QAM	1	99	1	0	9.37	19.96	23.00	3.04
				100	0	75	0	9.03	19.62	23.00	3.38
	3617.6	3634.7	QPSK	1	99	1	0	10.26	20.85	23.00	2.15
				100	0	75	0	9.71	20.30	23.00	2.70
			16QAM	1	99	1	0	10.18	20.77	23.00	2.23
				100	0	75	0	9.75	20.34	23.00	2.66
			64QAM	1	99	1	0	**10.68**	**21.27**	23.00	1.73
				100	0	75	0	9.72	20.31	23.00	2.69
	3675.1	3692.2	QPSK	1	99	1	0	**10.59**	**21.18**	23.00	1.82
				100	0	75	0	10.33	20.92	23.00	2.08
			16QAM	1	99	1	0	**10.58**	**21.17**	23.00	1.83
				100	0	75	0	10.36	20.95	23.00	2.05
			64QAM	1	99	1	0	10.56	21.15	23.00	1.85
				100	0	75	0	10.31	20.90	23.00	2.10

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OUTPUT POWER FOR LTE BAND 48 (20.0MHz + 20MHz) - CA 48C

Antenna Gain [dBi]		10.69						Output Power			
Bandwidth	PCC Frequency [MHz]	SCC Frequency [MHz]	Modulation	PCC RB Size	PCC RB Offset	SCC RB Size	SCC RB Offset	Conducted Average [dBm/10MHz]	Conducted Power + Ant. Gain [dBm/10MHz]	EIRP Limit [dBm/10MHz]	Margin [dB]
20 MHz / 20 MHz	3560	3579.8	QPSK	1	99	1	0	9.53	20.12	23.00	2.88
				100	0	100	0	9.11	19.70	23.00	3.30
			16QAM	1	99	1	0	9.47	20.06	23.00	2.94
				100	0	100	0	9.18	19.77	23.00	3.23
			64QAM	1	99	1	0	9.51	20.10	23.00	2.90
				100	0	100	0	9.11	19.70	23.00	3.30
	3615.1	3634.9	QPSK	1	99	1	0	10.40	20.99	23.00	2.01
				100	0	100	0	9.98	20.57	23.00	2.43
			16QAM	1	99	1	0	10.34	20.93	23.00	2.07
				100	0	100	0	9.98	20.57	23.00	2.43
			64QAM	1	99	1	0	10.32	20.91	23.00	2.09
				100	0	100	0	9.94	20.53	23.00	2.47
	3670.2	3690	QPSK	1	99	1	0	**10.77**	**21.36**	23.00	1.64
				100	0	100	0	9.99	20.58	23.00	2.42
			16QAM	1	99	1	0	**10.35**	**20.94**	23.00	2.06
				100	0	100	0	10.03	20.62	23.00	2.38
			64QAM	1	99	1	0	**10.34**	**20.93**	23.00	2.07
				100	0	100	0	9.96	20.55	23.00	2.45

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5.5. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a internal antenna for the [List the bands supported] with a maximum peak gain as follow:

Frequency (MHz)	Peak Gain (dBi)
LTE Band 48 3550 ~ 3700 MHz	10.59

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5.6. WORST-CASE ORIENTATION

The worst-case scenario for all measurements is based on the average conducted output power measurement investigation results. Output power measurements were measured on QPSK, 16QAM and 64QAM modulations. It was found that QPSK and 16QAM results were worst case. All testing was performed using QPSK and 16QAM modulations to represent the worst case. However, the out of band emissions and spurious radiation were only performed on bandwidth and RB offset(with RB size 1) with the highest power. (Refer to the below list)

For uplink CA of band 48, the worst-case scenario for spurious tests(radiated/conducted) are based on the average conducted output power measurement investigation results. So spurious tests were performed 20MHz/20MHz bandwidth combinations. (Adjacent allocation of single RB in PCC and SCC represents worst-case of single RB allocations.)

Highest power setting for each bands					
LTE Band	**Channel (MHz)**	**Modulation**	**Bandwidth (MHz)**	**RB size**	**RB offset**
48	3560	16QAM	20	1	99
	3625	16QAM		1	99
	3690	16QAM		1	99
48C (Uplink CA)	PCC: 3670.2	QPSK	PCC: 20	1	99
	SCC: 3690	QPSK	SCC: 20	1	0

- Radiated spurious emissions

For LTE Band 48, the spurious emissions was investigated in three orthogonal orientations X, Y and Z it was determined that Y orientation was worst-case orientation.

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5.7. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
PoE POWER SUPPLY	Mass Power Electronics Limited	PIF-4800045-1KMW	R37K3AD0AC3SE3	N/A
UTP Cat.5e Cable	N/A	N/A	N/A	N/A

I/O CABLES

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	RJ-45	1	RJ-45	Shielded	1.0m	N/A

TEST SETUP

The EUT is continuously communicated to the call box during the tests.

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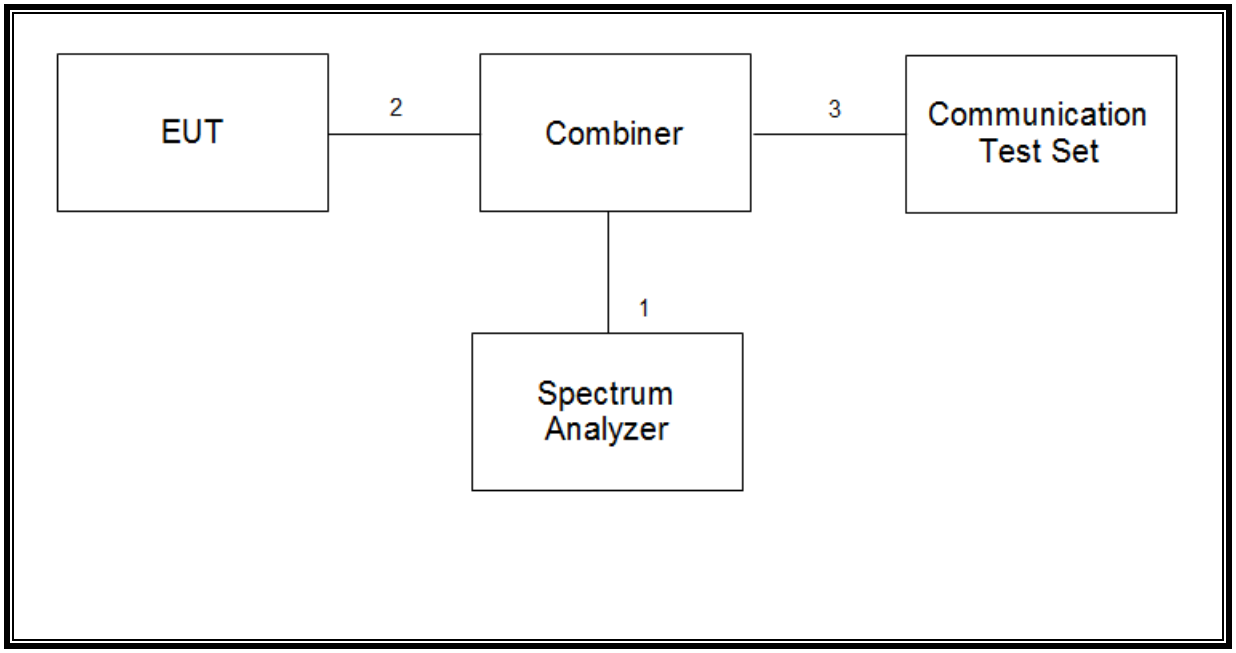
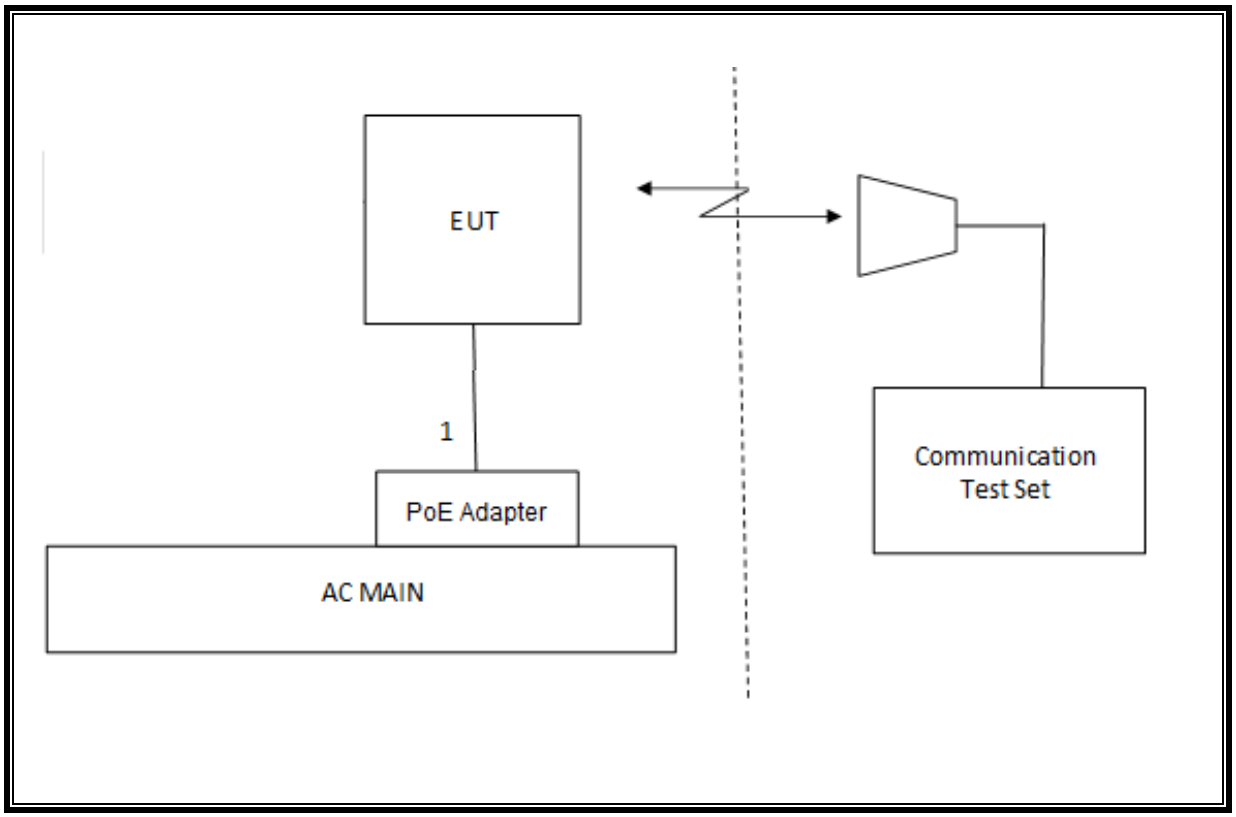
SETUP DIAGRAM FOR TESTS (CONDUCTED TEST SETUP)



SETUP DIAGRAM FOR TESTS (RADIATED TEST SETUP)



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6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment List				
Description	**Manufacturer**	**Model**	**S/N**	**Cal Due**
Antenna, Tuned Dipole 400~1000 MHz	ETS	3121D DB4	00164753	06-30-19
Antenna, Horn, 40 GHz	ETS	3116C	00166155	08-14-20
Preamplifier	ETS	3116C-PA	00168841	08-09-19
Antenna, Horn, 40 GHz	ETS	3116C	00168645	12-04-19
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	750	08-04-20
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	845	08-04-20
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	749	08-04-20
Antenna, Horn, 18 GHz	ETS	3115	00167211	08-04-20
Antenna, Horn, 18 GHz	ETS	3115	00161451	08-04-20
Antenna, Horn, 18 GHz	ETS	3117	00168724	08-04-20
Antenna, Horn, 18 GHz	ETS	3117	00205959	08-04-20
Antenna, Horn, 18 GHz	ETS	3117	00168717	08-04-20
Combiner	WEINSCHEL	1575	2150	08-08-19
Communications Test Set	R&S	CMW500	150314	08-09-19
DC Power Supply	Agilent / HP	E3640A	MY54226395	08-06-19
Preamplifier, 1000 MHz	Sonoma	310N	341282	08-07-19
Preamplifier, 1000 MHz	Sonoma	310N	370599	08-06-19
Preamplifier, 1000 MHz	Sonoma	310N	351741	08-07-19
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1876511	08-07-19
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	2029169	08-07-19
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	08-07-19
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54490312	08-06-19
EMI Test Receive, 40 GHz	R&S	ESU40	100439	08-06-19
EMI Test Receive, 40 GHz	R&S	ESU40	100457	08-06-19
EMI Test Receive, 44 GHz	R&S	ESW40	101590	08-06-19
High Pass Filter 1.2GHz	Micro-Tronics	HPM50108-02	G005	08-08-19
High Pass Filter 1.2GHz	Micro-Tronics	HPM50108-02	G006	08-08-19
High Pass Filter 2.8GHz	Micro-Tronics	HPM50111-02	010	08-08-19
High Pass Filter 2.8GHz	Micro-Tronics	HPM50111-02	011	08-08-19
High Pass Filter 4GHz	Micro-Tronics	HPM50118-02	G001	08-08-19
High Pass Filter 4GHz	Micro-Tronics	HPM50118-02	G002	08-08-19
Attenuator	PASTERNACK	PE7087-10	A009	08-08-19
Attenuator	PASTERNACK	PE7087-10	A001	08-08-19
Attenuator	PASTERNACK	PE7087-10	A008	08-08-19
Attenuator	PASTERNACK	PE7087-10	2	08-07-19
Attenuator	PASTERNACK	PE7395-10	A011	08-08-19
Antenna, Loop, 9kHz-30MHz	R&S	HFH2-Z2	100418	10-26-19
Temperature Chamber	ESPEC	SH-642	93001109	08-06-19
UL Software				
Description	**Manufacturer**	**Model**	**Version**	
Antenna port test software	UL	CLT	Ver 2.5	

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7. Summary Table

FCC Part Section	Test Description	Test Limit	Test Condition	Test Result
2.1049	Occupied Band width (99%)	N/A	Conducted	Pass
96.41(g)	Peak to Average Ratio	13 dB		Pass
96.41(e)	Conducted Spurious Emission	-40 dBm		Pass
96.41(e)	Emission mask	Section 9.2.2		Pass
2.1046	Conducted output power	N/A		Pass
2.1055	Frequency Stability	Within the authorized frequency band		Pass
96.41(b)	Equivalent Isotropic Radiated Power	End User Device: 23dBm/10MHz	Radiated	Pass
96.41(e)	Radiated Spurious Emission	-40dBm		Pass

This EUT is the End User Device defined in Part96.

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8. PEAK TO AVERAGE RATIO

Test Procedure

Per KDB 971168 D01 Power Meas License Digital Systems v03r01;

The transmitter output was connected to a CMW500 Test Set and configured to operate at maximum power. The PAR were measured on the Spectrum Analyzer.

Test Spec

In addition, when the transmitter power is measured in terms of average value, the peak-to-average ratio of the power shall not exceed 13 dB.

RESULTS

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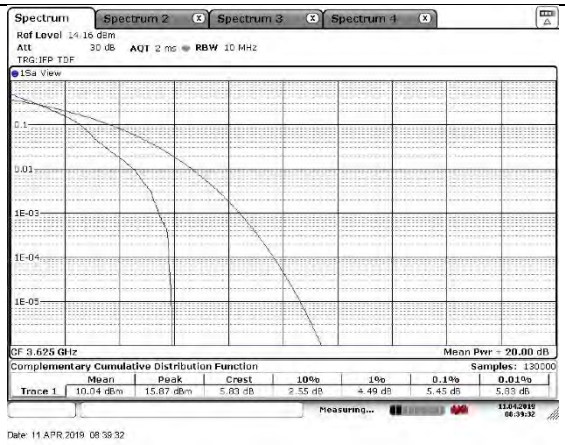
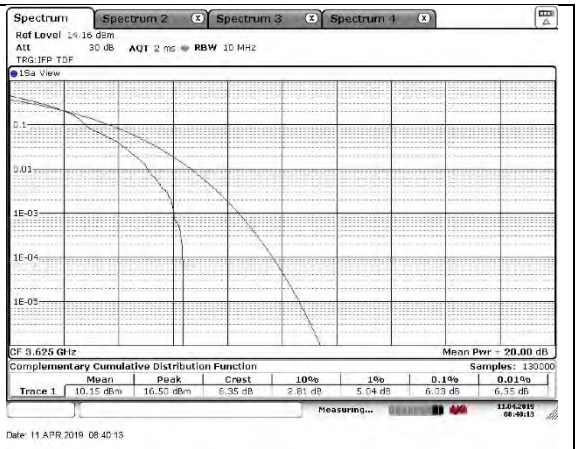
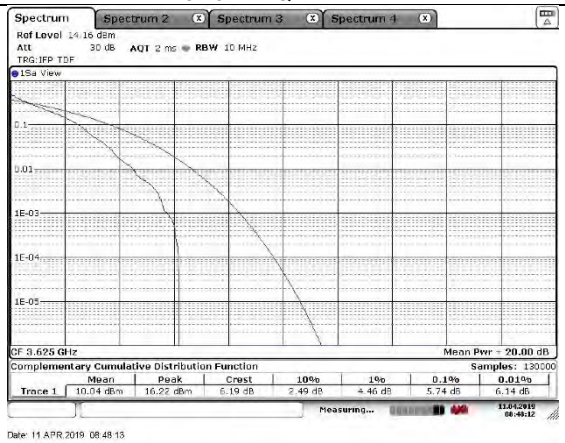
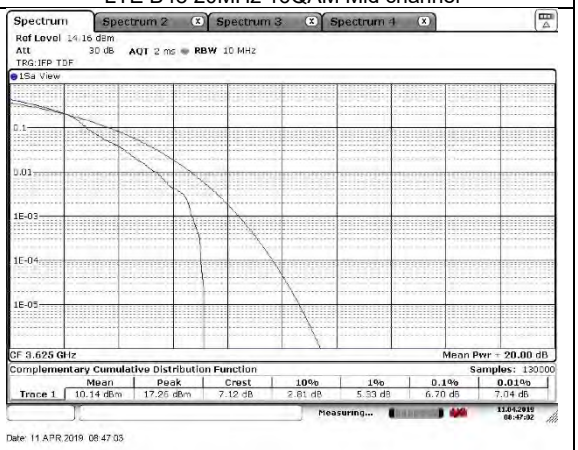
8.1. CONDUCTED PEAK TO AVERAGE RESULT

LTE Band 48

LTE Band 48 20 MHz	 LTE B48 20MHz QPSK Mid channel	 LTE B48 20MHz 16QAM Mid channel
LTE Band 48 15 MHz	 LTE B48 15MHz QPSK Mid channel	 LTE B48 15MHz 16QAM Mid channel

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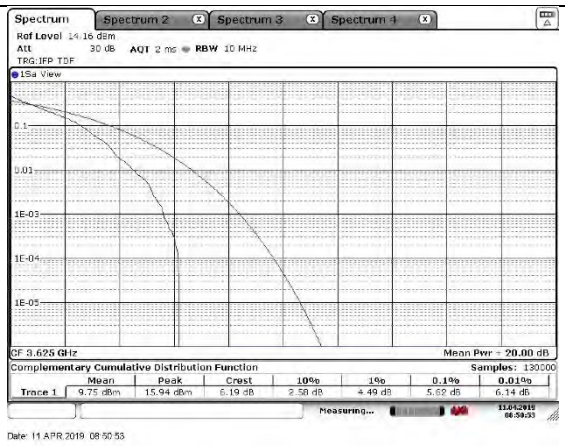
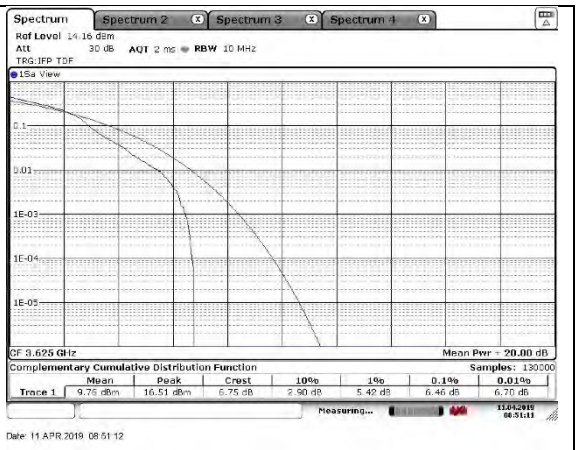
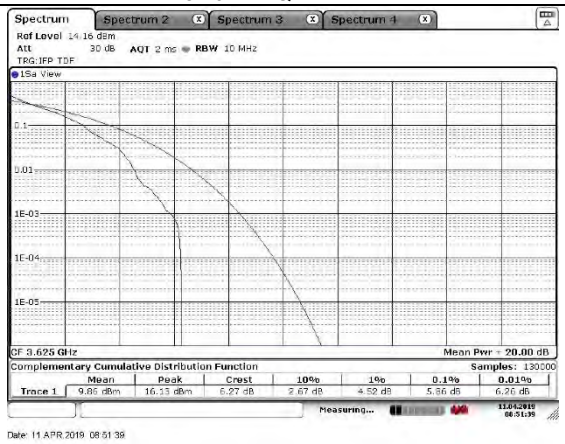
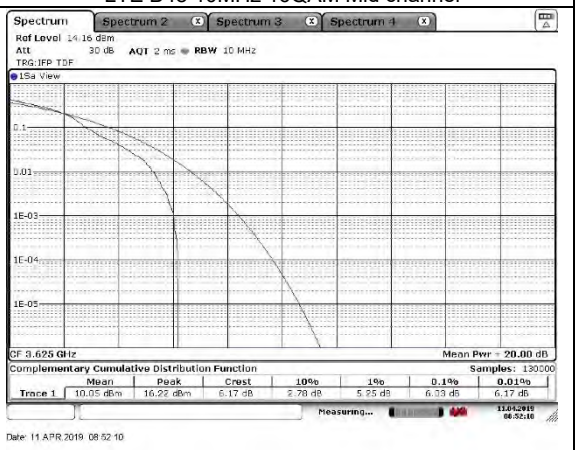
LTE Band 48 10 MHz	 LTE B48 10MHz QPSK Mid channel	 LTE B48 10MHz 16QAM Mid channel
LTE Band 48 5 MHz	 LTE B48 5MHz QPSK Mid channel	 LTE B48 5MHz 16QAM Mid channel

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9. LIMITS AND CONDUCTED RESULTS

9.1. OCCUPIED BANDWIDTH

RULE PART(S)

FCC: §2.1049

LIMITS

For reporting purposes only

TEST PROCEDURE

The transmitter output was connected to a calibrated coaxial cable and coupler, the other end of which was connected to a spectrum analyzer. The occupied bandwidth was measured with the spectrum analyzer at the low, middle and high channel in each band.
(KDB 971168 D01 Power Meas License Digital Systems v03r01)

RESULTS

See the following pages.

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9.1.1. OCCUPIED BANDWIDTH RESULTS

Band	BW [MHz]	Mode	f [MHz]	99% OBW [MHz]
Band 48	20	QPSK	3560.0	**17.85**
			3625.0	17.83
			3690.0	17.85
		16QAM	3560.0	**17.85**
			3625.0	17.81
			3690.0	**17.85**
	15	QPSK	3557.5	**13.39**
			3625.0	**13.39**
			3692.5	**13.39**
		16QAM	3557.5	13.37
			3625.0	13.39
			3692.5	**13.40**
	10	QPSK	3555.0	**8.95**
			3625.0	8.94
			3695.0	8.93
		16QAM	3555.0	**8.95**
			3625.0	**8.95**
			3695.0	8.94
	5	QPSK	3552.5	**4.52**
			3625.0	4.51
			3697.5	4.51
		16QAM	3552.5	**4.50**
			3625.0	**4.50**
			3697.5	**4.50**

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Band	PCC	SCC	Mode	PCC RB	SCC RB	99% OBW
	f [MHz]	f [MHz]		Size / Offset	Size / Offset	[MHz]
Band 48 UL CA	5	20	QPSK	25/0	100/0	22.79
	5	20	16QAM	25/0	100/0	22.76
	20	5	QPSK	100/0	25/0	22.76
	20	5	16QAM	100/0	25/0	22.74
	10	20	QPSK	50/0	100/0	27.62
	10	20	16QAM	50/0	100/0	27.68
	20	10	QPSK	100/0	50/0	27.68
	20	10	16QAM	100/0	50/0	27.62
	15	20	QPSK	75/0	100/0	32.53
	15	20	16QAM	75/0	100/0	32.60
	20	15	QPSK	100/0	75/0	32.53
	20	15	16QAM	100/0	75/0	32.53
	20	20	QPSK	100/0	100/0	37.50
	20	20	16QAM	100/0	100/0	37.42

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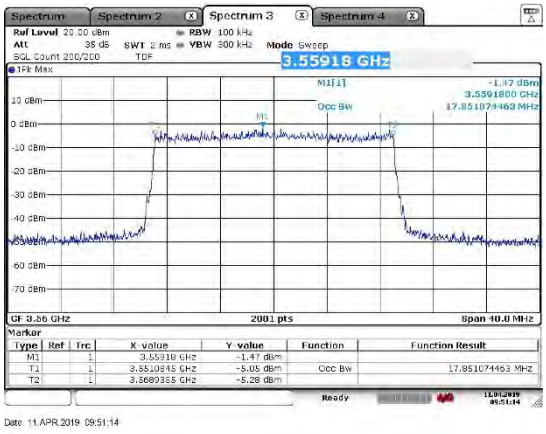
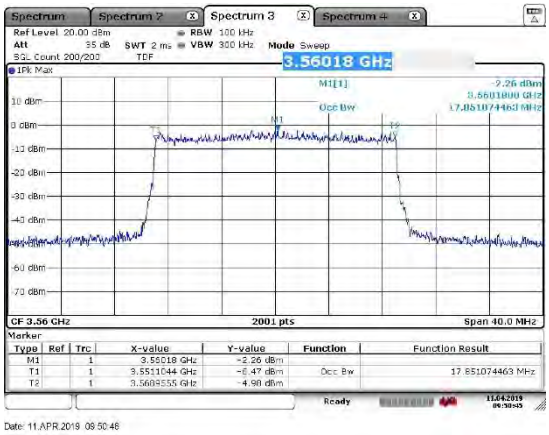
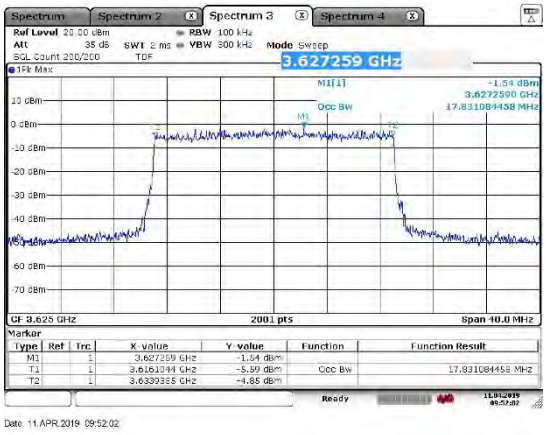
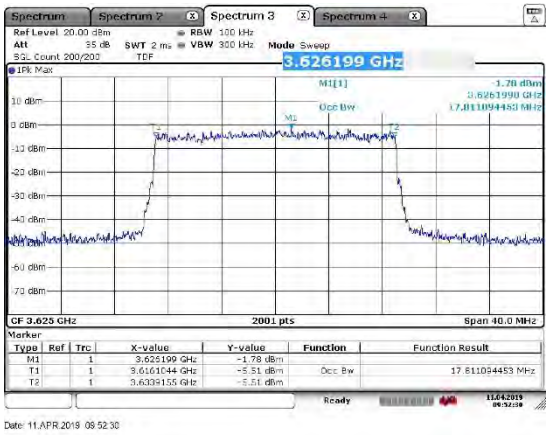
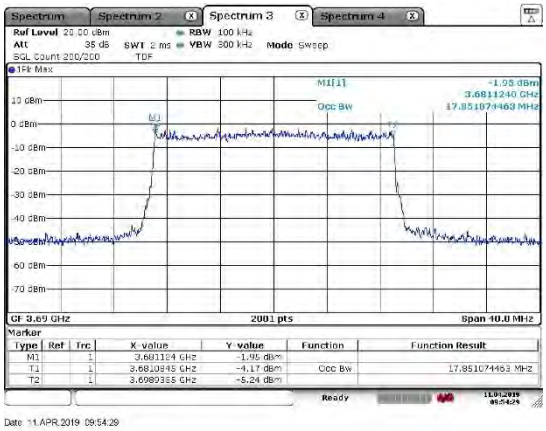
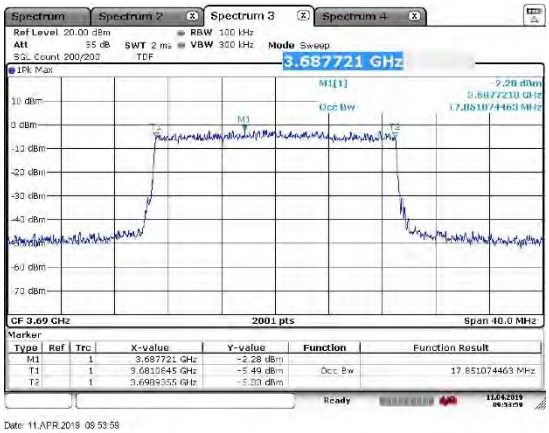
9.1.2. OCCUPIED BANDWIDTH RESULTS

LTE Band 48 – Single Transmission

Band 48 20MHz	 20MHz QPSK Low channel	 20MHz 16QAM Low channel
	 20MHz QPSK Mid channel	 20MHz 16QAM Mid channel
	 20MHz QPSK High channel	 20MHz 16QAM High channel

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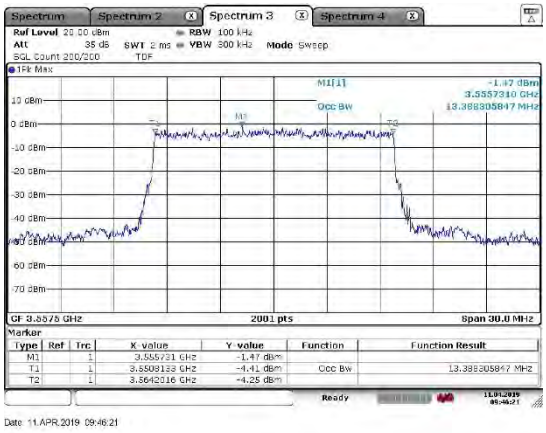
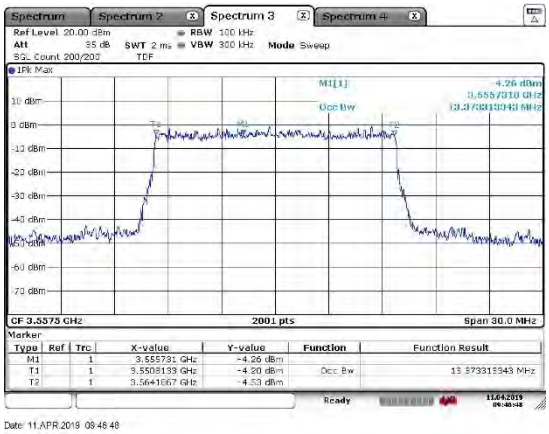
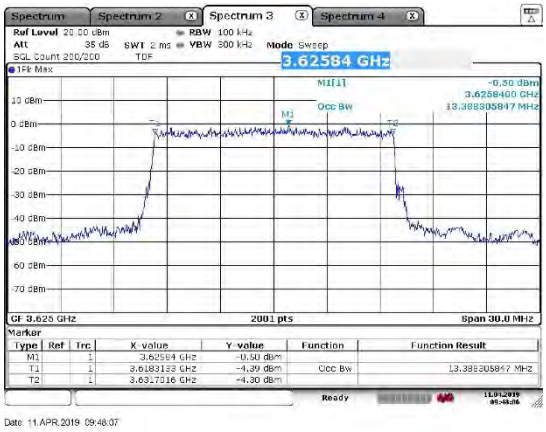
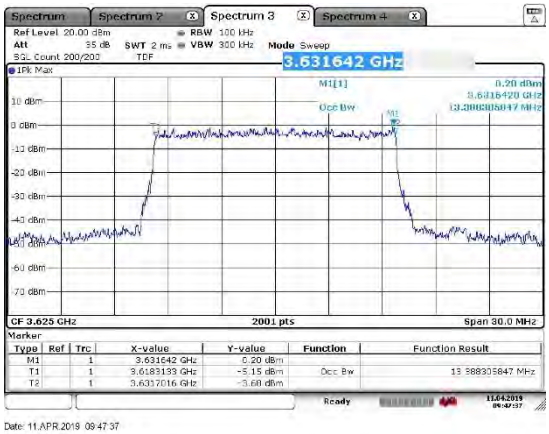
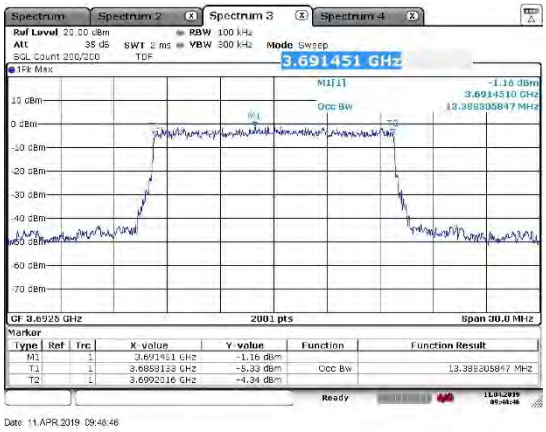
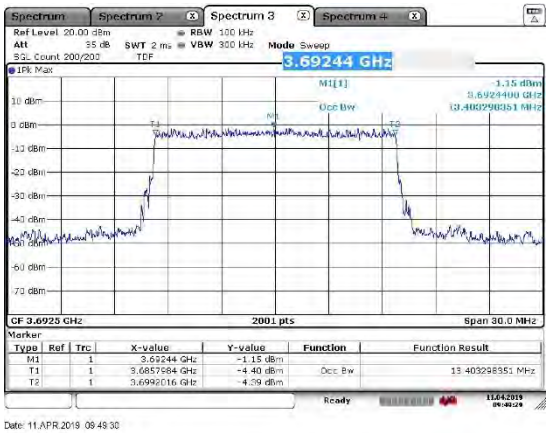
Band 48 15MHz	 15MHz QPSK Low channel	 15MHz 16QAM Low channel
	 15MHz QPSK Mid channel	 15MHz 16QAM Mid channel
	 15MHz QPSK High channel	 15MHz 16QAM High channel

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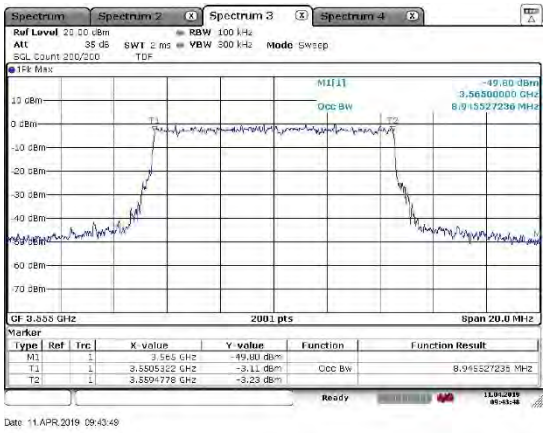
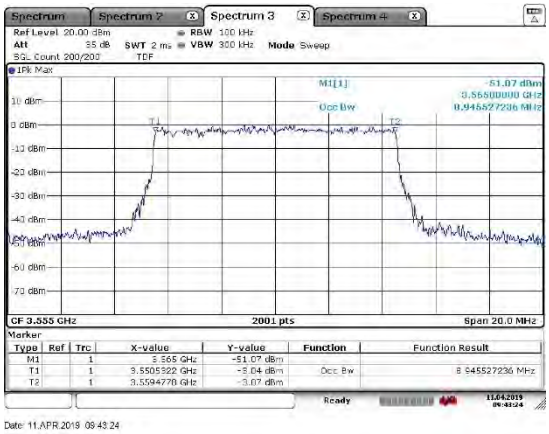
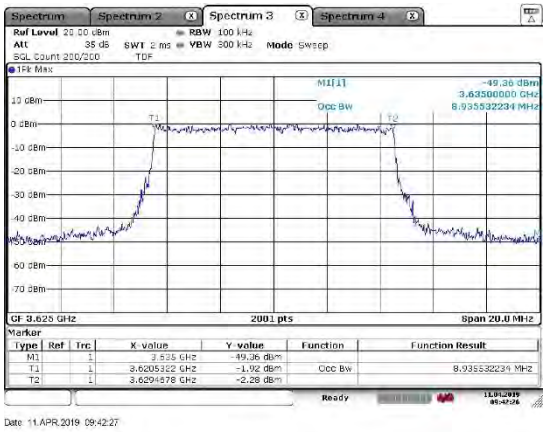
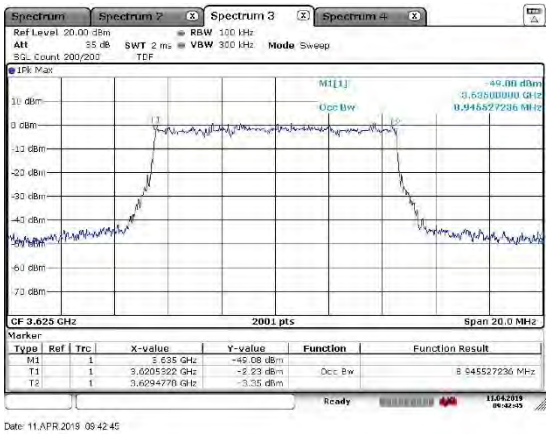
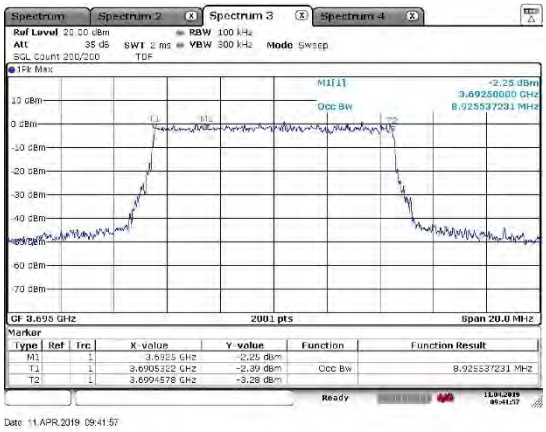
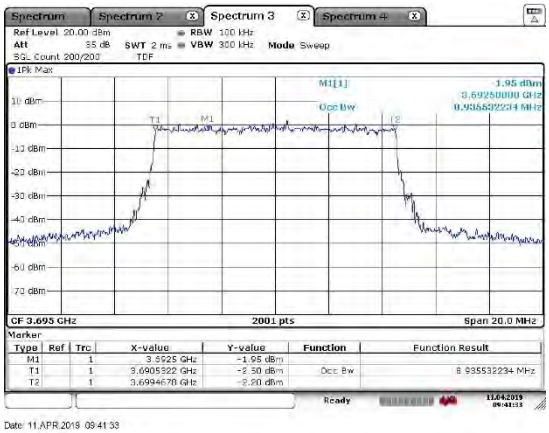
Band 48 10MHz	 10MHz QPSK Low channel	 10MHz 16QAM Low channel
	 10MHz QPSK Mid channel	 10MHz 16QAM Mid channel
	 10MHz QPSK High channel	 10MHz 16QAM High channel

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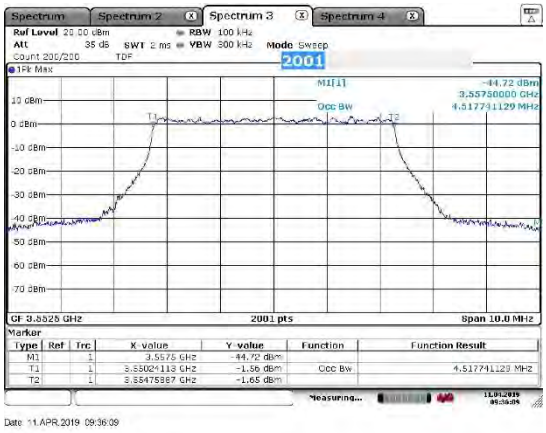
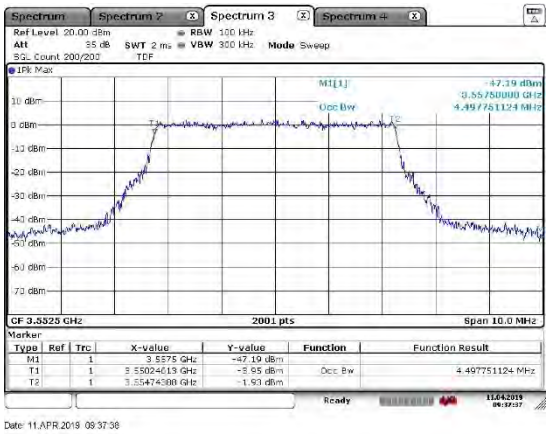
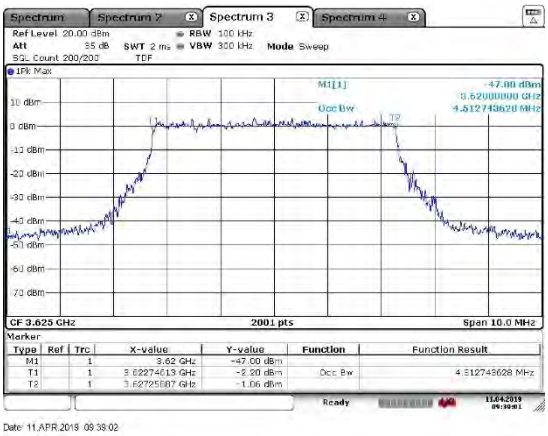
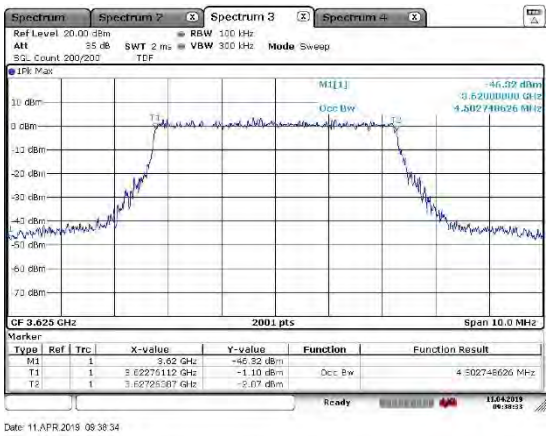
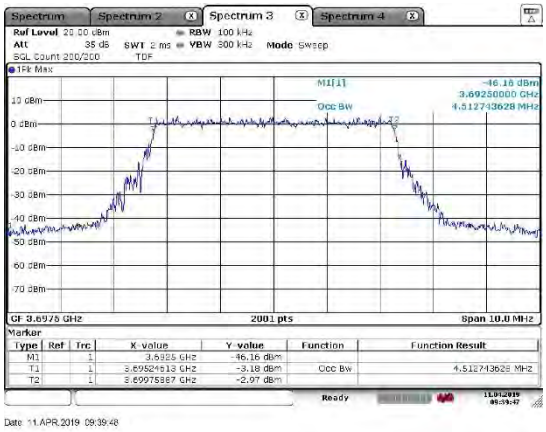
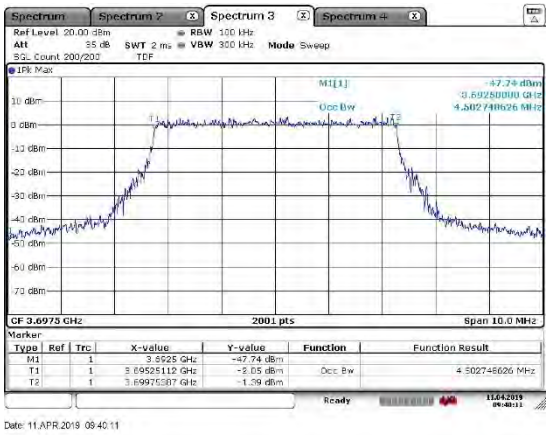
Band 48 5MHz	 5MHz QPSK Low channel	 5MHz 16QAM Low channel
	 5MHz QPSK Mid channel	 5MHz 16QAM Mid channel
	 5MHz QPSK High channel	 5MHz 16QAM High channel

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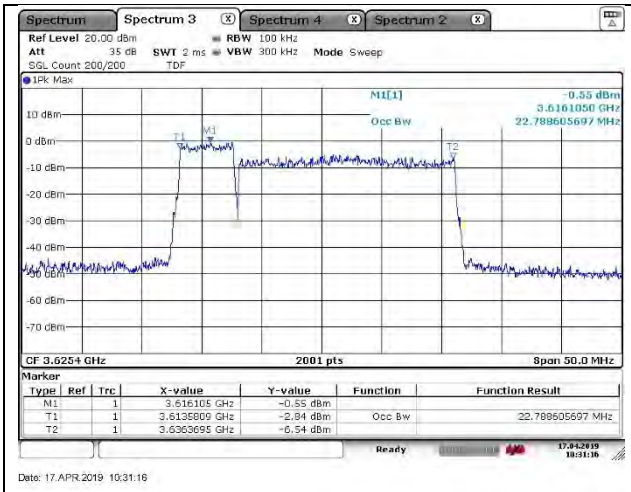
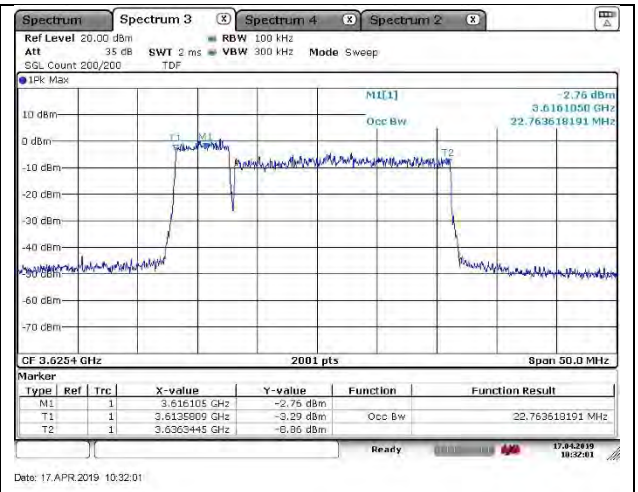
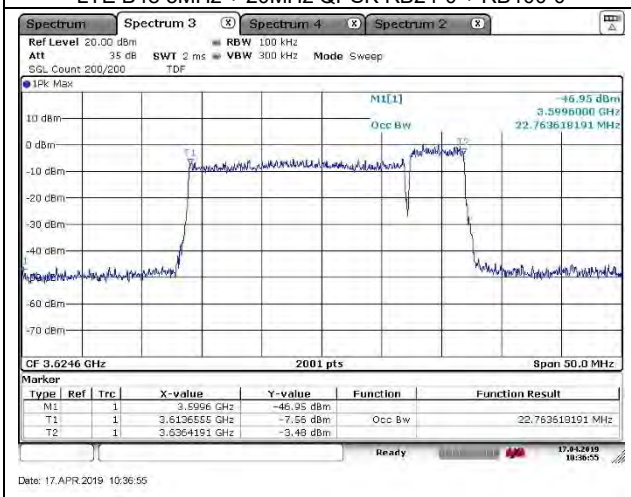
LTE Band 48 (UL CA)



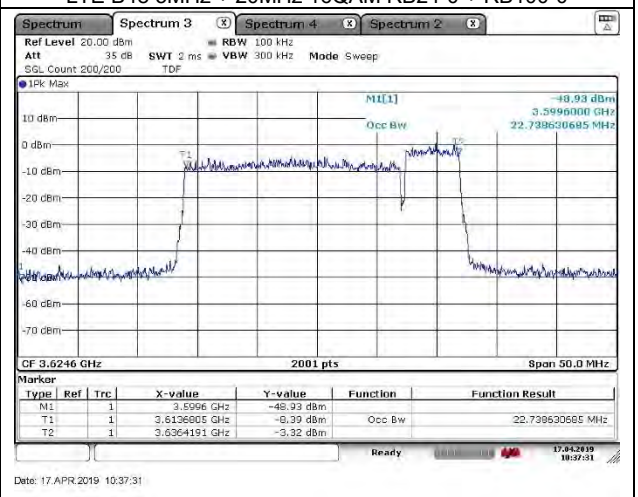
LTE B48 5MHz + 20MHz QPSK RB24-0 + RB100-0



LTE B48 5MHz + 20MHz 16QAM RB24-0 + RB100-0



LTE B48 20MHz + 5MHz QPSK RB100-0 + RB75-0



LTE B48 20MHz + 5MHz 16QAM RB100-0 + RB24-0

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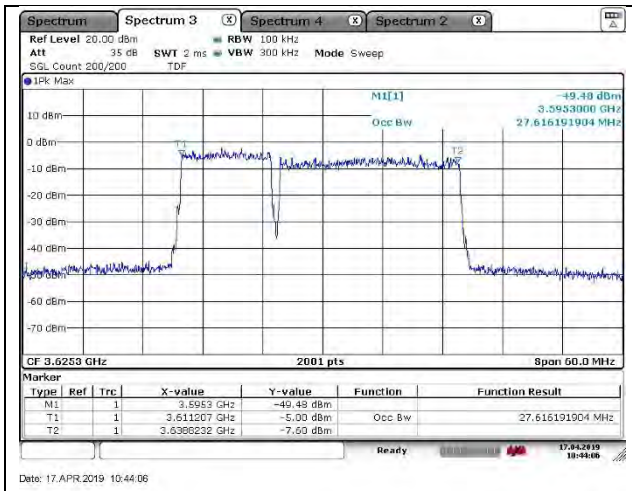
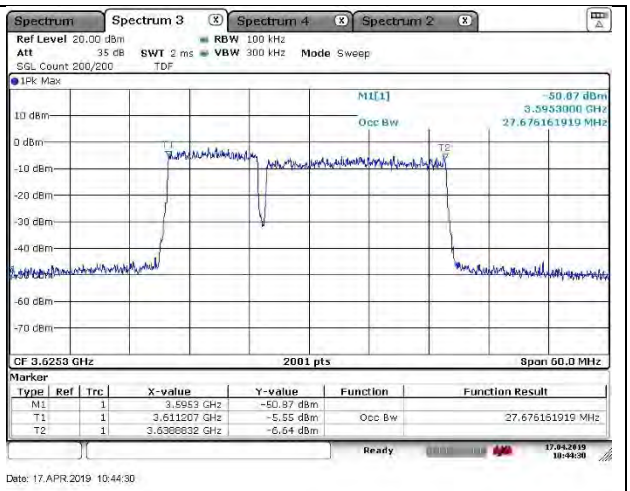
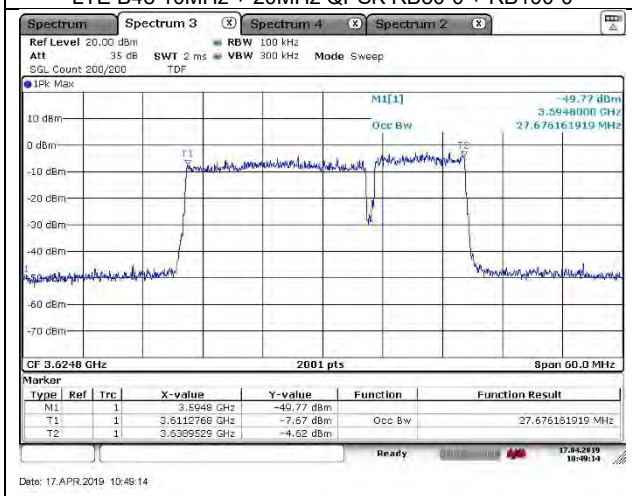


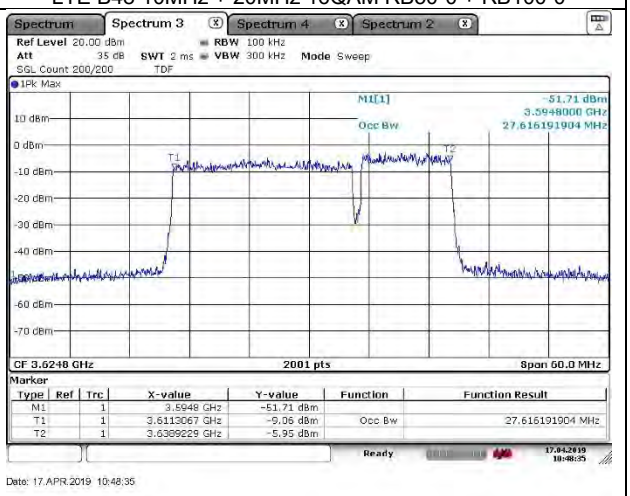
LTE B48 10MHz + 20MHz QPSK RB50-0 + RB100-0



LTE B48 10MHz + 20MHz 16QAM RB50-0 + RB100-0



LTE B48 20MHz + 10MHz QPSK RB100-0 + RB50-0



LTE B48 20MHz + 10MHz 16QAM RB100-0 + RB50-0

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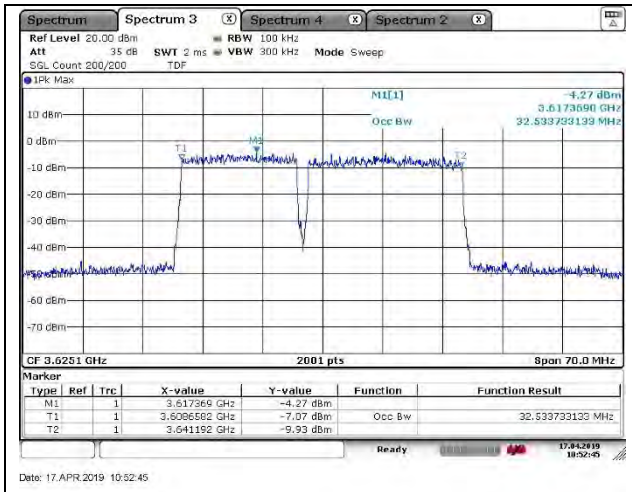
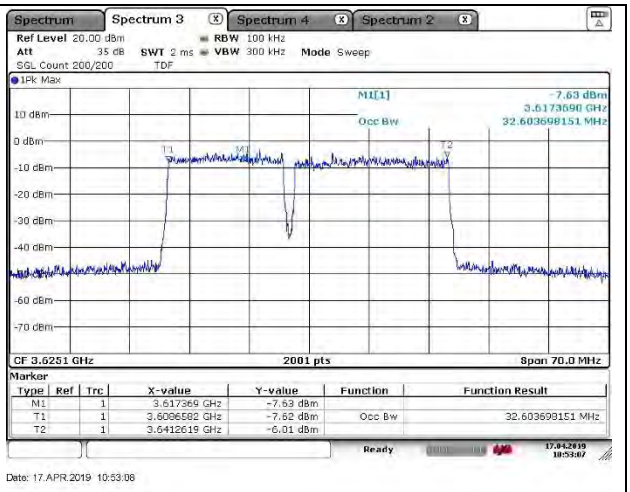
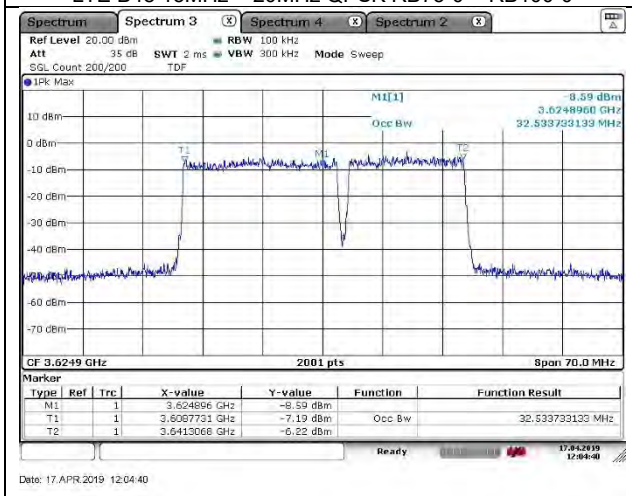


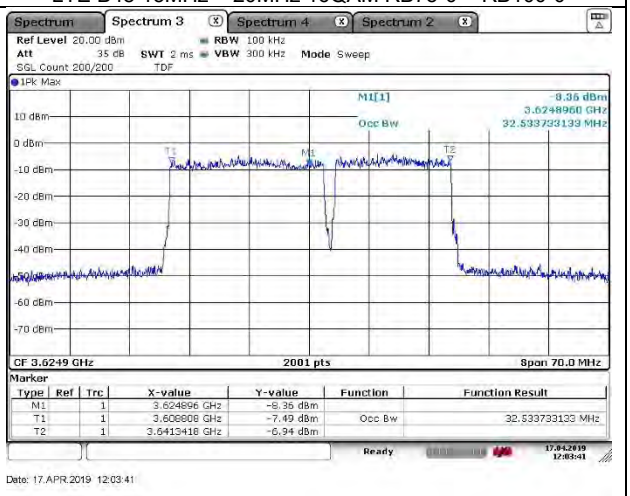
LTE B48 15MHz + 20MHz QPSK RB75-0 + RB100-0



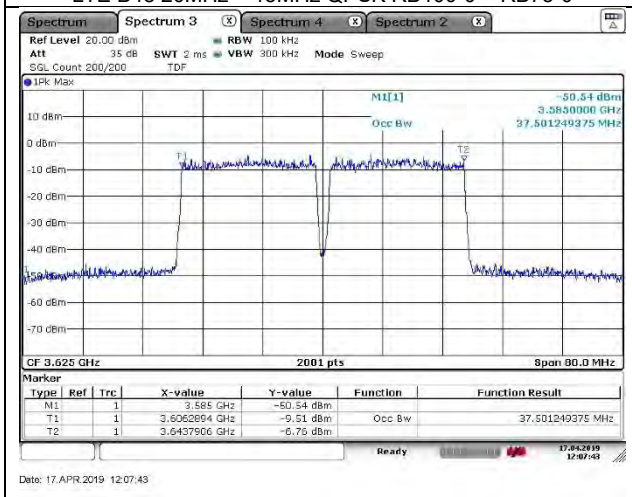
LTE B48 15MHz + 20MHz 16QAM RB75-0 + RB100-0



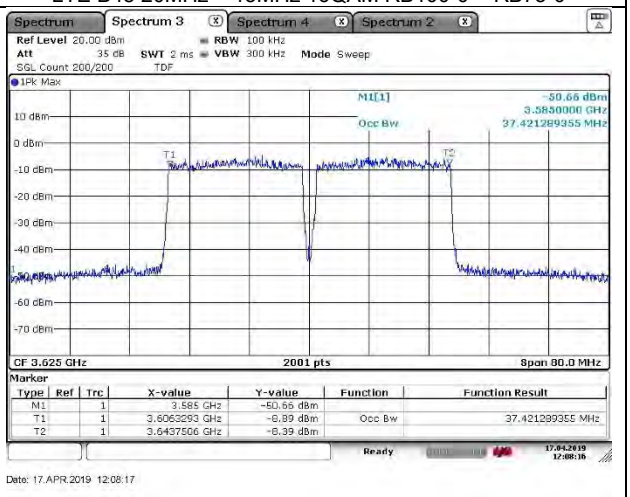
LTE B48 20MHz + 15MHz QPSK RB100-0 + RB75-0



LTE B48 20MHz + 15MHz 16QAM RB100-0 + RB75-0



LTE B48 20MHz + 20MHz QPSK RB100-0 + RB100-0



LTE B48 20MHz + 20MHz 16QAM RB100-0 + RB100-0

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9.1. MAXIMUM EIRP (CONDUCTED AND EIRP)

RULE PART(S)

FCC: §96.41

LIMITS

§96.41:
(b) Power limits. Unless otherwise specified in this section, the maximum effective isotropic radiated power (EIRP) and maximum Power Spectral Density (PSD) of any CBSD and End User Device must comply with the limits shown in the table in this paragraph (b):

Device	Maximum EIRP (dBm/10 megahertz)	Maximum PSD (dBm/MHz)
End User Device	23	n/a
Category A CBSD	30	20
Category B CBSD[1]	47	37

TEST PROCEDURE

TIA-603-E Clause 2.2.17
KDB 971168 Section 5.6

ERP/EIRP = PMeas + GT − LC
where: ERP/EIRP = effective or equivalent radiated power, respectively (expressed in the same units as PMeas, typically dBW or dBm);
PMeas = measured transmitter output power or PSD, in dBm or dBW;
GT = gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP);
LC = signal attenuation in the connecting cable between the transmitter and antenna, in dB.

RESULTS

RF Output Power(total power) EIRP results meets Maximum EIRP limit (23 dBm/10MHz) of End User Device.
Please refer to section 5.4.

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9.2. BAND EDGE EMISSIONS

RULE PART(S)

FCC: §96.41

LIMITS

§96.41(e)(i):
(ii) Except as otherwise specified in paragraph (e)(2) of this section, for channel and frequency assignments made by a CBSD to End User Devices, the conducted power of any End User Device emission outside the fundamental emission (whether in or outside of the authorized band) shall not exceed −13 dBm/MHz within 0 to B megahertz (where B is the bandwidth in megahertz of the assigned channel or multiple contiguous channels of the End User Device) above the upper CBSD-assigned channel edge and within 0 to B megahertz below the lower CBSD-assigned channel edge. At all frequencies greater than B megahertz above the upper CBSD assigned channel edge and less than B megahertz below the lower CBSD-assigned channel edge, the conducted power of any End User Device emission shall not exceed −25 dBm/MHz. Notwithstanding the emission limits in this paragraph, the Adjacent Channel Leakage Ratio for End User Devices shall be at least 30 dB.

- within 0 MHz to B MHz above and below the assigned channel ≤ -13 dBm/MHz
- greater than B MHz above and below the assigned channel ≤ -25 dBm/MHz
- any emission below 3530 MHz and above 3720 MHz ≤ -40 dBm/MHz

TEST PROCEDURE

Per KDB 971168 D01 Power Meas License Digital Systems v03r01
The transmitter output was connected to a CMW500 Test Set and configured to operate at maximum power. The band edge emissions were measured at the required operating frequencies in each band on the Spectrum Analyzer.

SA setting

a) Set the RBW = 1 MHz

b) Set VBW ≥ 3 × RBW;

c) Set span ≥ 1.5 times the OBW;

d) Sweep time = Auto;

e) Detector = RMS;

f) Ensure that the number of measurement points ≥ 2*Span/RBW;

g) Trace mode = Average (100);

NOTE

Single – Duty cycle correction factor(2.25dB) already applied on the plot. (UL/DL Configuration : 0)
UL CA – Duty cycle correction factor(3 dB) already applied on the plot. (UL/DL Configuration : 6)

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RESULTS

See the following pages.

- Calculation for verification of ACLR criterion satisfaction(Limit: 30dBc).

1. Case of Single transmit
   a) Minimum power of single transmit (Of all the channels / RB alloction)
      = 7.50 dBm
   b) Maximum channel bandwidth = 20 MHz
   c) The acceptable adjacent channel power (worst case)
      = 7.50 dBm - 30 dB = -22.5 dBm
   d) The acceptable in-band peak marker level
      = -22.5 dBm - 10*Log(20MHz/1MHz) = -35.5 dBm
   e) Additional tests are performed for conditions where the in-band peak marker level is greater than or equal to ***-35.5 dBm***. (Please refer to the section 9.2.2)

   Note: The additional test exclusion case when the above conditions are not met:
   - Range 1: 0 - 1MHz, Range 2: 1MHz ~ B MHz (B is the channel bandwidth)
   - Range 1 power : Peak marker level(dBm) + 10*Log(1MHz/RBW)
   - Range 2 power : Peak marker level(dBm) + 10*Log((B-1)MHz/1MHz)
   - Total adjacent channel power(Range 1 power + Range 2 power) < -22.5 dBm

2. Case of UL CA transmit
   a) Minimum power of single transmit (Of all combinations / RB alloction)
      = 8.93 dBm
   b) Maximum channel bandwidth = 40 (20 + 20) MHz
   c) The acceptable adjacent channel power (worst case)
      = 8.93 dBm - 30 dB = -21.07 dBm
   d) The acceptable in-band peak marker level
      = -21.07 dBm - 10*Log(40MHz/1MHz) = -37.07 dBm
   e) Additional tests are performed for conditions where the in-band peak marker level is greater than or equal to ***-37.07 dBm***. (Please refer to the section 9.2.2)

   Note: The additional test exclusion case when the above conditions are not met:
   - Range 1: 0 - 1 MHz, Range 2: 1 MHz ~ B MHz (B is the total aggregated bandwidth)
   - Range 1 power : Peak marker level(dBm) + 10*Log(1MHz/RBW)
   - Range 2 power : Peak marker level(dBm) + 10*Log((B-1)MHz/1MHz)
   - Total adjacent channel power(Range 1 power + Range 2 power) < -21.07 dBm

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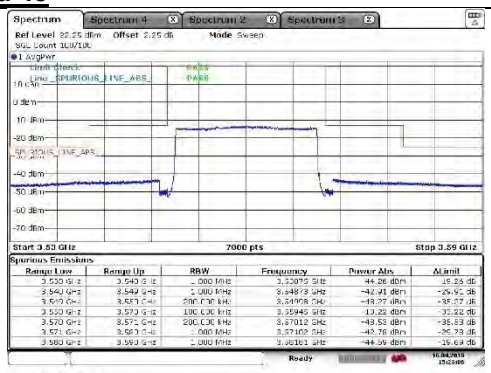
9.2.1. EMISSION MASK RESULT

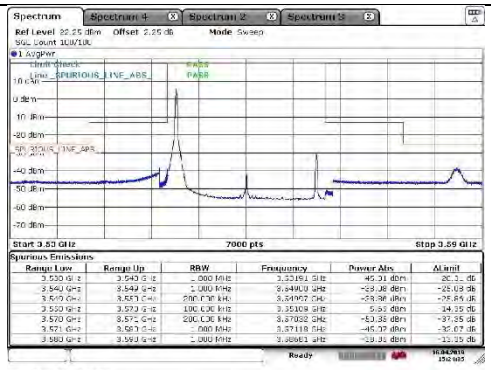
LTE Band 48

Band 48

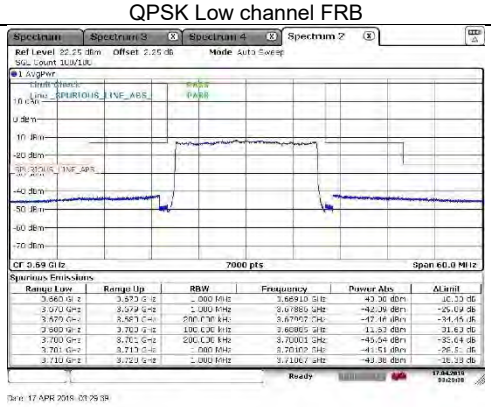
20MHz



QPSK Low channel FRB



QPSK Low channel 1RB



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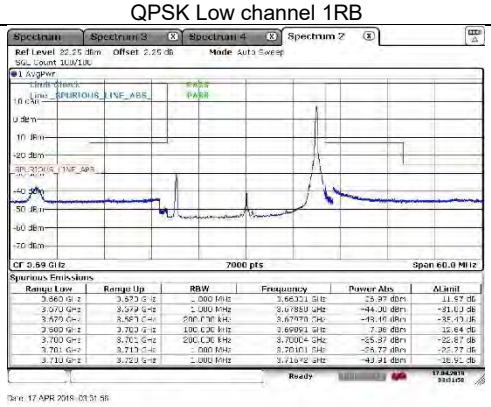

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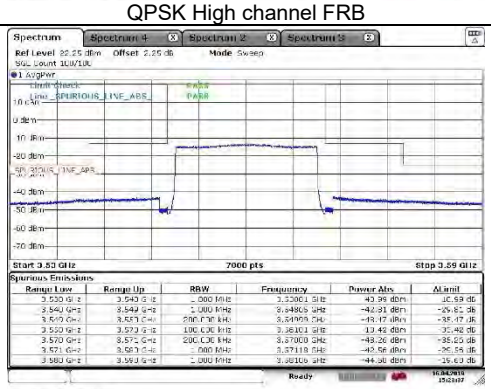
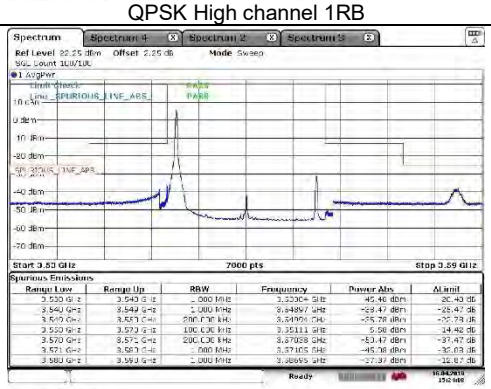


16QAM Low channel FRB



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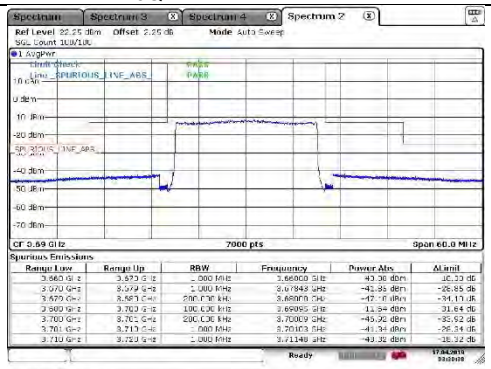
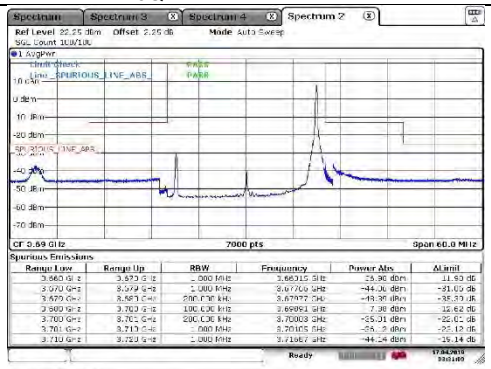


16QAM High channel FRB



16QAM High channel 1RB

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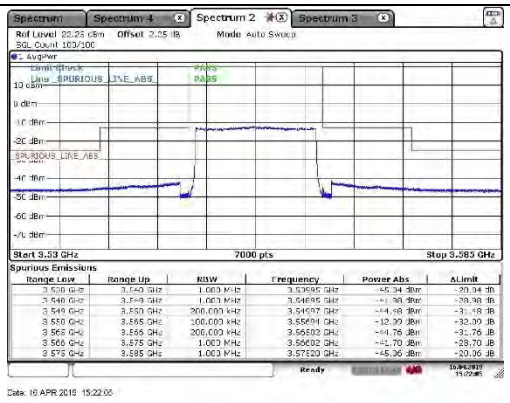
Band 48

15MHz



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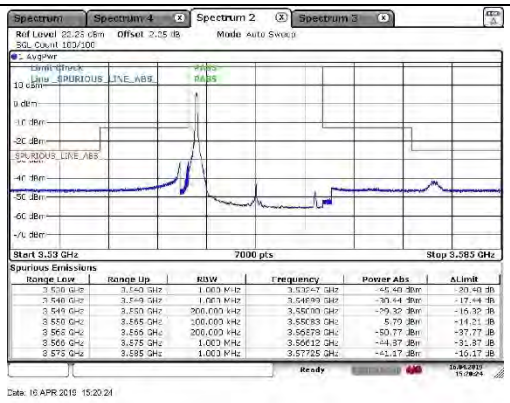

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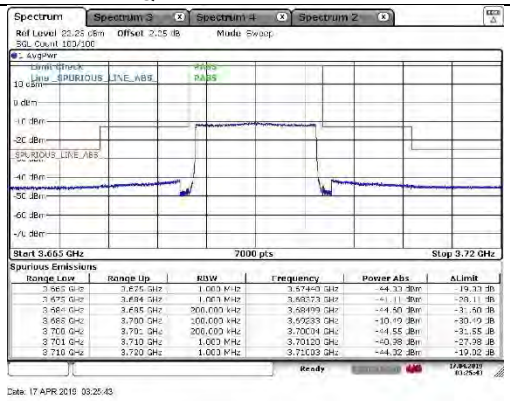

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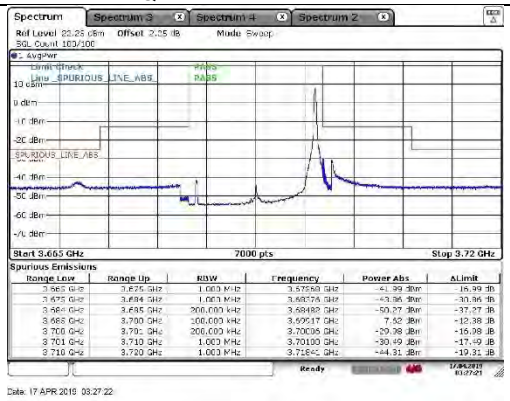

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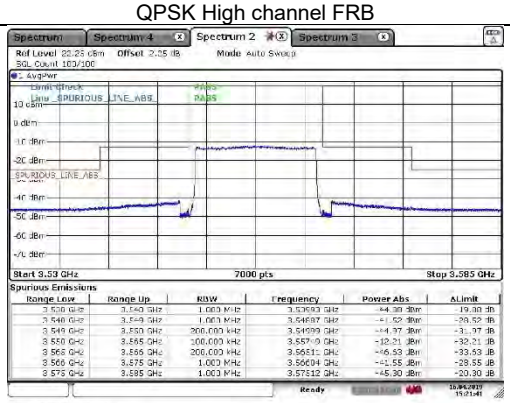
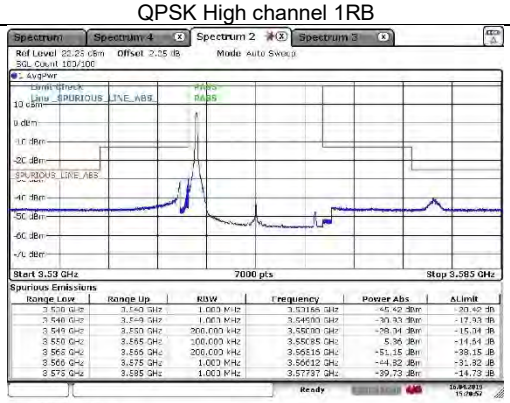
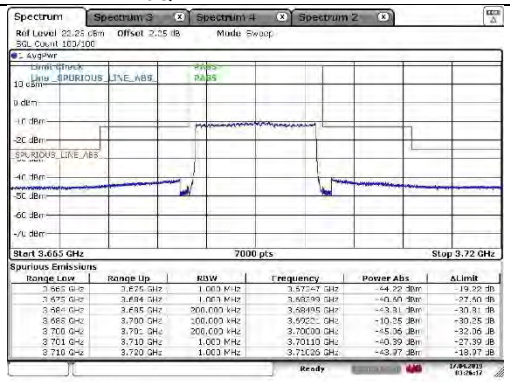


16QAM Low channel FRB



16QAM Low channel 1RB



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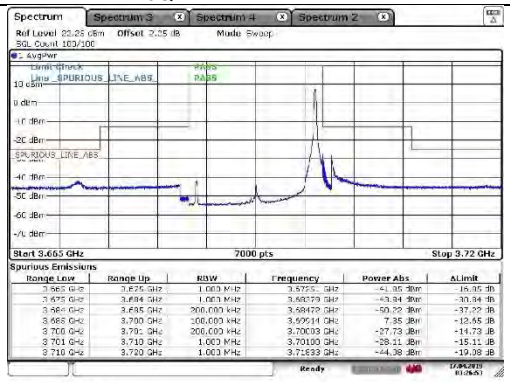

16QAM High channel 1RB

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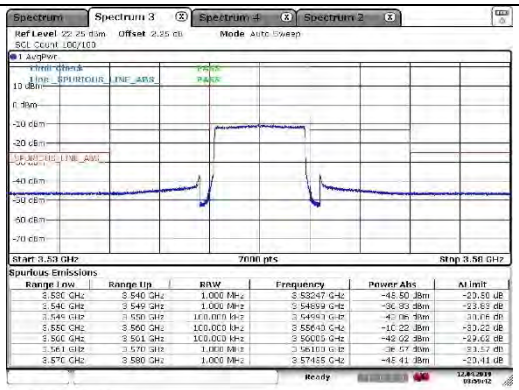
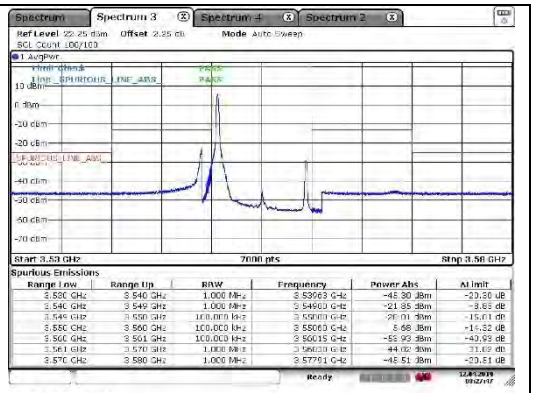
Band 48

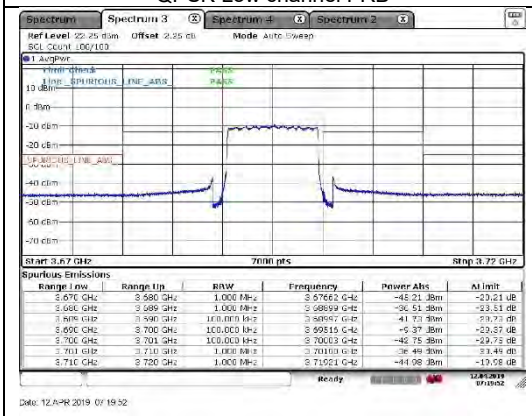
10MHz



QPSK Low channel FRB



QPSK Low channel 1RB



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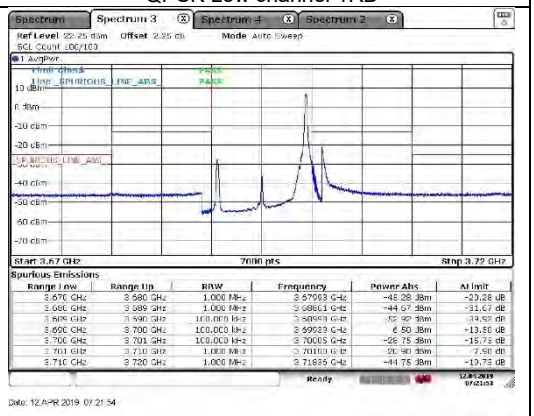

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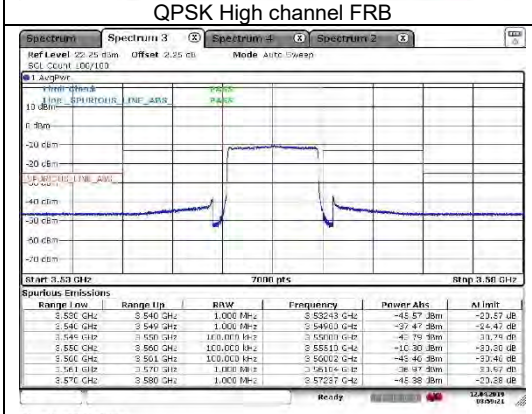

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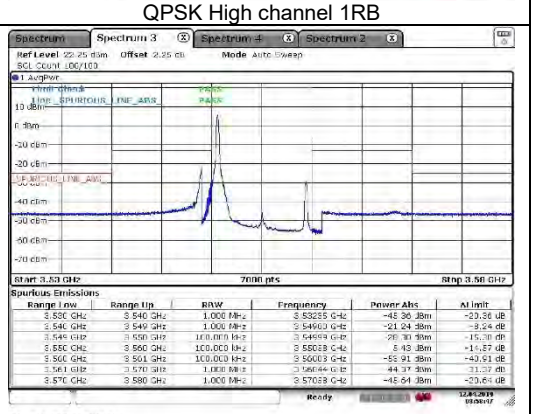

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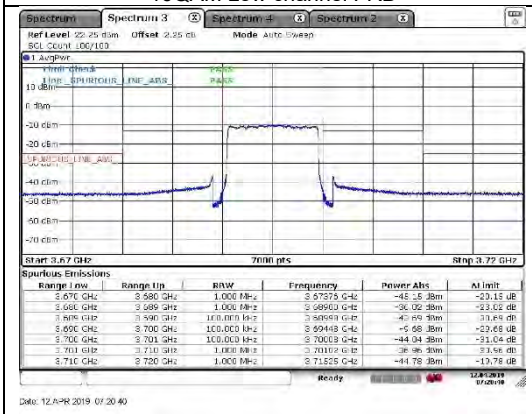

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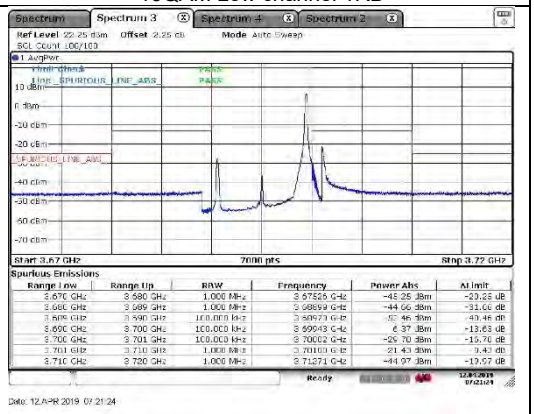

16QAM High channel 1RB

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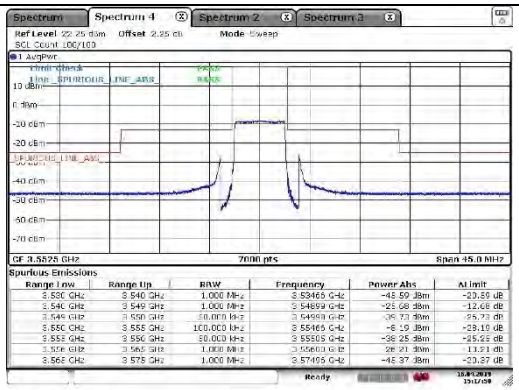
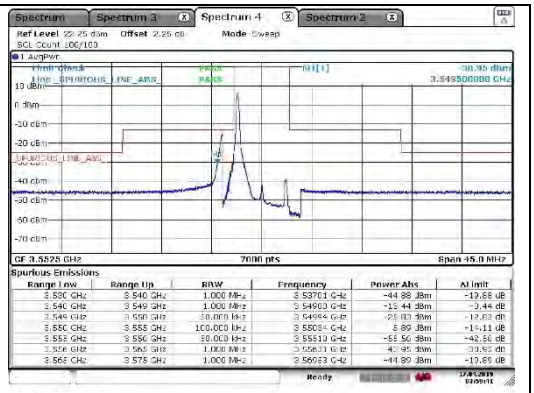
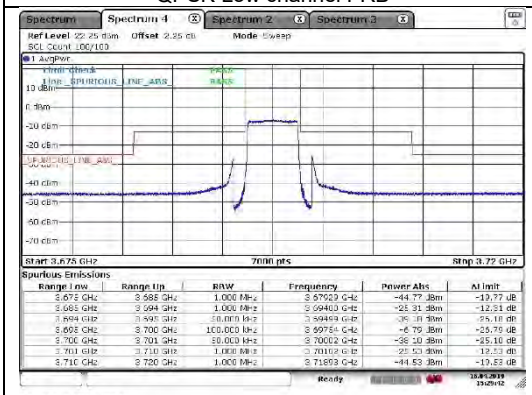
5MHz



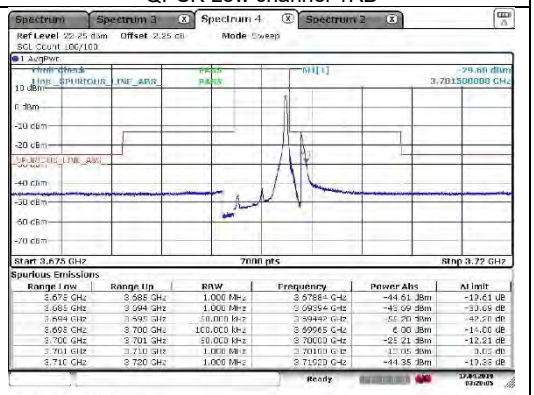
QPSK Low channel FRB



QPSK Low channel 1RB



QPSK High channel FRB



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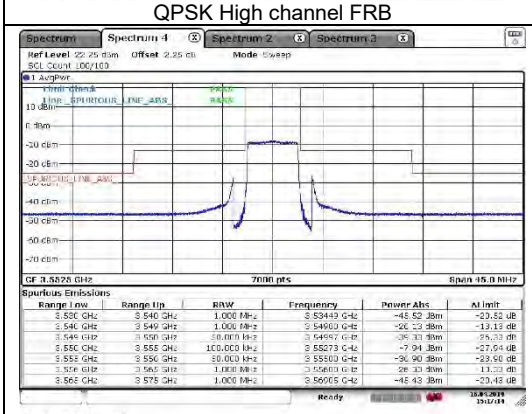
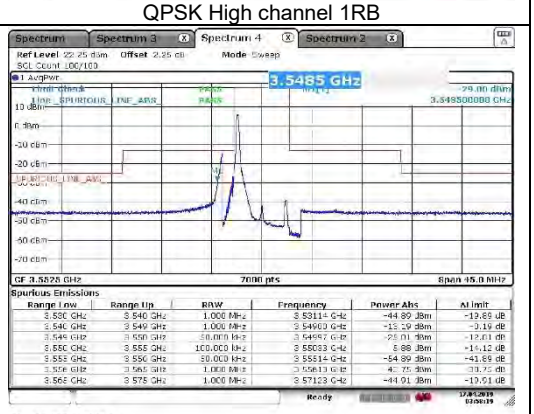


16QAM Low channel FRB



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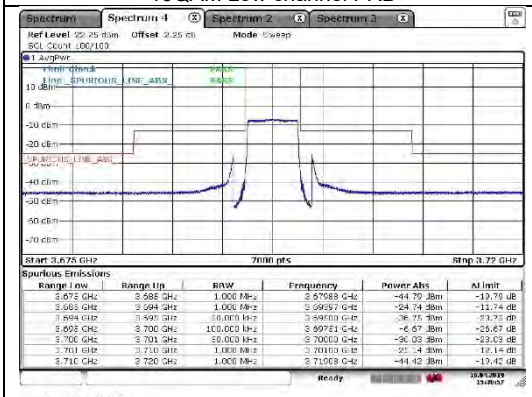
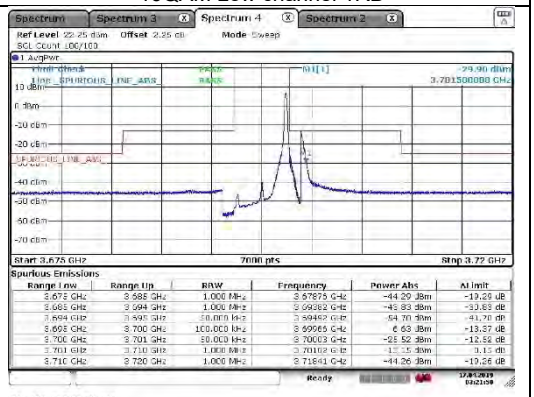


16QAM High channel FRB



16QAM High channel 1RB

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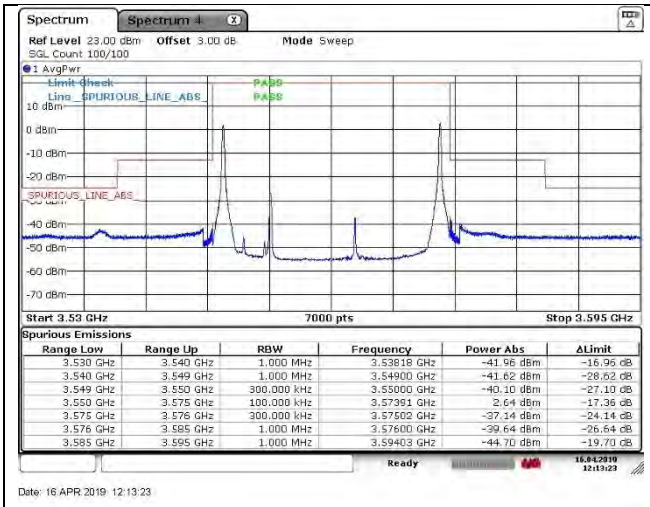
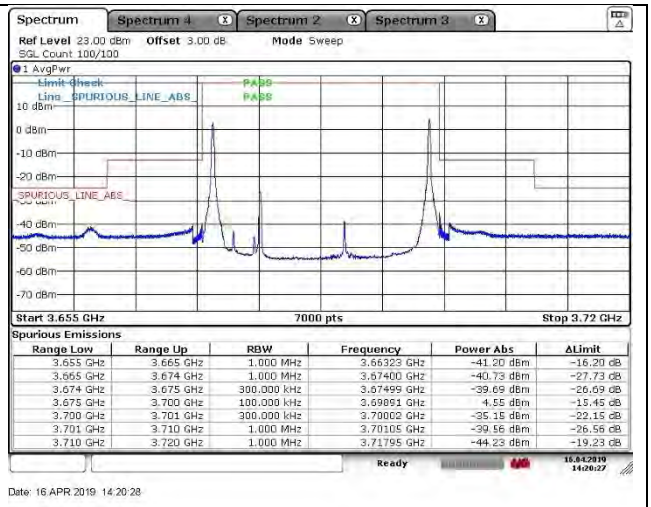
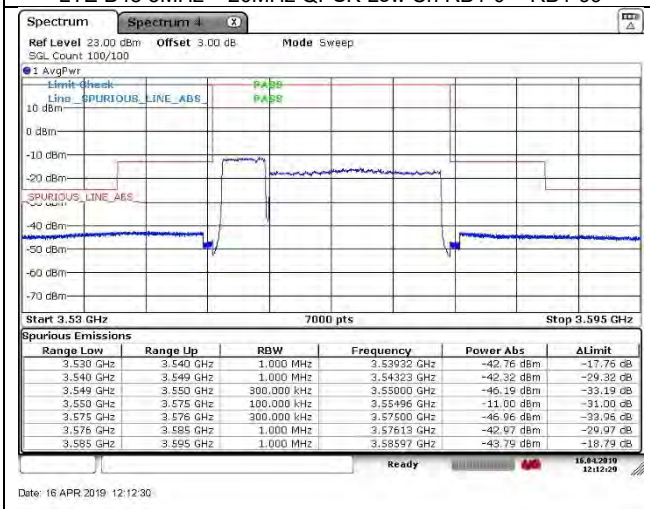
LTE Band 48(UL CA)



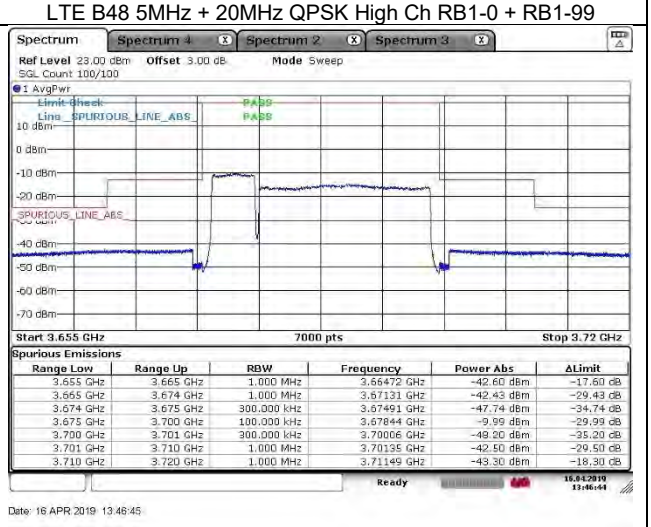
LTE B48 5MHz + 20MHz QPSK Low Ch RB1-0 + RB1-99



LTE B48 5MHz + 20MHz QPSK High Ch RB1-0 + RB1-99



LTE B48 5MHz + 20MHz QPSK Low Ch RB25-0 + RB100-0



LTE B48 5MHz + 20MHz QPSK High Ch RB25-0 + RB100-0

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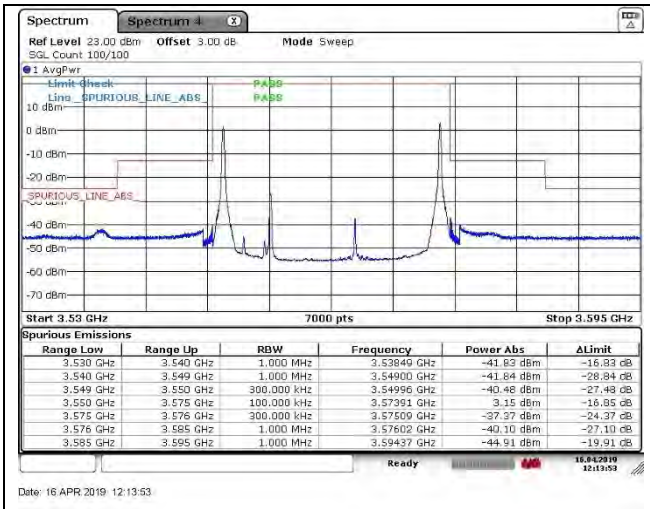
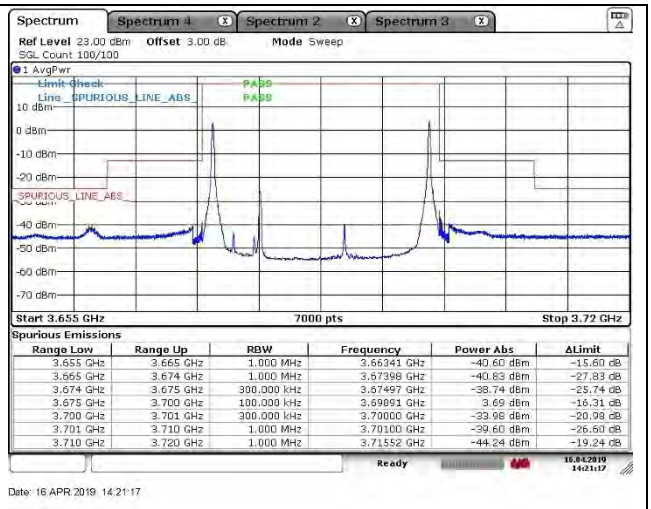
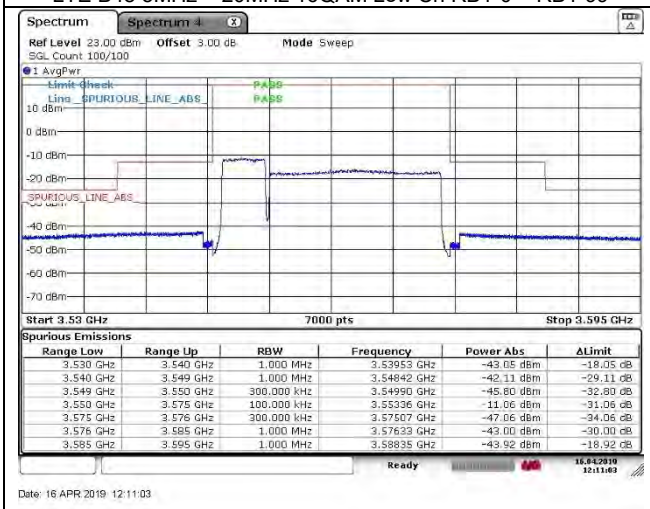


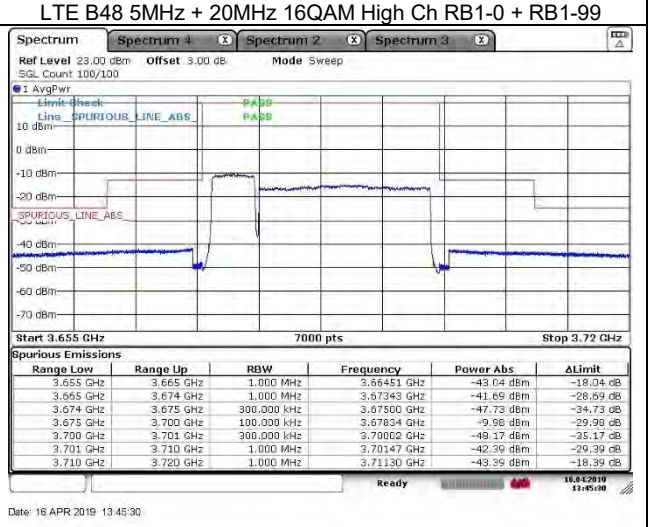
LTE B48 5MHz + 20MHz 16QAM Low Ch RB1-0 + RB1-99



LTE B48 5MHz + 20MHz 16QAM High Ch RB1-0 + RB1-99



LTE B48 5MHz + 20MHz 16QAM Low Ch RB25-0 + RB100-0



LTE B48 5MHz + 20MHz 16QAM High Ch RB25-0 + RB100-0

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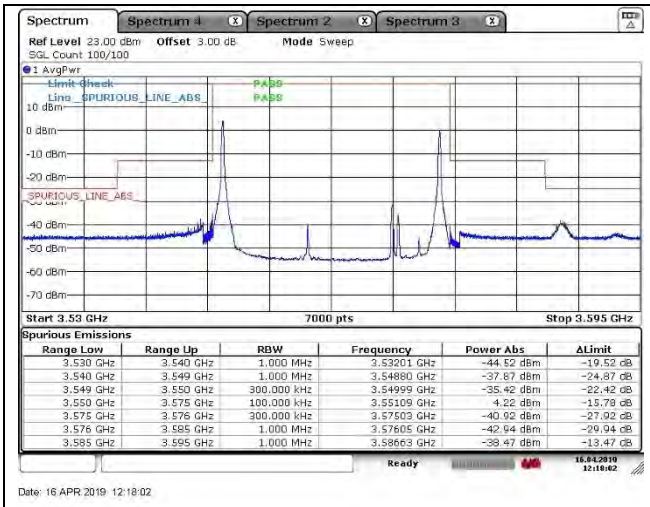
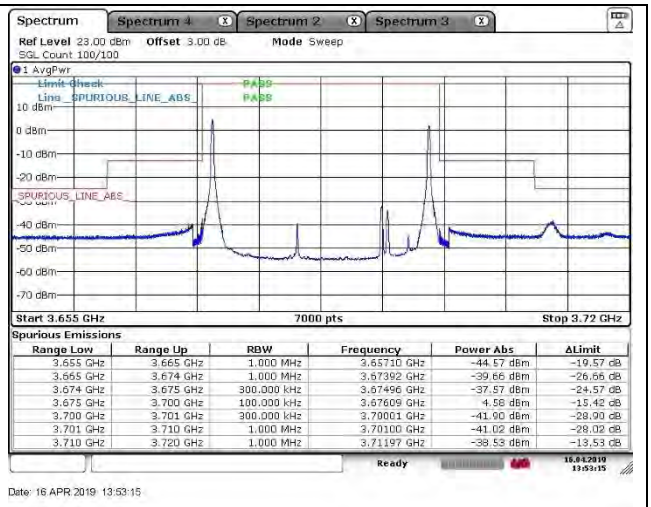
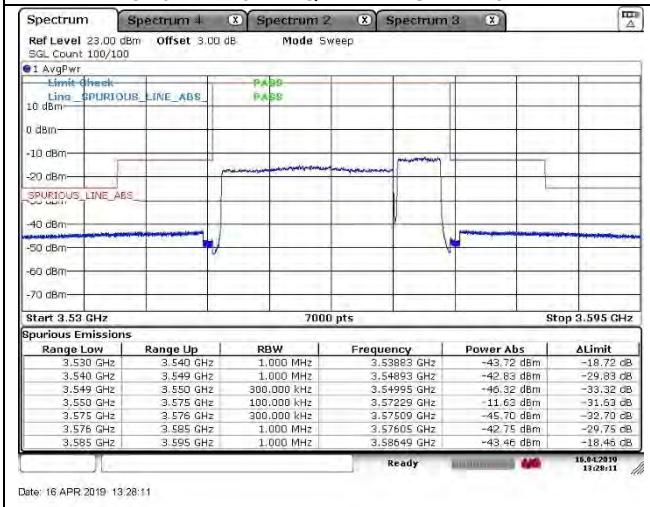


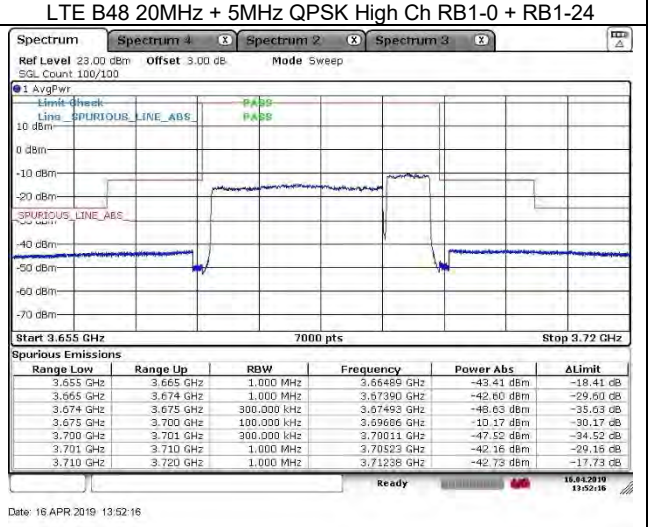
LTE B48 20MHz + 5MHz QPSK Low Ch RB1-0 + RB1-24



LTE B48 20MHz + 5MHz QPSK High Ch RB1-0 + RB1-24



LTE B48 20MHz + 5MHz QPSK Low Ch RB100-0 + RB25-0



LTE B48 20MHz + 5MHz QPSK High Ch RB100-0 + RB25-0

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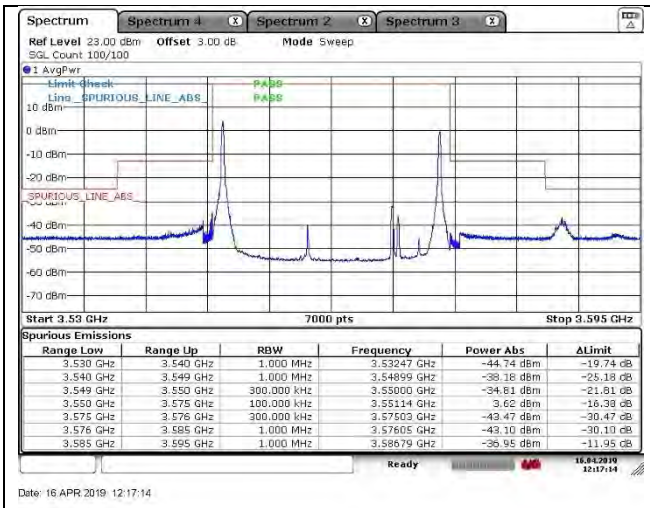
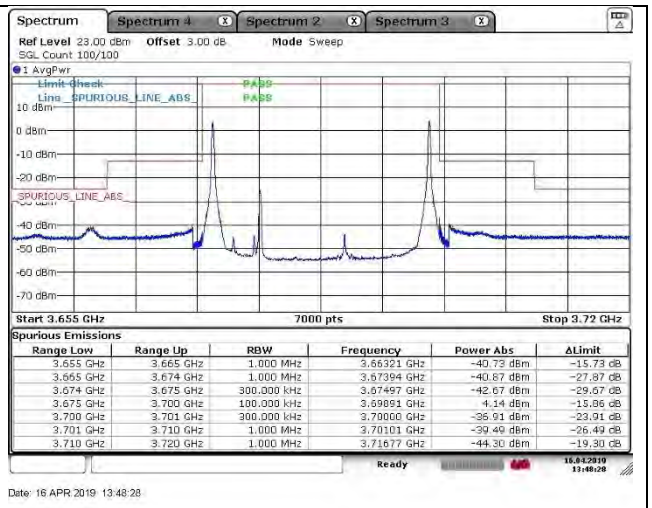


Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
3.530 GHz	3.540 GHz	1.000 MHz	3.53247 GHz	-44.74 dBm	-19.74 dB
3.540 GHz	3.549 GHz	1.000 MHz	3.54899 GHz	-38.18 dBm	-25.18 dB
3.549 GHz	3.550 GHz	300.000 kHz	3.55000 GHz	-34.81 dBm	-21.81 dB
3.550 GHz	3.575 GHz	100.000 kHz	3.55114 GHz	3.62 dBm	-16.38 dB
3.575 GHz	3.576 GHz	300.000 kHz	3.57503 GHz	-43.47 dBm	-30.47 dB
3.576 GHz	3.585 GHz	1.000 MHz	3.57605 GHz	-43.10 dBm	-30.10 dB
3.585 GHz	3.595 GHz	1.000 MHz	3.58679 GHz	-36.95 dBm	-11.95 dB

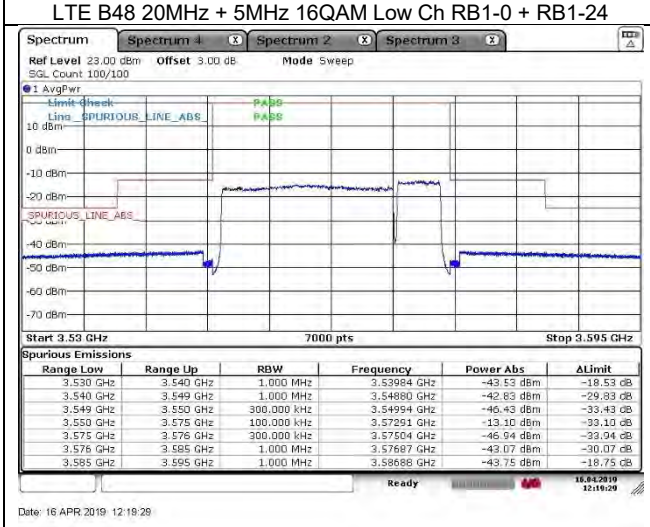
LTE B48 20MHz + 5MHz 16QAM Low Ch RB1-0 + RB1-24



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
3.655 GHz	3.665 GHz	1.000 MHz	3.66321 GHz	-40.73 dBm	-15.73 dB
3.665 GHz	3.674 GHz	1.000 MHz	3.67394 GHz	-40.87 dBm	-27.87 dB
3.674 GHz	3.675 GHz	300.000 kHz	3.67497 GHz	-42.67 dBm	-29.67 dB
3.675 GHz	3.700 GHz	100.000 kHz	3.69891 GHz	4.14 dBm	-15.86 dB
3.700 GHz	3.701 GHz	300.000 kHz	3.70000 GHz	-36.91 dBm	-23.91 dB
3.701 GHz	3.710 GHz	1.000 MHz	3.70101 GHz	-39.49 dBm	-26.49 dB
3.710 GHz	3.720 GHz	1.000 MHz	3.71677 GHz	-44.30 dBm	-19.30 dB

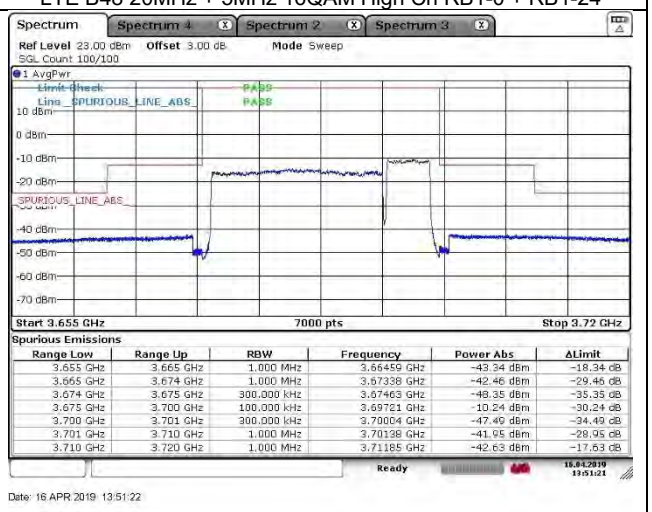
LTE B48 20MHz + 5MHz 16QAM High Ch RB1-0 + RB1-24



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
3.530 GHz	3.540 GHz	1.000 MHz	3.53984 GHz	-43.53 dBm	-18.53 dB
3.540 GHz	3.549 GHz	1.000 MHz	3.54880 GHz	-42.83 dBm	-29.83 dB
3.549 GHz	3.550 GHz	300.000 kHz	3.54994 GHz	-46.43 dBm	-33.43 dB
3.550 GHz	3.575 GHz	100.000 kHz	3.57291 GHz	-13.10 dBm	-33.10 dB
3.575 GHz	3.576 GHz	300.000 kHz	3.57504 GHz	-46.94 dBm	-33.94 dB
3.576 GHz	3.585 GHz	1.000 MHz	3.57697 GHz	-43.07 dBm	-30.07 dB
3.585 GHz	3.595 GHz	1.000 MHz	3.58688 GHz	-43.75 dBm	-18.75 dB

LTE B48 20MHz + 5MHz 16QAM Low Ch RB100-0 + RB25-0



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
3.655 GHz	3.665 GHz	1.000 MHz	3.66459 GHz	-43.34 dBm	-18.34 dB
3.665 GHz	3.674 GHz	1.000 MHz	3.67338 GHz	-42.46 dBm	-29.46 dB
3.674 GHz	3.675 GHz	300.000 kHz	3.67463 GHz	-48.35 dBm	-35.35 dB
3.675 GHz	3.700 GHz	100.000 kHz	3.69761 GHz	-10.24 dBm	-30.24 dB
3.700 GHz	3.701 GHz	300.000 kHz	3.70004 GHz	-47.49 dBm	-34.49 dB
3.701 GHz	3.710 GHz	1.000 MHz	3.70138 GHz	-41.95 dBm	-28.95 dB
3.710 GHz	3.720 GHz	1.000 MHz	3.71185 GHz	-42.63 dBm	-17.63 dB

LTE B48 20MHz + 5MHz 16QAM High Ch RB100-0 + RB25-0

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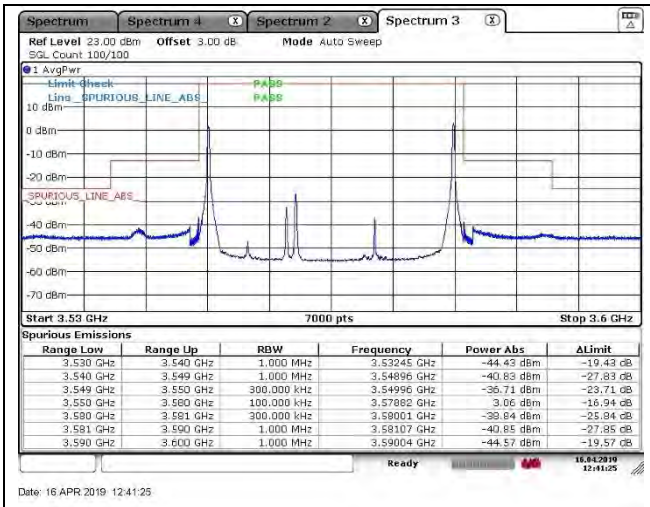
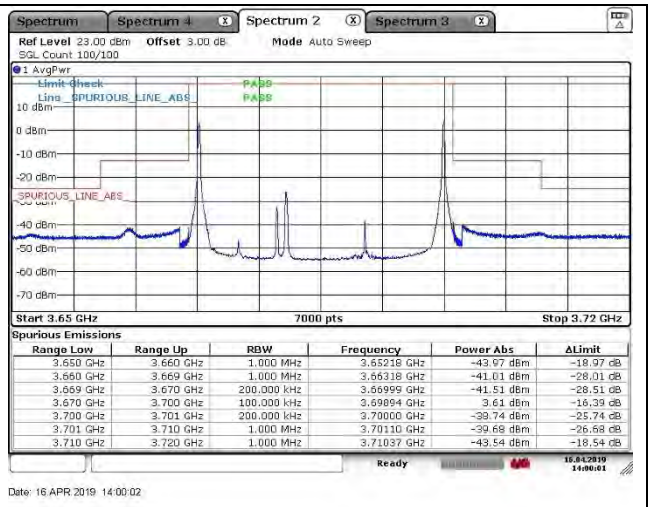
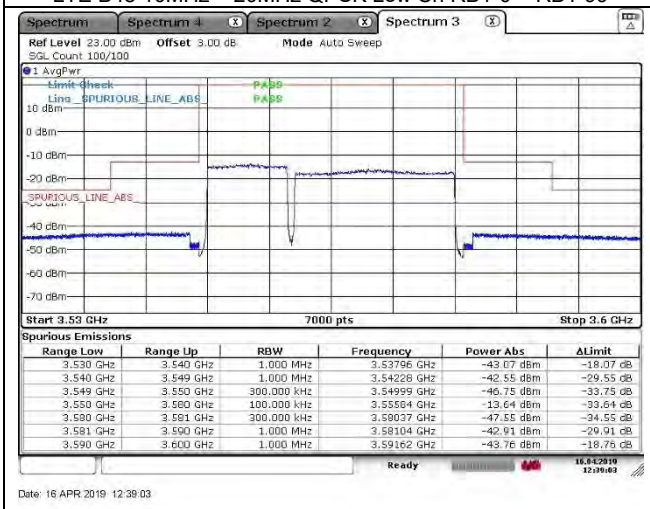


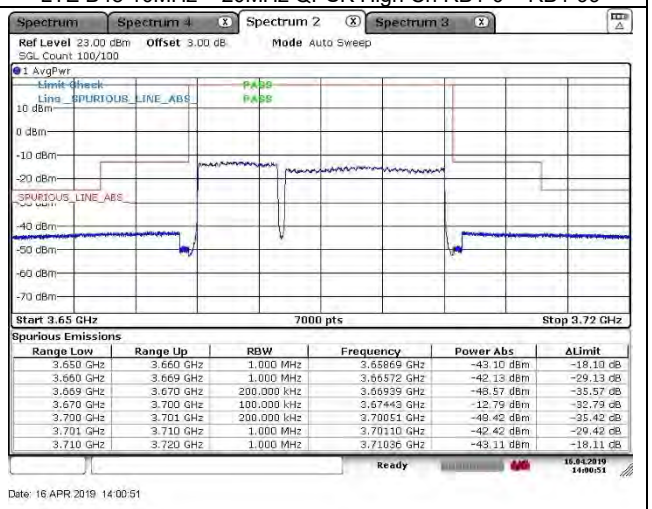
LTE B48 10MHz + 20MHz QPSK Low Ch RB1-0 + RB1-99



LTE B48 10MHz + 20MHz QPSK High Ch RB1-0 + RB1-99



LTE B48 10MHz + 20MHz QPSK Low Ch RB50-0 + RB100-0



LTE B48 10MHz + 20MHz QPSK High Ch RB50-0 + RB100-0

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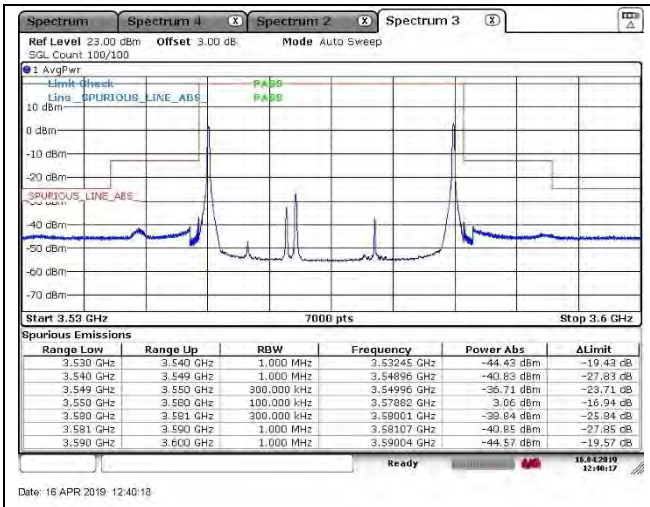
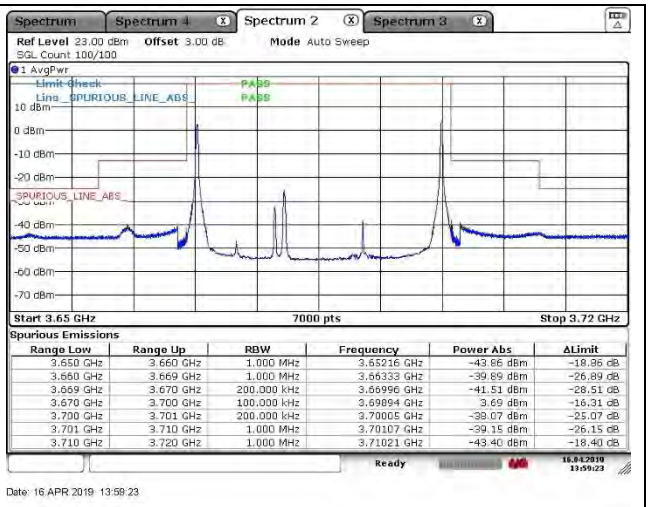
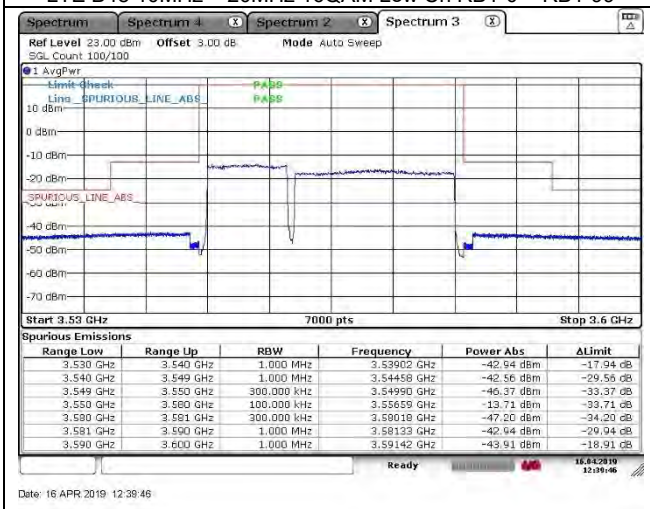


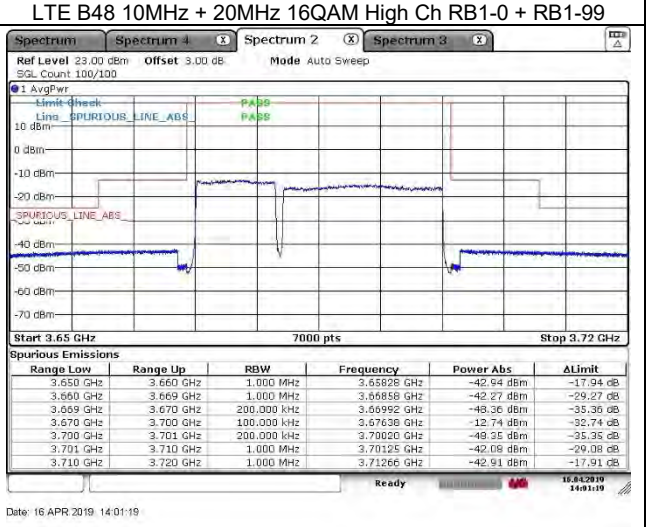
LTE B48 10MHz + 20MHz 16QAM Low Ch RB1-0 + RB1-99



LTE B48 10MHz + 20MHz 16QAM High Ch RB1-0 + RB1-99



LTE B48 10MHz + 20MHz 16QAM Low Ch RB50-0 + RB100-0



LTE B48 10MHz + 20MHz 16QAM High Ch RB50-0 + RB100-0

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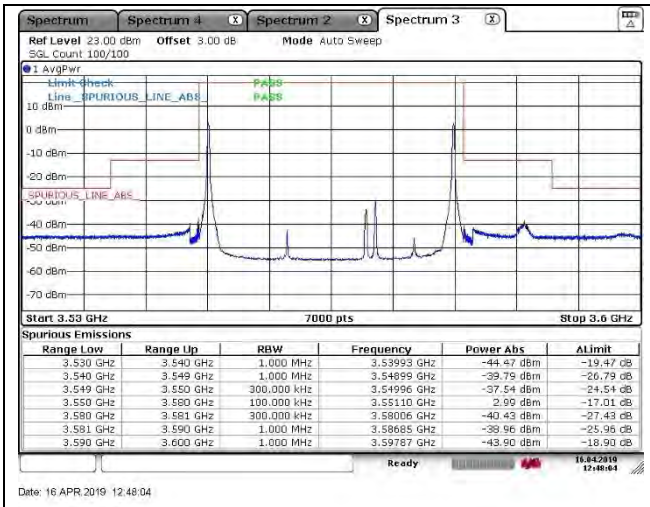
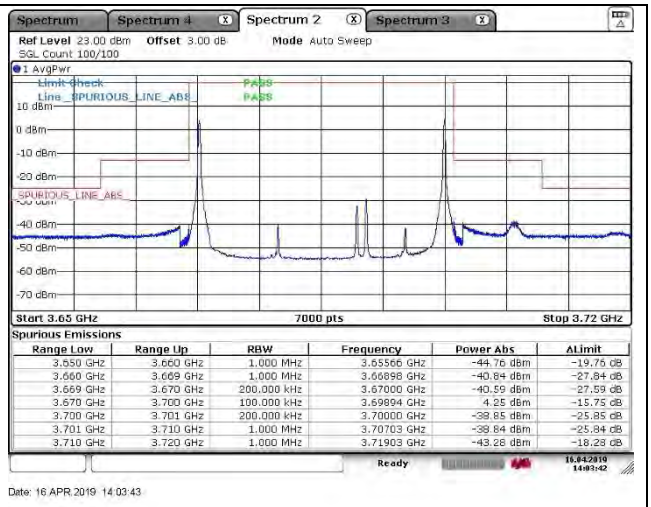
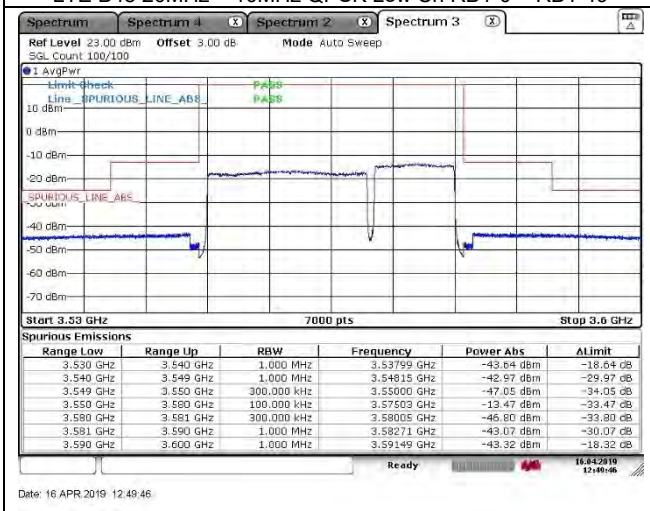


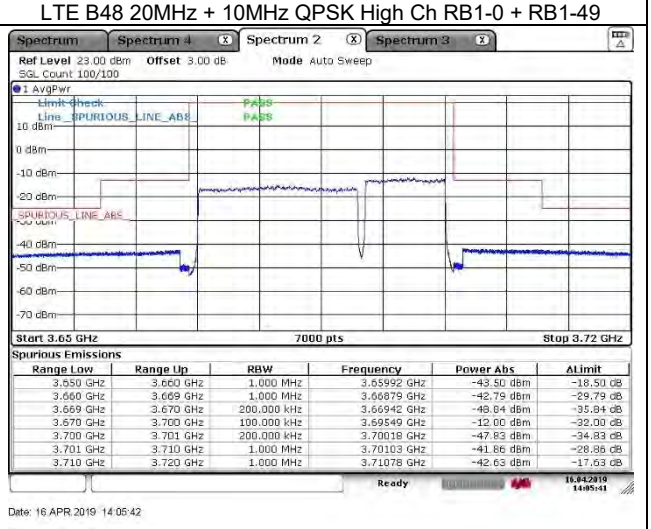
LTE B48 20MHz + 10MHz QPSK Low Ch RB1-0 + RB1-49



LTE B48 20MHz + 10MHz QPSK High Ch RB1-0 + RB1-49



LTE B48 20MHz + 10MHz QPSK Low Ch RB100-0 + RB50-0



LTE B48 20MHz + 10MHz QPSK High Ch RB100-0 + RB50-0

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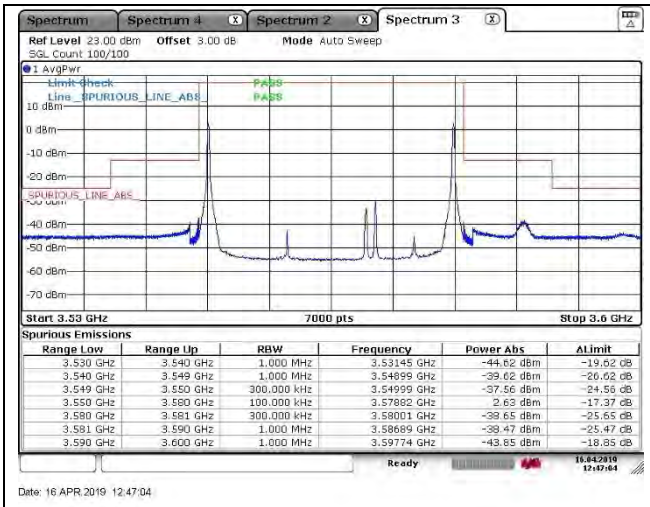
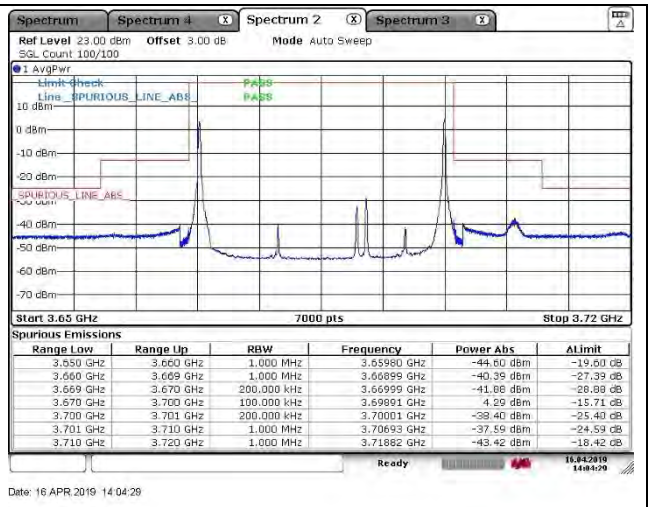
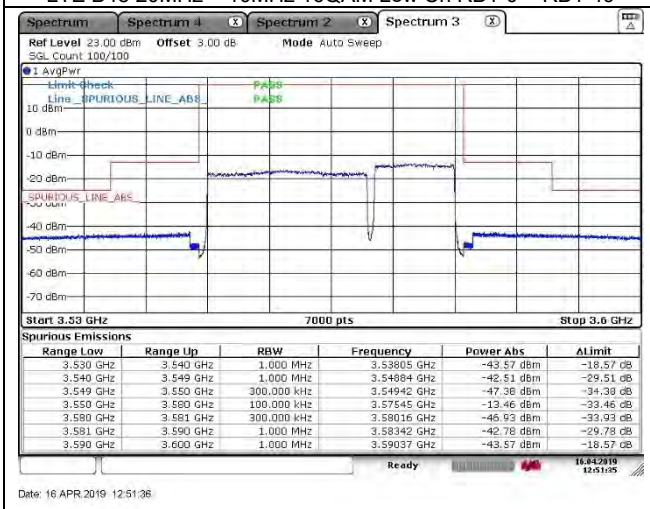


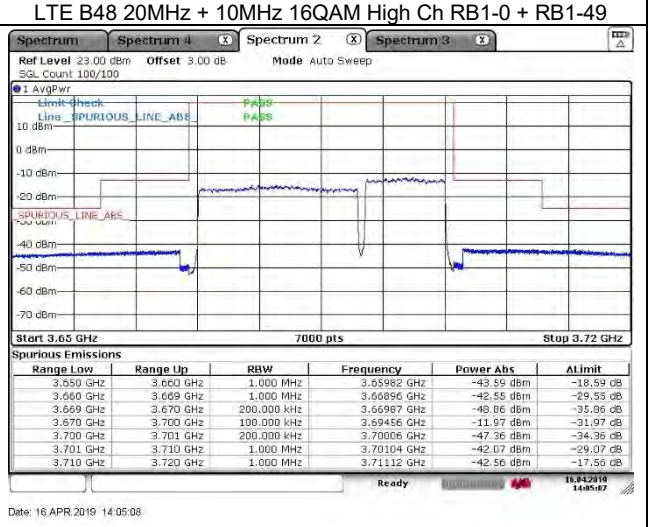
LTE B48 20MHz + 10MHz 16QAM Low Ch RB1-0 + RB1-49



LTE B48 20MHz + 10MHz 16QAM High Ch RB1-0 + RB1-49



LTE B48 20MHz + 10MHz 16QAM Low Ch RB100-0 + RB50-0



LTE B48 20MHz + 10MHz 16QAM High Ch RB100-0 + RB50-0

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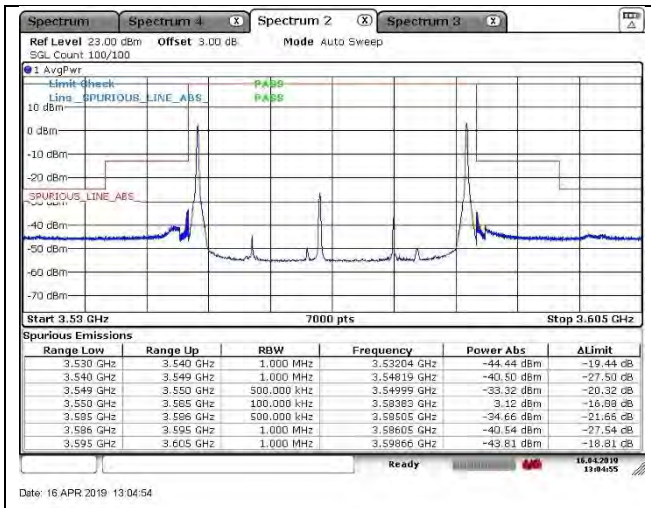
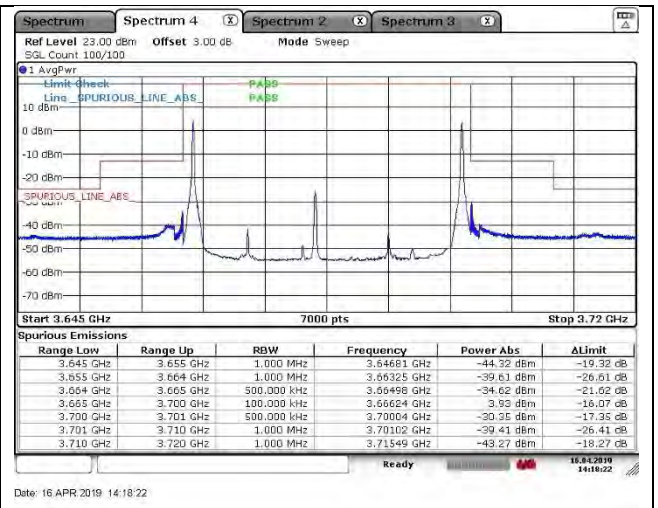


Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
3.530 GHz	3.540 GHz	1.000 MHz	3.53204 GHz	-44.44 dBm	-19.44 dB
3.540 GHz	3.549 GHz	1.000 MHz	3.54819 GHz	-40.50 dBm	-27.50 dB
3.549 GHz	3.550 GHz	500.000 kHz	3.54999 GHz	-33.32 dBm	-20.32 dB
3.550 GHz	3.585 GHz	100.000 kHz	3.58383 GHz	3.12 dBm	-16.88 dB
3.585 GHz	3.586 GHz	500.000 kHz	3.58505 GHz	-34.66 dBm	-21.66 dB
3.586 GHz	3.595 GHz	1.000 MHz	3.58605 GHz	-40.54 dBm	-27.54 dB
3.595 GHz	3.605 GHz	1.000 MHz	3.59866 GHz	-43.81 dBm	-18.81 dB

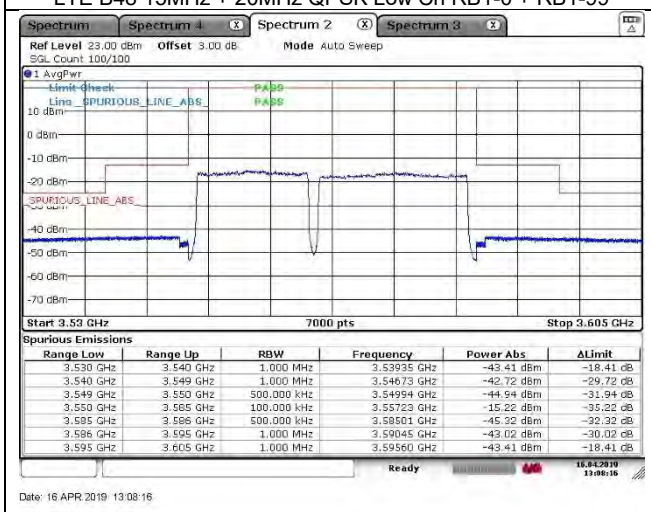
LTE B48 15MHz + 20MHz QPSK Low Ch RB1-0 + RB1-99



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
3.645 GHz	3.655 GHz	1.000 MHz	3.64681 GHz	-44.32 dBm	-19.32 dB
3.655 GHz	3.664 GHz	1.000 MHz	3.66325 GHz	-39.61 dBm	-26.61 dB
3.664 GHz	3.665 GHz	500.000 kHz	3.66498 GHz	-34.62 dBm	-21.62 dB
3.665 GHz	3.700 GHz	100.000 kHz	3.66624 GHz	3.93 dBm	-16.07 dB
3.700 GHz	3.701 GHz	500.000 kHz	3.70004 GHz	-30.35 dBm	-17.35 dB
3.701 GHz	3.710 GHz	1.000 MHz	3.70102 GHz	-39.41 dBm	-26.41 dB
3.710 GHz	3.720 GHz	1.000 MHz	3.71549 GHz	-43.27 dBm	-18.27 dB

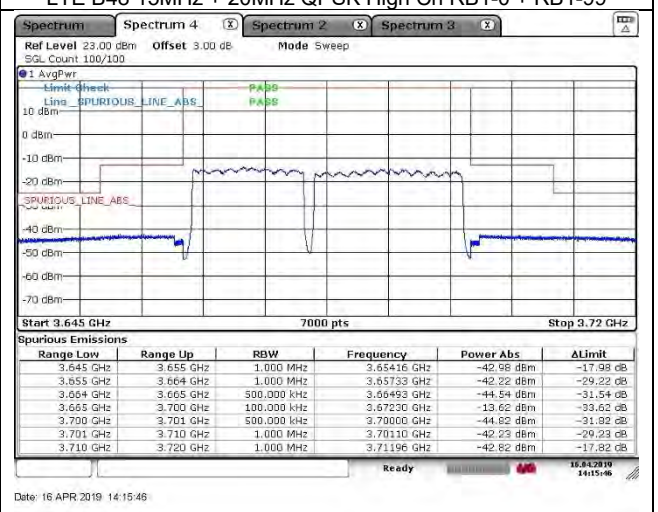
LTE B48 15MHz + 20MHz QPSK High Ch RB1-0 + RB1-99



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
3.530 GHz	3.540 GHz	1.000 MHz	3.53935 GHz	-43.41 dBm	-18.41 dB
3.540 GHz	3.549 GHz	1.000 MHz	3.54673 GHz	-42.72 dBm	-29.72 dB
3.549 GHz	3.550 GHz	500.000 kHz	3.54994 GHz	-44.94 dBm	-31.94 dB
3.550 GHz	3.585 GHz	100.000 kHz	3.55723 GHz	-15.22 dBm	-35.22 dB
3.585 GHz	3.586 GHz	500.000 kHz	3.58501 GHz	-45.32 dBm	-32.32 dB
3.586 GHz	3.595 GHz	1.000 MHz	3.59045 GHz	-43.02 dBm	-30.02 dB
3.595 GHz	3.605 GHz	1.000 MHz	3.59560 GHz	-43.41 dBm	-18.41 dB

LTE B48 15MHz + 20MHz QPSK Low Ch RB75-0 + RB100-0



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
3.645 GHz	3.655 GHz	1.000 MHz	3.65416 GHz	-42.98 dBm	-17.98 dB
3.655 GHz	3.664 GHz	1.000 MHz	3.65733 GHz	-42.22 dBm	-29.22 dB
3.664 GHz	3.665 GHz	500.000 kHz	3.66493 GHz	-44.54 dBm	-31.54 dB
3.665 GHz	3.700 GHz	100.000 kHz	3.67230 GHz	-13.62 dBm	-33.62 dB
3.700 GHz	3.701 GHz	500.000 kHz	3.70000 GHz	-44.82 dBm	-31.82 dB
3.701 GHz	3.710 GHz	1.000 MHz	3.70110 GHz	-42.23 dBm	-29.23 dB
3.710 GHz	3.720 GHz	1.000 MHz	3.71196 GHz	-42.82 dBm	-17.82 dB

LTE B48 15MHz + 20MHz QPSK High Ch RB75-0 + RB100-0

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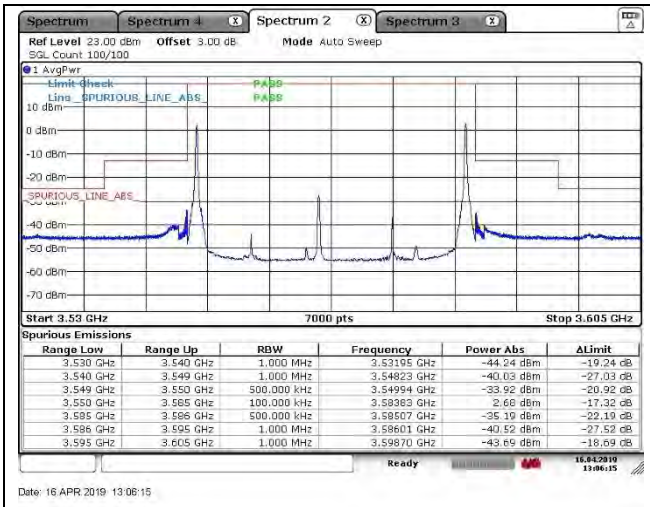
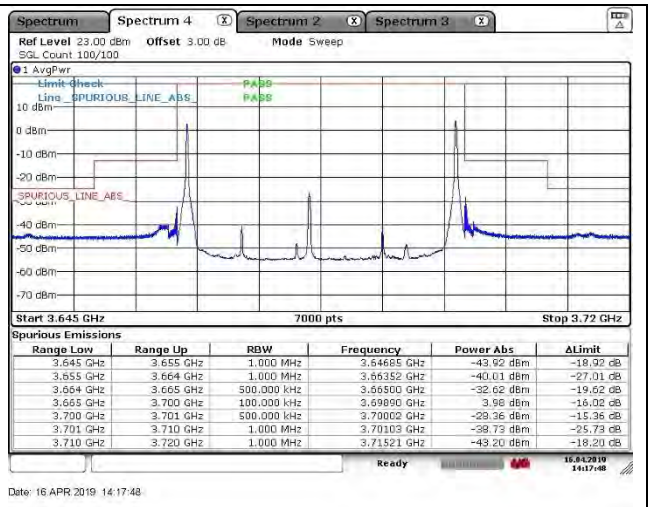
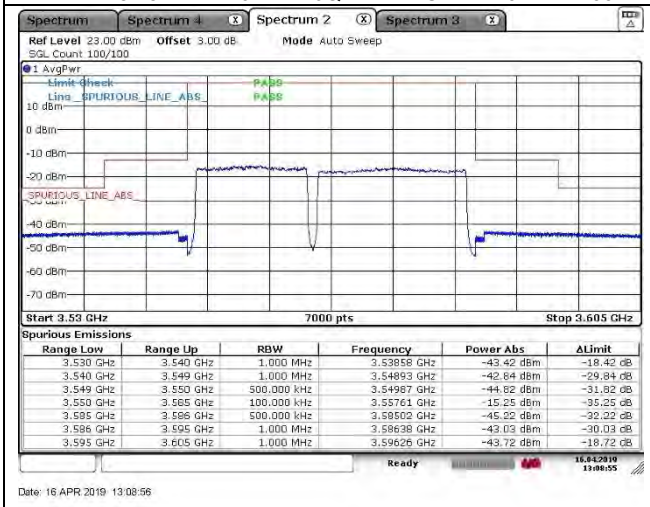


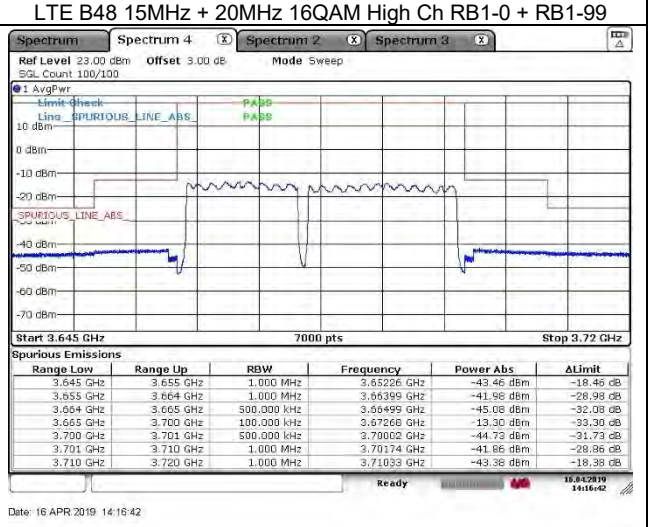
LTE B48 15MHz + 20MHz 16QAM Low Ch RB1-0 + RB1-99



LTE B48 15MHz + 20MHz 16QAM High Ch RB1-0 + RB1-99



LTE B48 15MHz + 20MHz 16QAM Low Ch RB75-0 + RB100-0



LTE B48 15MHz + 20MHz 16QAM High Ch RB75-0 + RB100-0

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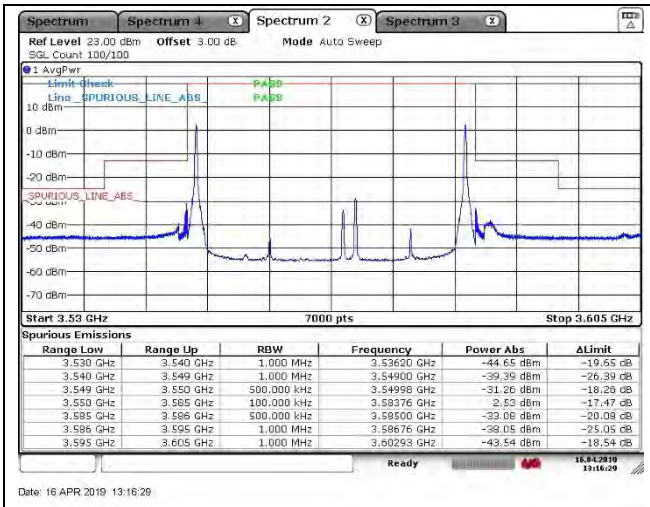
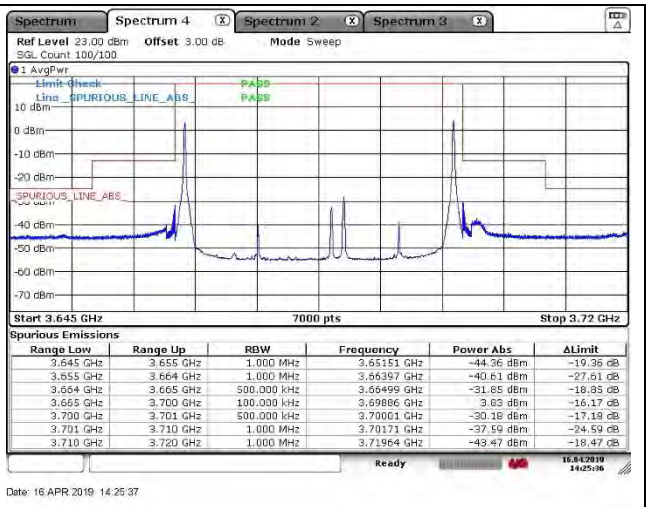
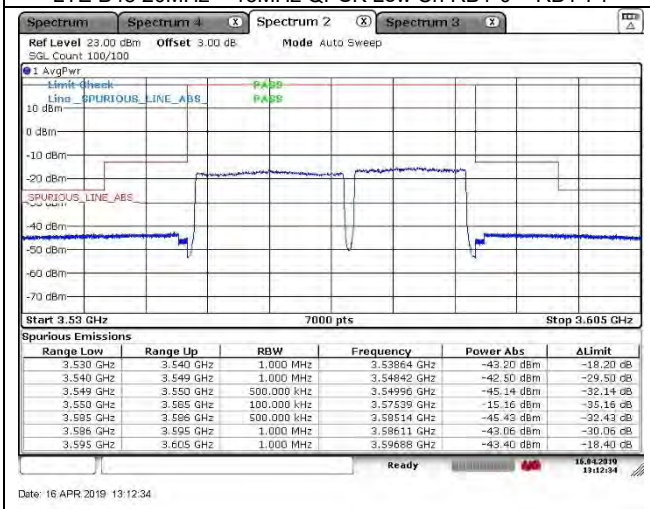


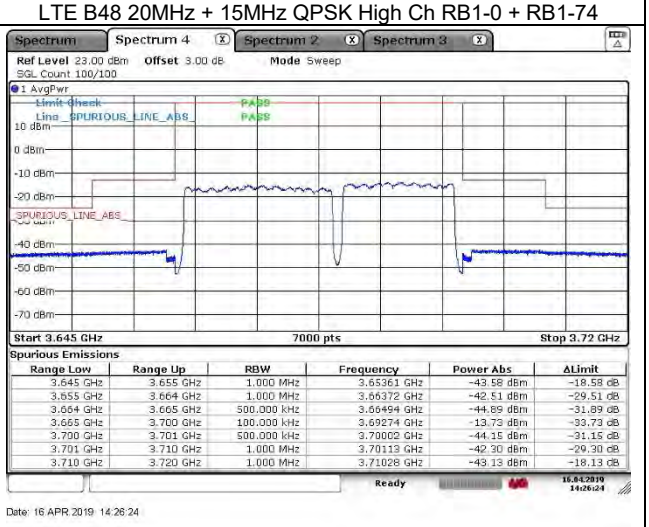
LTE B48 20MHz + 15MHz QPSK Low Ch RB1-0 + RB1-74



LTE B48 20MHz + 15MHz QPSK High Ch RB1-0 + RB1-74



LTE B48 20MHz + 15MHz QPSK Low Ch RB100-0 + RB75-0



LTE B48 20MHz + 15MHz QPSK High Ch RB100-0 + RB75-0

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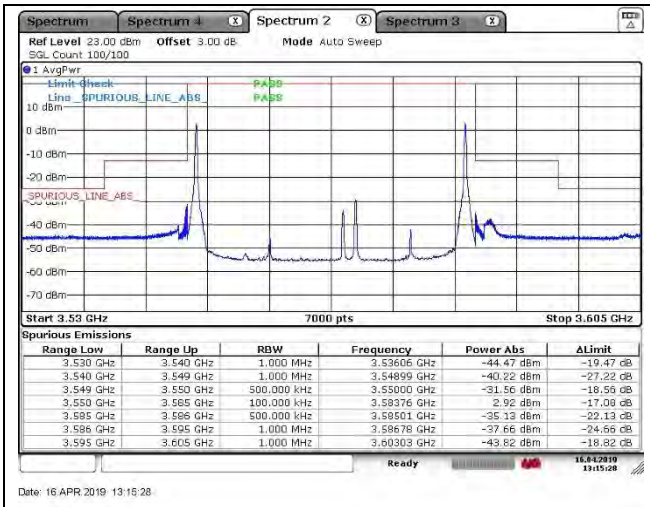
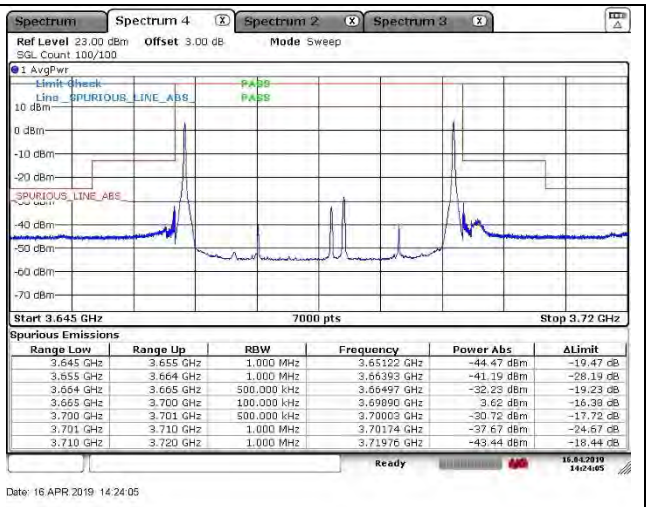
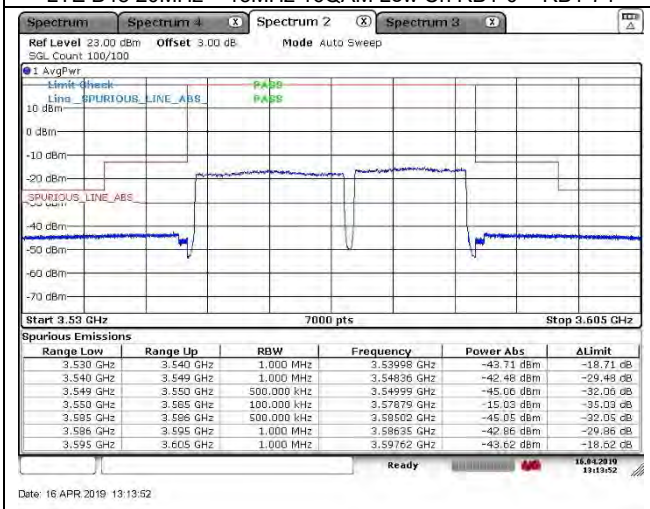


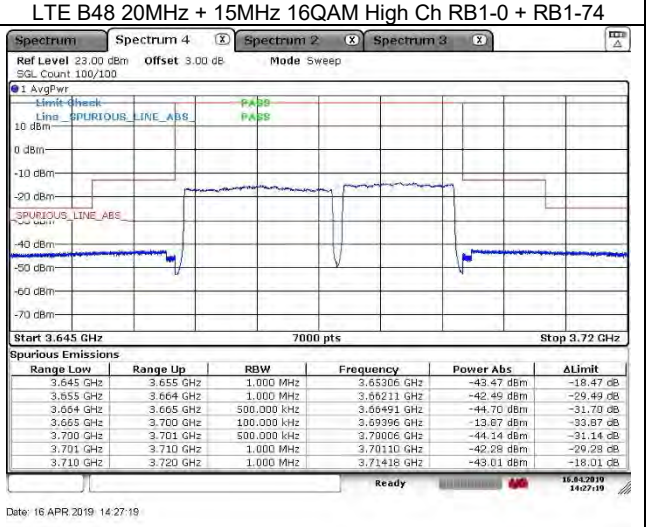
LTE B48 20MHz + 15MHz 16QAM Low Ch RB1-0 + RB1-74



LTE B48 20MHz + 15MHz 16QAM High Ch RB1-0 + RB1-74



LTE B48 20MHz + 15MHz 16QAM Low Ch RB100-0 + RB75-0



LTE B48 20MHz + 15MHz 16QAM High Ch RB100-0 + RB75-0

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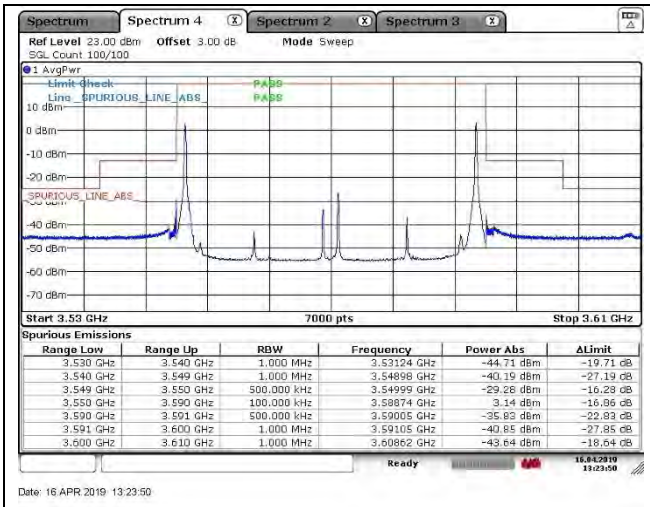
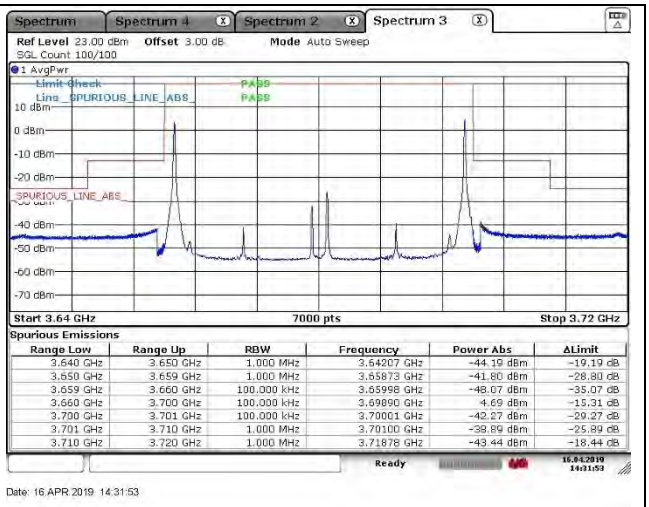
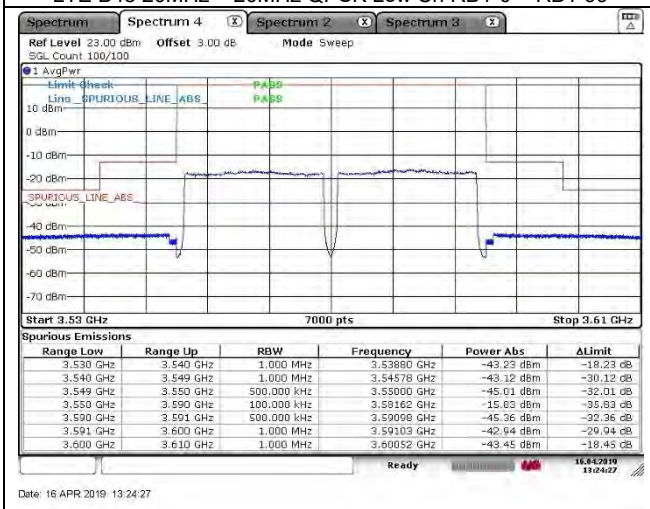


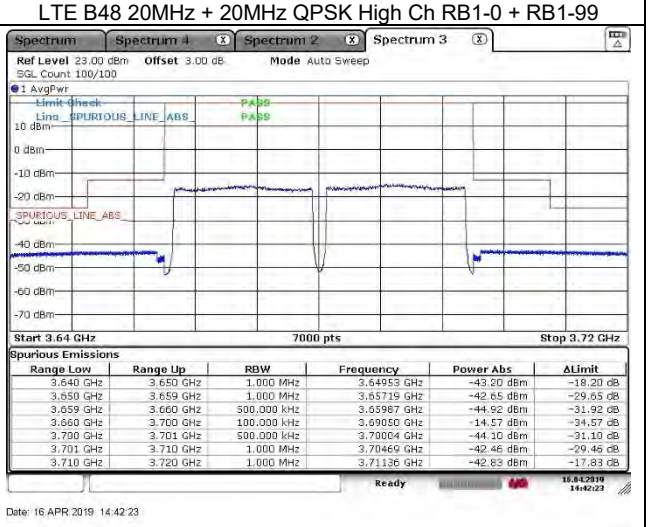
LTE B48 20MHz + 20MHz QPSK Low Ch RB1-0 + RB1-99



LTE B48 20MHz + 20MHz QPSK High Ch RB1-0 + RB1-99



LTE B48 20MHz + 20MHz QPSK Low Ch RB100-0 + RB100-0



LTE B48 20MHz + 20MHz QPSK High Ch RB100-0 + RB100-0

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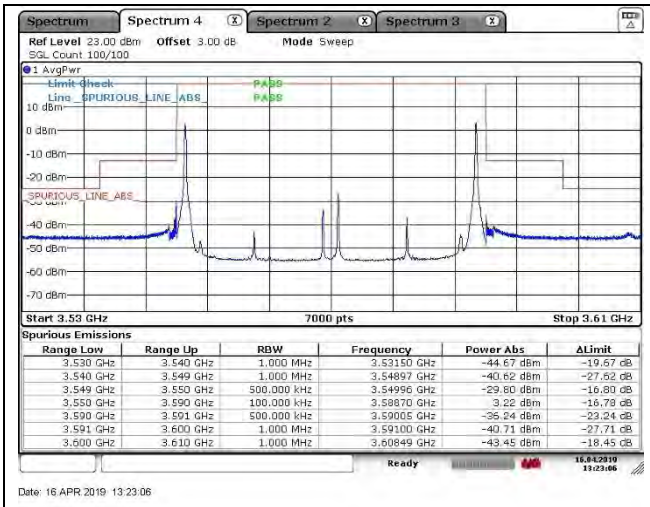
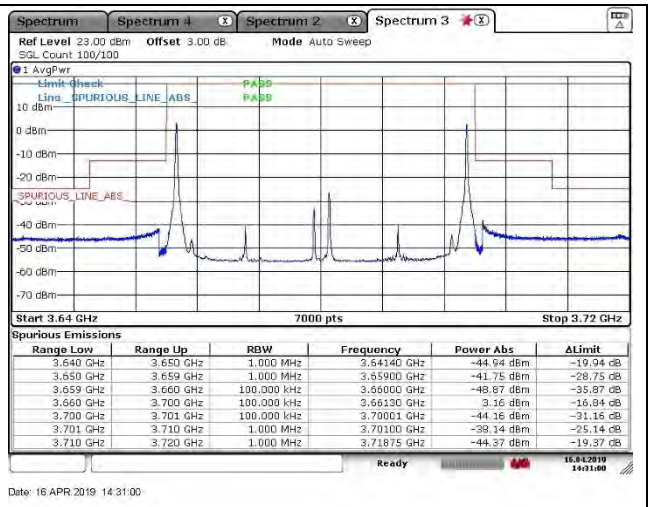
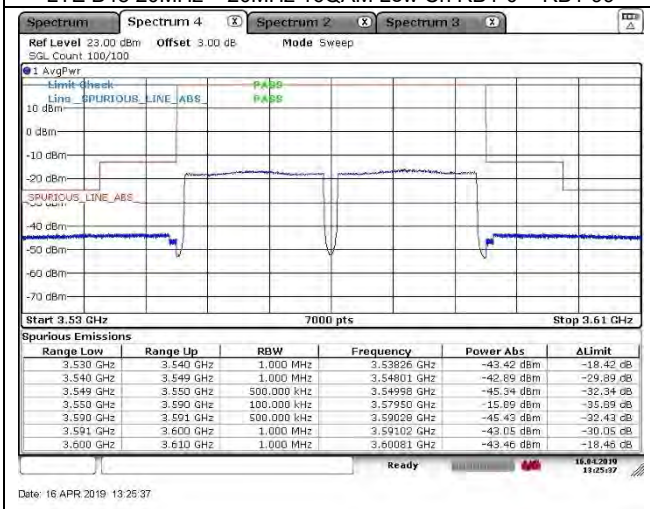


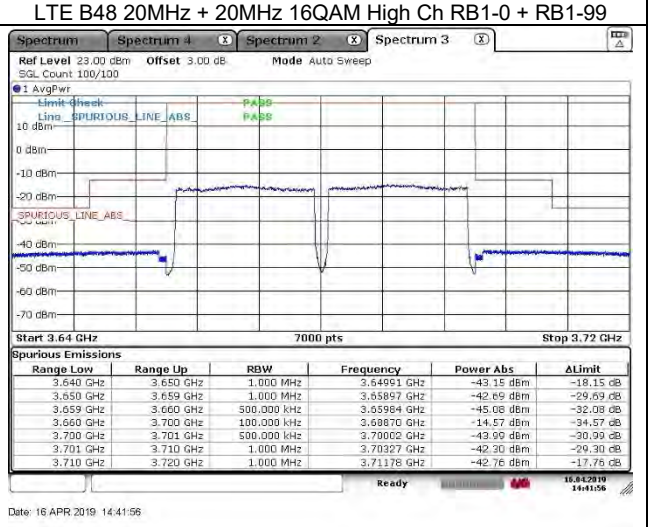
LTE B48 20MHz + 20MHz 16QAM Low Ch RB1-0 + RB1-99



LTE B48 20MHz + 20MHz 16QAM High Ch RB1-0 + RB1-99



LTE B48 20MHz + 20MHz 16QAM Low Ch RB100-0 + RB100-0



LTE B48 20MHz + 20MHz 16QAM High Ch RB100-0 + RB100-0

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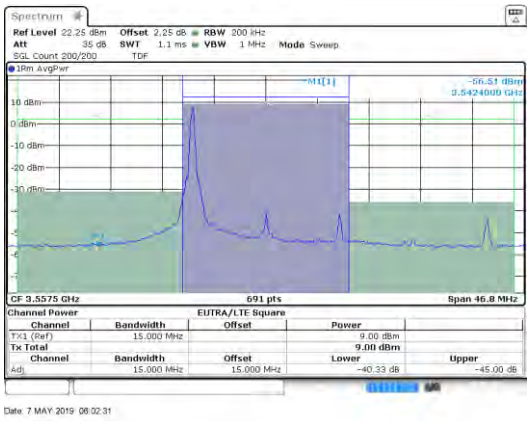
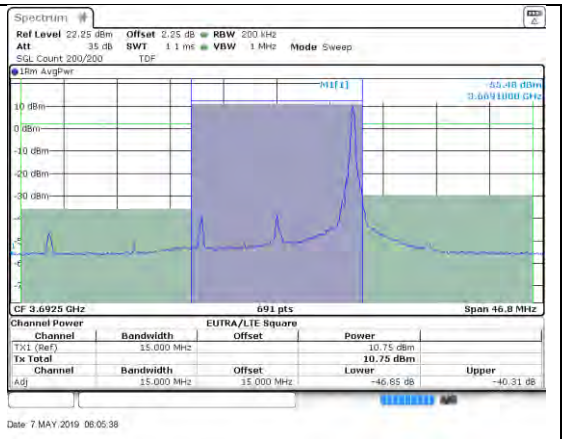
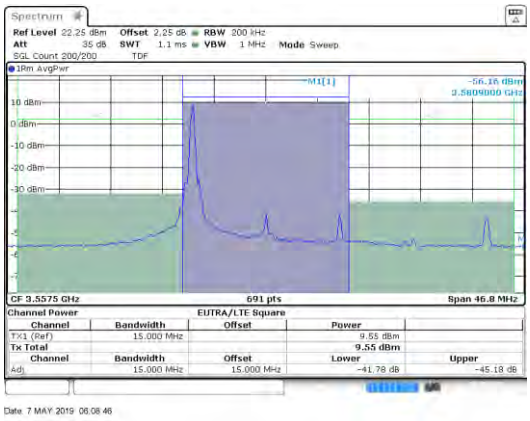
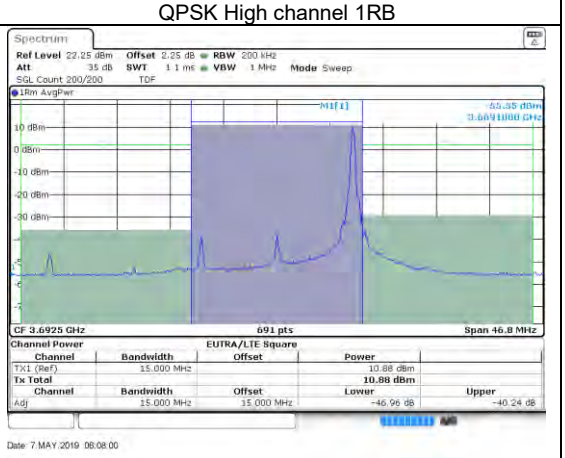
9.2.2. ADJACENT CHANNEL LEAKAGE RATIO RESULT

LTE Band 48

Band 48 15MHz	 QPSK Low channel 1RB	 QPSK High channel 1RB
	 16QAM Low channel 1RB	 16QAM High channel 1RB

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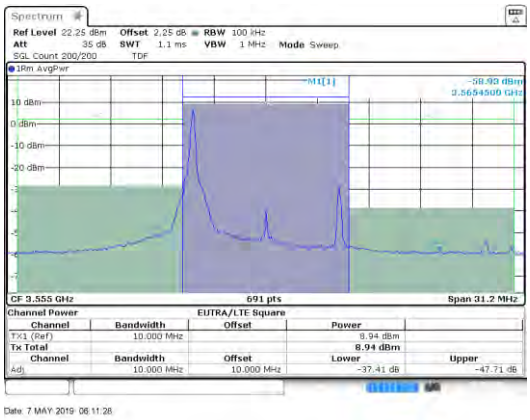
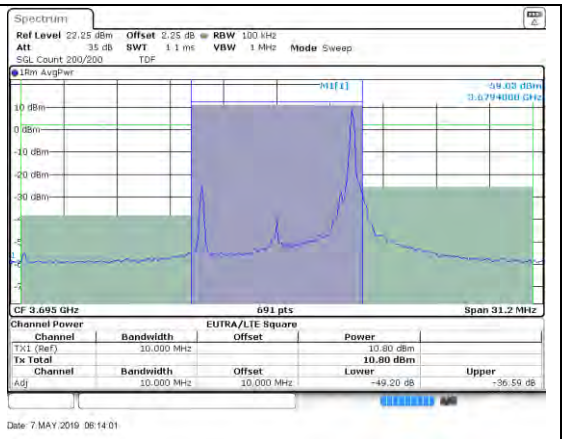
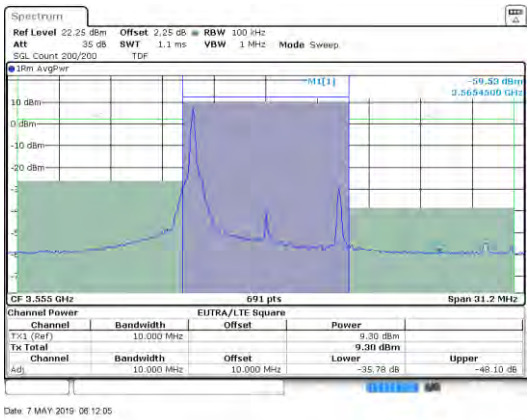
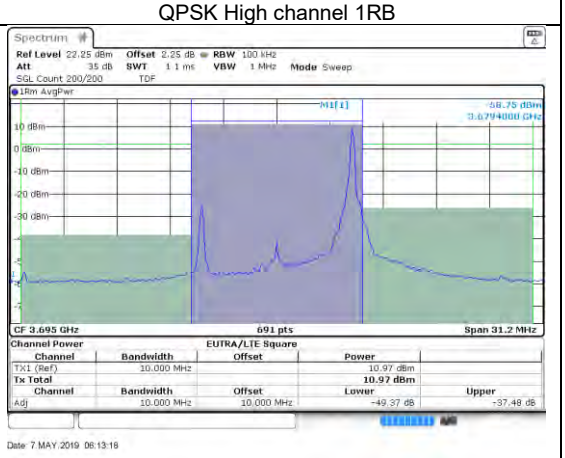
Band 48 10MHz	 QPSK Low channel 1RB	 QPSK High channel 1RB
	 16QAM Low channel 1RB	 16QAM High channel 1RB

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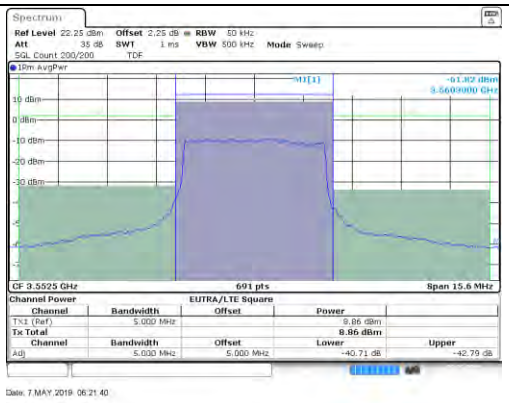
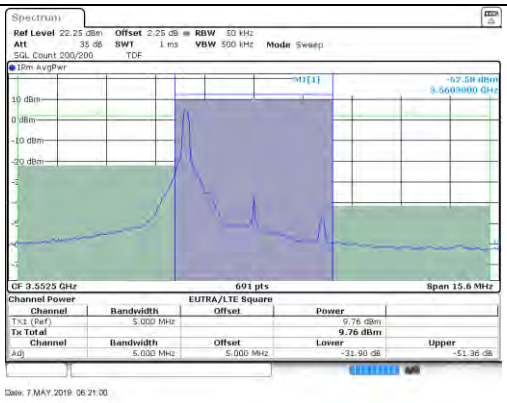
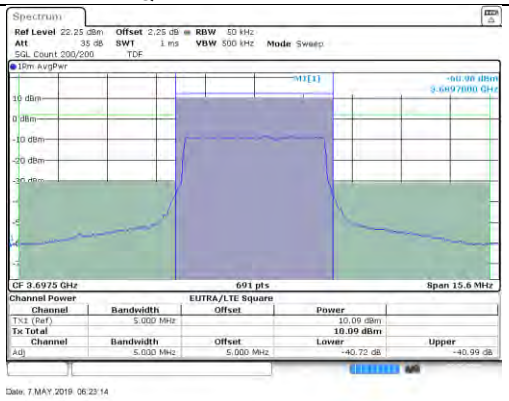
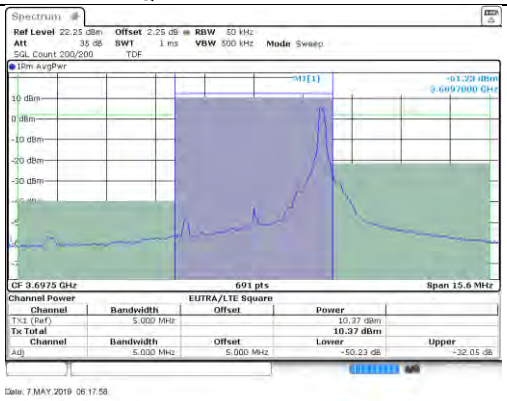
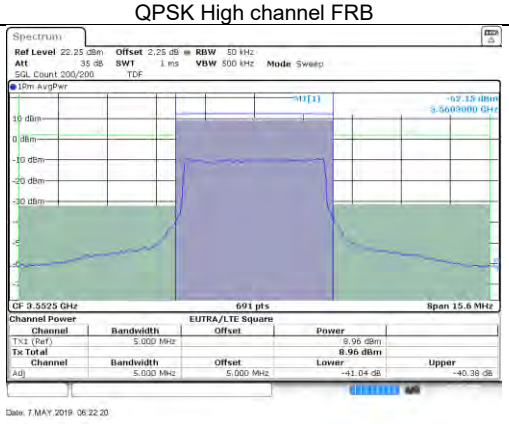
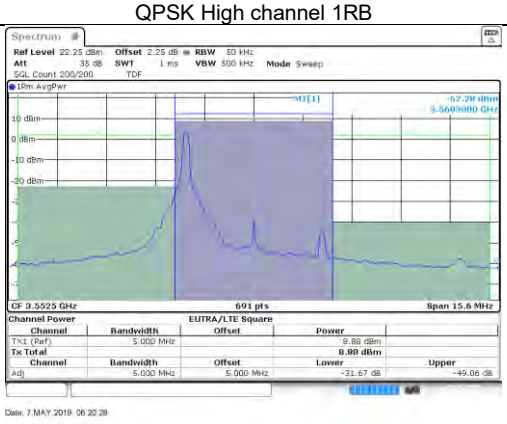
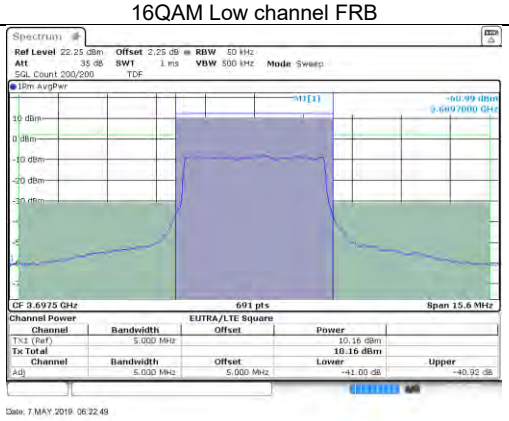
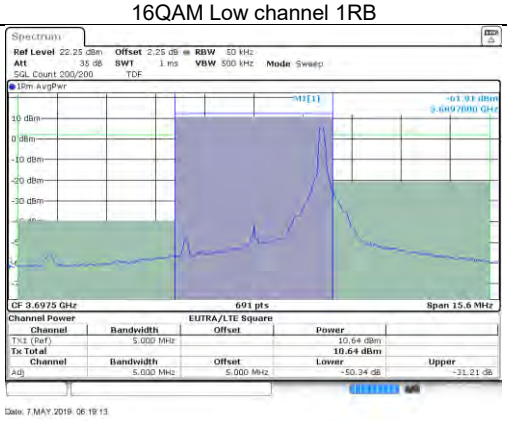
Band 48 5MHz	 QPSK Low channel FRB	 QPSK Low channel 1RB
	 QPSK High channel FRB	 QPSK High channel 1RB
	 16QAM Low channel FRB	 16QAM Low channel 1RB
	 16QAM High channel FRB	 16QAM High channel 1RB

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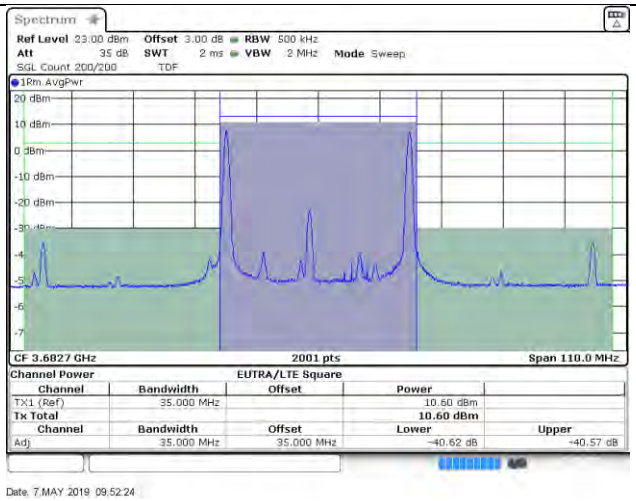
LTE Band 48(UL CA)



LTE B48 15MHz + 20MHz 16QAM High Ch RB1-0 + RB1-99

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9.3. OUT OF BAND EMISSIONS

RULE PART(S)

FCC: §2.1051, §96.41

LIMITS

§96.41(e)(2):
The conducted power of emissions below 3530 MHz or above 3720 MHz shall not exceed −40dBm/MHz.

TEST PROCEDURE

Per KDB 971168 D01 Power Meas License Digital Systems v03r01
The RF output of the transmitter was connected to a spectrum analyzer through a calibrated coaxial cable. Sufficient scans were taken to show the out-of-band Emissions, if any, up to 10th harmonic. Multiple sweeps were recorded in maximum hold mode using a peak detector to ensure that the worst-case emissions were caught.

a) Set the RBW = 100KHz for emission below 1GHz and 1MHz for emissions above 1GHz (Tests were performed 1MHz [Worst case], to sweep 1 time for all frequency range)

b) Set VBW ≥ 3 × RBW;

c) Set span ≥ 1.5 times the OBW;

d) Sweep time = auto couple;

e) Detector = rms;

f) Ensure that the number of measurement points = Max (40001);

g) Trace mode = Maxhold

h) Sweep count = 100

Note : Please refer to section 5.6 for bandwidth and RB setting about LTE bands.

RESULTS

See the following pages.

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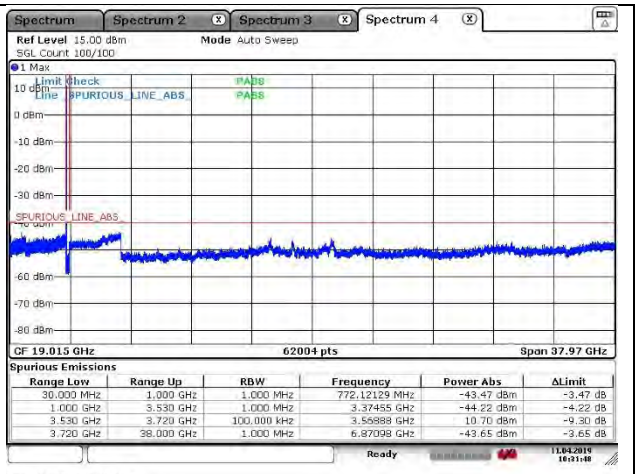
9.3.1. OUT OF BAND EMISSIONS RESULT

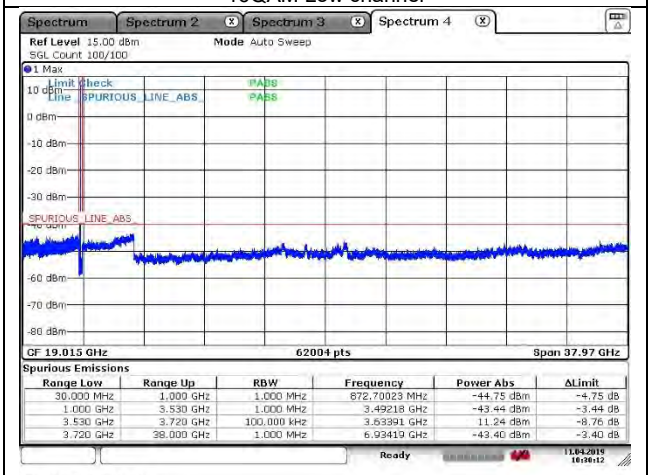
LTE Band 48

Band 48

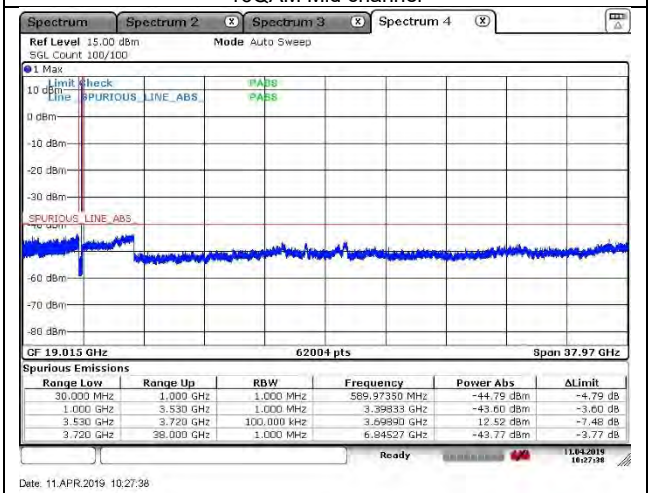
20MHz



16QAM Low channel



16QAM Mid channel



16QAM High channel

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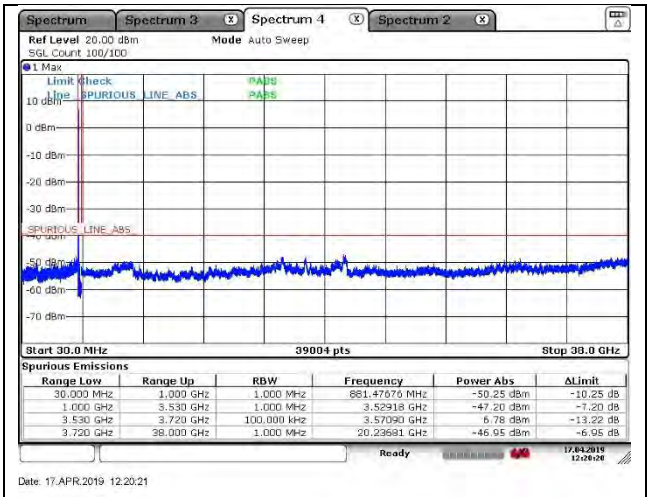
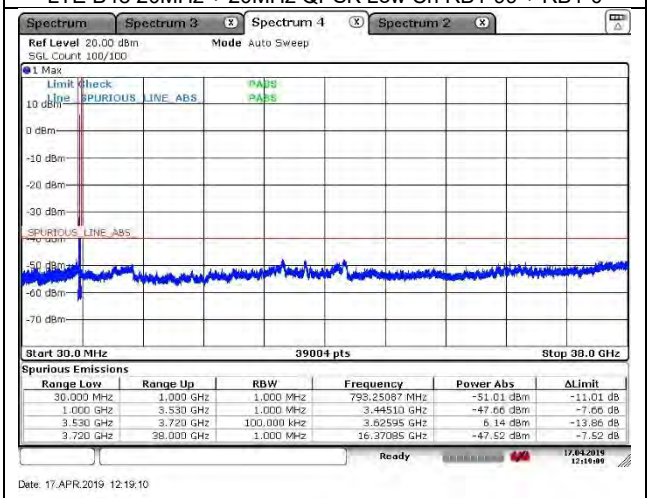
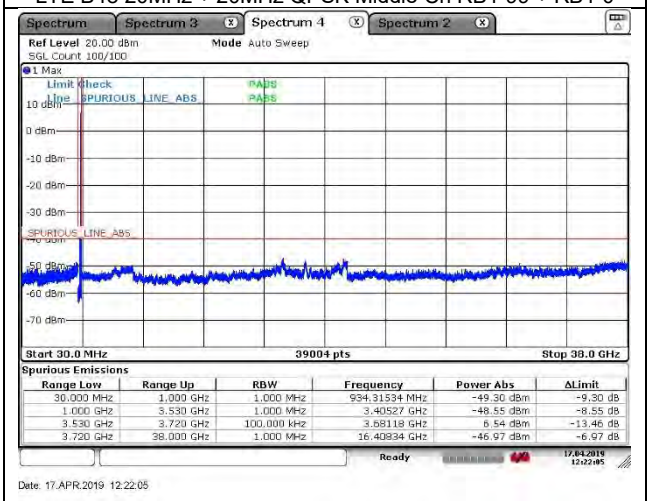
LTE Band 48 (UL CA)



LTE B48 20MHz + 20MHz QPSK Low Ch RB1-99 + RB1-0



LTE B48 20MHz + 20MHz QPSK Middle Ch RB1-99 + RB1-0



LTE B48 20MHz + 20MHz QPSK High Ch RB1-99 + RB1-0

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9.4. FREQUENCY STABILITY

RULE PART(S)

FCC: §2.1055

LIMITS

Within the authorized frequency band

TEST PROCEDURE

Per KDB 971168 D01 Power Meas License Digital Systems v03r01

RESULTS

9.4.1. FREQUENCY STABILITY RESULTS

LTE Band 48 (QPSK)

Limit		3550	3700	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ End of OBW	F high @ End of OBW		
Temperature	Voltage	(MHz)	(MHz)		
Normal (20C)	Normal (48.0 Vdc)	3552.4977	3697.5023		
Extreme (50C)		3552.4977	3697.5022	-19.0	-0.005
Extreme (40C)		3552.4977	3697.5022	-16.0	-0.004
Extreme (30C)		3552.4977	3697.5022	-17.0	-0.005
Extreme (10C)		3552.4977	3697.5023	-3.0	-0.001
Extreme (0C)		3552.4978	3697.5023	11.0	0.003
Extreme (-10C)		3552.4978	3697.5023	14.0	0.004
Extreme (-20C)		3552.4978	3697.5023	20.0	0.006
Extreme (-30C)		3552.4978	3697.5023	19.0	0.005
20C	+15% (55.2 Vdc)	3552.4977	3697.5022	-11.0	-0.003
	-15% (40.8 Vdc)	3552.4977	3697.5022	-20.0	-0.006

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10. RADIATED TEST RESULTS

10.1. FIELD STRENGTH OF SPURIOUS RADIATION

RULE PART(S)

FCC: §2.1051, §96.41

LIMIT

§96.41(e)(2):
The conducted power of emissions below 3530 MHz or above 3720 MHz shall not exceed −40dBm/MHz.

TEST PROCEDURE

ANSI / TIA / EIA 603 E Clause 2.2.12; ESU40 setting reference to 971168 D01 v03

For peak power measurement with a ESU40:
a) Set the RBW = 100 KHz for emission below 1GHz and 1MHz for emissions above 1GHz
b) Set VBW ≥ 3 × RBW;
c) Set span ≥ 1.5 times the OBW;
d) Sweep time = auto couple;
e) Detector = rms;
f) Ensure that the number of measurement points ≥ span/RBW;
g) Trace mode = Maxhold;
h) Sweep count = 100

NOTE 1: Radiated spurious emissions were investigated below 30MHz, 30MHz – 1GHz and above 1GHz. There were no emissions found on below 30MHz and 30MHz – 1GHz.

Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 10m open field test site. Therefore, sufficient tests were made to demonstrate that the alternative site produces results that correlated with the one of tests made in an open field site based on KDB 414788.

NOTE 2: Please refer to section 5.4 for bandwidth and RB setting about LTE bands.

RESULTS

See the following pages.

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10.1.1. SPURIOUS RADIATION PLOTS

LTE Band 48

LTE

Band 48

16QAM

UL Verification Services, Inc.
Above 1GHz High Frequency Substitution Measurement

Company: SEOWON INTECH CO., LTD
Project #: 4788755803
Date: 2019-04-18
Test Engineer: 45585
Configuration: EUT / AC Adapter, Y-Position
Location: Chamber 1
Mode: LTE_16QAM_Band48 Harmonics, 20MHz Bandwidth

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 3560MHz									
7120.00	-14.9	V	3.0	42.7	1.0	-56.6	-25.0	-31.6	
10680.00	-12.1	V	3.0	40.8	1.0	-51.9	-25.0	-26.9	
14240.00	-8.0	V	3.0	43.1	1.0	-50.1	-25.0	-25.1	
7120.00	-14.9	H	3.0	42.7	1.0	-56.5	-25.0	-31.5	
10680.00	-12.2	H	3.0	40.8	1.0	-51.9	-25.0	-26.9	
14240.00	-8.0	H	3.0	43.1	1.0	-50.1	-25.0	-25.1	
Mid Ch, 3625MHz									
7250.00	-14.7	V	3.0	42.6	1.0	-56.3	-25.0	-31.3	
10875.00	-12.4	V	3.0	40.8	1.0	-52.2	-25.0	-27.2	
14500.00	-8.1	V	3.0	43.3	1.0	-50.4	-25.0	-25.4	
7250.00	-14.4	H	3.0	42.6	1.0	-56.0	-25.0	-31.0	
10875.00	-12.3	H	3.0	40.8	1.0	-52.1	-25.0	-27.1	
14500.00	-7.7	H	3.0	43.3	1.0	-50.0	-25.0	-25.0	
High Ch, 3690MHz									
7380.00	-14.6	V	3.0	42.5	1.0	-56.1	-25.0	-31.1	
11070.00	-11.7	V	3.0	40.9	1.0	-51.6	-25.0	-26.6	
14760.00	-7.2	V	3.0	43.5	1.0	-49.7	-25.0	-24.7	
7380.00	-14.9	H	3.0	42.5	1.0	-56.4	-25.0	-31.4	
11070.00	-11.7	H	3.0	40.9	1.0	-51.6	-25.0	-26.6	
14760.00	-7.3	H	3.0	43.5	1.0	-49.8	-25.0	-24.8	

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LTE Band 48 (UL CA)

LTE

Band 48

PCC 20MHz

SCC 20MHz

QPSK

UL Verification Services, Inc.
Above 1GHz High Frequency Substitution Measurement

Company: SEOWON INTECH CO., LTD
Project #: 4788755803
Date: 2019-04-18
Test Engineer: 45585
Configuration: EUT
Location: Chamber 1
Mode: LTE_QPSK_ULCA Band 48 Harmonics, 20MHz/20MHz Bandwidth

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 3569.9MHz									
7139.80	-14.4	V	3.0	42.7	1.0	-56.1	-25.0	-31.1	
10709.70	-12.3	V	3.0	40.8	1.0	-52.0	-25.0	-27.0	
14279.60	-7.6	V	3.0	43.1	1.0	-49.7	-25.0	-24.7	
7139.80	-14.9	H	3.0	42.7	1.0	-56.6	-25.0	-31.6	
10709.70	-12.1	H	3.0	40.8	1.0	-51.8	-25.0	-26.8	
14279.60	-7.3	H	3.0	43.1	1.0	-49.4	-25.0	-24.4	
Mid Ch, 3625MHz									
7250.00	-14.7	V	3.0	42.6	1.0	-56.3	-25.0	-31.3	
10875.00	-12.5	V	3.0	40.8	1.0	-52.4	-25.0	-27.4	
14500.00	-7.5	V	3.0	43.3	1.0	-49.7	-25.0	-24.7	
7250.00	-14.9	H	3.0	42.6	1.0	-56.5	-25.0	-31.5	
10875.00	-11.9	H	3.0	40.8	1.0	-51.7	-25.0	-26.7	
14500.00	-7.9	H	3.0	43.3	1.0	-50.2	-25.0	-25.2	
High Ch, 3680.1MHz									
5290.00	-17.4	V	3.0	43.7	1.0	-60.2	-25.0	-35.2	
7935.00	-15.1	V	3.0	42.2	1.0	-56.3	-25.0	-31.3	
10580.00	-12.3	V	3.0	40.7	1.0	-52.1	-25.0	-27.1	
5290.00	-17.8	H	3.0	43.7	1.0	-60.6	-25.0	-35.6	
7935.00	-15.3	H	3.0	42.2	1.0	-56.5	-25.0	-31.5	
10580.00	-12.4	H	3.0	40.7	1.0	-52.1	-25.0	-27.1	

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