FCC Radio Test Report

FCC ID: M82-FWA1012VC

This report concerns: Original Grant

Project No.	:	1807T071
Equipment	:	Network Security Platform
Test Model	:	FWA-1012VC
Series Model	:	FWA-1012VCXXXXXXXXXXXXXXXX (where X may be any alphanumeric character , blank or “-”.)
Applicant	:	Advantech Co., Ltd.
Address	:	No.1, Alley 20, Lane 26, Rueiguang Road, Neihu District, Taipei 11491, Taiwan, R.O.C.

Date of Receipt	:	Aug. 02, 2018
Date of Test	:	Aug. 02, 2018 ~ Sep. 14, 2018
Issued Date	:	Sep. 19, 2018
Tested by	:	BTL Inc.

Technical Manager : _____
(James Chiu)

Authorized Signatory : Sean Chen
(Sean Chen)

BTL INC.

No.18, Ln. 171, Sec. 2, Jiuzong Rd.,
Neihu Dist., Taipei City 114, Taiwan (R.O.C.)
TEL: +886-2-2657-3299 FAX: +886-2-2657-3331

Testing Laboratory
0659

Declaration

BTL represents to the client that testing is done in accordance with standard procedures as applicable and that test instruments used has been calibrated with standards traceable to international standard(s) and/or national standard(s).

BTL's reports apply only to the specific samples tested under conditions. It is manufacture's responsibility to ensure that additional production units of this model are manufactured with the identical electrical and mechanical components. **BTL** shall have no liability for any declarations, inferences or generalizations drawn by the client or others from **BTL** issued reports.

The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.

This report is the confidential property of the client. As a mutual protection to the clients, the public and ourselves, the test report shall not be reproduced, except in full, without our written approval.

BTL's laboratory quality assurance procedures are in compliance with the **ISO Guide 17025** requirements, and accredited by the conformity assessment authorities listed in this test report.

BTL is not responsible for the sampling stage, so the results only apply to the sample as received.

The information, data and test plan are provided by manufacturer, so it is manufacturer's responsibility to ensure that the apparatus meets the essential requirements in all the possible configurations as representative of its intended use.

Limitation

For the use of the authority's logo is limited unless the Test Standard(s)/Scope(s)/Item(s) mentioned in this test report is (are) included in the conformity assessment authorities acceptance respective.

CONTENTS

REPORT ISSUED HISTORY

Issue No.	Description	Issued Date
BTL-FCCP-3-1807T071	Original Issue.	Sep. 19, 2018

1 CERTIFICATION

Equipment	:	Network Security Platform
Brand Name	:	ADVANTECH
Test Model	:	FWA-1012VC
Series Model	:	FWA-1012VCXXXXXXXXXXXXXXX (where X may be any alphanumeric character , blank or “-”.)
Applicant	:	Advantech Co., Ltd.
Manufacturer	:	Advantech Co., Ltd.
Address	:	No.1, Alley 20, Lane 26, Rueiguang Road, Neihu District, Taipei 11491, Taiwan, R.O.C.
Date of Test	:	Aug. 02, 2018 ~ Sep. 14, 2018
Test Sample	:	Production Unit
Standard(s)	:	47 CRF FCC Part 2 47 CRF FCC Part 22, Subpart H KDB 971168 D01 Power Meas License Digital Systems v03r01 ANSI/TIA-603-D-2010

The above equipment has been tested and found in compliance with the requirement of the relative standards by BTL Inc.
The test data, data evaluation, and equipment configuration contained in our test report (Ref No. BTL-FCCP-3-1807T071) were obtained utilizing the test procedures, test instruments, test sites that has been accredited by the Authority of TAF according to the ISO-17025 quality assessment standard and technical standard(s).

Test result included in this report is only for the WCDMA Band V and LTE Band 5.

2 SUMMARY OF TEST RESULTS

Test procedures according to the technical standards.

FCC Clause No	Description	Test Result	Judgement	Tested By
§2.1046 §22.913(a)	RF Power Output	APPENDIX A	Pass	Kay Wu
§2.1049 §22.917(b)	Occupied Bandwidth	APPENDIX B	Pass	Kay Wu
§2.1051 §22.917(a)	Out of Band Emissions	APPENDIX C	Pass	Kay Wu
§2.1051 §22.917(a)	Spurious Emissions at Antenna Terminals	APPENDIX D	Pass	Kay Wu
§2.1053 §22.917(a)	Field strength of spurious radiation	APPENDIX E	Pass	Toby Tian
§2.1055 §22.355	Frequency stability	APPENDIX F	Pass	Kay Wu

NOTE:

(1) ”N/A” denotes test is not applicable in this Test Report.

2.1 TEST FACILITY

The test facilities used to collect the test data in this report:

☐ **CB08:** (FCC RN:674415; FCC DN:TW0659; IC Assigned Code:20088-1)
No. 68-1, Ln. 169, Sec. 2, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan (R.O.C.)

☐ **CB11:** (FCC RN:674415; FCC DN:TW0659; IC Assigned Code:20088-2)
No. 68-1, Ln. 169, Sec. 2, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan (R.O.C.)

☒ **CB15:** (FCC RN:674415; FCC DN:TW0659; IC Assigned Code:20088-5)
No. 68-1, Ln. 169, Sec. 2, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan (R.O.C.)

☐ **CB16:** (FCC RN:674415; FCC DN:TW0659; IC Assigned Code:20088-6)
No. 68-1, Ln. 169, Sec. 2, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan (R.O.C.)

☒ **TR03:** (FCC RN:674415; FCC DN:TW0659)
No. 68-1, Ln. 169, Sec. 2, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan (R.O.C.)

2.2 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. The BTL measurement uncertainty is less than the CISPR 16-4-2 U_{cispr} requirement.

The reported uncertainty of measurement y ± U, where expanded uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95 %.

A. Conducted test:

Applied	Parameter	Uncertainty
☒	RF Power Output	± 024 dB
☒	Frequency stability	± $1.2x10^{-7}$
☒	Occupied Bandwidth	± 3.8 %
☒	Spurious Emissions at Antenna Terminals	± 2.71dB
☒	Temperature	± 0.08 °C

B. Radiated emissions below 1 GHz test:

Applied	Test Site	Method	Measurement Frequency Range	Ant. H / V	U (dB)
☐	CB08 (10m)	CISPR	30 MHz ~ 200 MHz	V	3.48
			30 MHz ~ 200 MHz	H	3.08
			200 MHz ~ 1,000 MHz	V	3.94
			200 MHz ~ 1,000 MHz	H	3.46
☐	CB08 (3m)	CISPR	30 MHz ~ 200 MHz	V	3.68
			30 MHz ~ 200 MHz	H	3.28
			200 MHz ~ 1,000 MHz	V	4.26
			200 MHz ~ 1,000 MHz	H	3.92
☐	CB11 (3m)	CISPR	30 MHz ~ 200 MHz	V	4.26
			30 MHz ~ 200 MHz	H	3.76
			200 MHz ~ 1,000 MHz	V	4.46
			200 MHz ~ 1,000 MHz	H	3.84
☒	CB15 (3m)	CISPR	30 MHz ~ 200 MHz	V	4.20
			30 MHz ~ 200 MHz	H	3.64
			200 MHz ~ 1,000 MHz	V	4.56
			200 MHz ~ 1,000 MHz	H	3.90
☐	CB16 (3m)	CISPR	30 MHz ~ 200 MHz	V	4.20
			30 MHz ~ 200 MHz	H	3.64
			200 MHz ~ 1,000 MHz	V	4.56
			200 MHz ~ 1,000 MHz	H	3.90

C. Radiated emissions above 1 GHz test:

Applied	Test Site	Method	Measurement Frequency Range	Ant. H / V	U (dB)
☐	CB08 (3m)	CISPR	1 GHz ~ 6 GHz	V	4.40
			1 GHz ~ 6 GHz	H	3.88
			6 GHz ~18 GHz	V	4.70
			6 GHz ~18 GHz	H	4.08
☐	CB11 (3m)	CISPR	1 GHz ~ 6 GHz	V	4.44
			1 GHz ~ 6 GHz	H	4.40
			6 GHz ~18 GHz	V	4.02
			6 GHz ~18 GHz	H	4.00
☒	CB15 (3m)	CISPR	1 GHz ~ 6 GHz	V	4.46
			1 GHz ~ 6 GHz	H	4.40
			6 GHz ~18 GHz	V	3.88
			6 GHz ~18 GHz	H	4.00
☐	CB16 (3m)	CISPR	1 GHz ~ 6 GHz	V	4.46
			1 GHz ~ 6 GHz	H	4.40
			6 GHz ~18 GHz	V	3.88
			6 GHz ~18 GHz	H	4.00

Applied	Test Site	Method	Measurement Frequency Range	U (dB)
☐	CB08 (1m)	CISPR	18 GHz ~ 26.5 GHz	4.68
			26.5 GHz ~ 40 GHz	5.16
☐	CB11 (1m)	CISPR	18 GHz ~ 26.5 GHz	4.76
			26.5 GHz ~ 40 GHz	5.24
☒	CB15 (1m)	CISPR	18 GHz ~ 26.5 GHz	4.62
			26.5 GHz ~ 40 GHz	5.12
☐	CB16 (1m)	CISPR	18 GHz ~ 26.5 GHz	4.62
			26.5 GHz ~ 40 GHz	5.12

Note: Unless specifically mentioned, the uncertainty of measurement has not been taken into account to declare the compliance or non-compliance to the specification.
Our calculated Measurement Instrumentation Uncertainty is shown in the tables above.
These are our U_{lab} values in CISPR 16-4-2 terminology.
Since Table 1 of CISPR 16-4-2 has values of measurement instrumentation uncertainty, called U_{CISPR}, as follows:

Conducted Disturbance (mains port) – 150 kHz – 30 MHz : 3.6 dB
Radiated Disturbance (electric field strength on an open area test site or alternative test site) – 30 MHz – 1000 MHz : 5.2 dB

3 GENERAL INFORMATION

3.1 DESCRIPTION OF EUT

Equipment	Network Security Platform		
Brand Name	ADVANTECH		
Test Model	FWA-1012VC		
Series Model	FWA-1012VCXXXXXXXXXXXXXXX (where X may be any alphanumeric character , blank or "-".)		
Model Difference	Different model distribute to different area.		
Power Source	DC Voltage supplied from AC/DC adapter.		
Power Rating	I/P: 100-240V~, 1.5A, 50-60Hz O/P: 12.0V⎓ 5.0A MAX		
Products Covered			
AC Adapter Manufacturer	FSP	Model	FSP060-DIBAN2
WWAN Module Manufacturer	Sierra	Model	EM7455 (FCC ID: N7NEM7455)
Specification information			
Modulation Type	WCDMA	UL: BPSK DL: QPSK	
	LTE	UL: QPSK,16QAM DL: QPSK,16QAM	
Frequency Range	TX: 824-849 MHz, RX: 869-894 MHz		

Band	Frequency	Channel Bandwidth	Modulation Type	Maximum ERP RF Power Output		Maximum Frequency Tolerance	Emission Designator
	MHz	MHz	-----	dBm	W	ppm	
WCDMA Band V	836.4	-	BPSK	20.16	0.104	0.0010	4M14F9W
LTE Band 5	836.5	10	QPSK	20.67	0.117	-0.0012	8M94G7D
	844	10	16QAM	20.07	0.102		8M94W7D

NOTE:

(1) For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.

(2) Table for Filed Antenna:

Brand	Model	Connector	Type	Antenna Gain(dBi)	
				WCDMA Band V	LTE Band 5
Advantech	TE FULL BAND DIPOLE ANTENNA(148)	SMA	DIPOLE	-0.06	-0.06

3.2 TEST MODES

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.
The EUT system operated these modes were found to be the worst case during the pre-scanning test as following:

WCDMA				
Test Items	Band	Test Channel		
		L	M	H
RF Power Output	V	V	V	V
Occupied Bandwidth	V	V	V	V
Out of Band Emissions	V	V		V
Spurious Emissions at Antenna Terminals	V		V	
Field strength of spurious radiation	V		V	
Frequency stability	V		V	

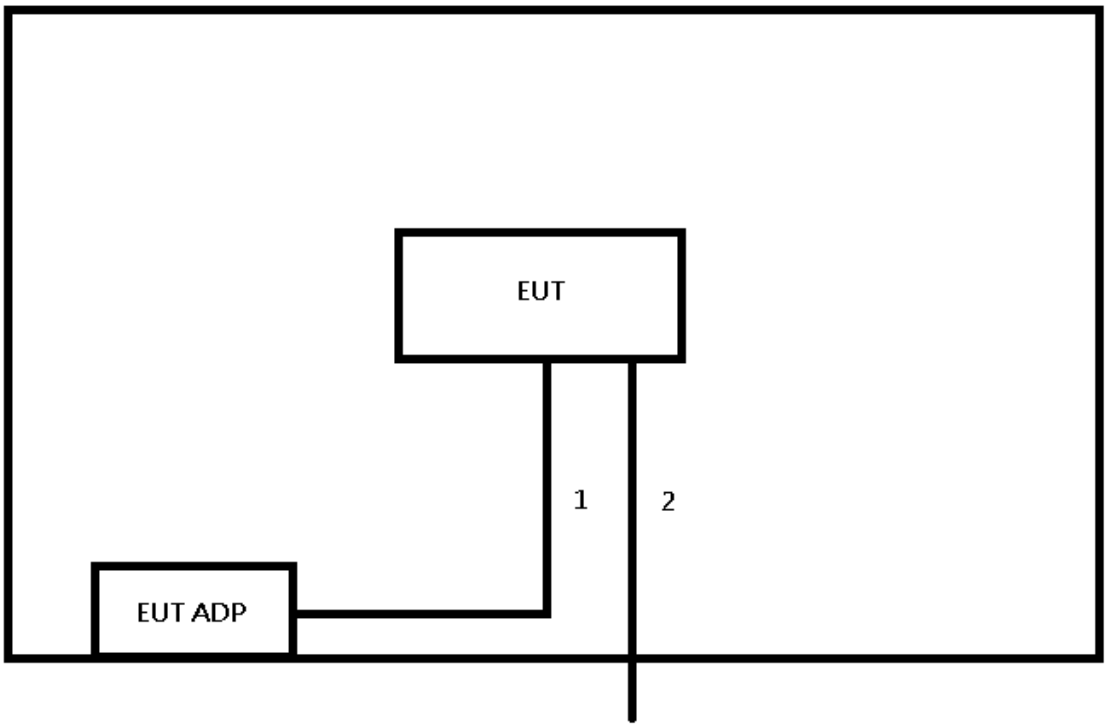
LTE															
Test Items	Band	Bandwidth (MHz)						Modulation		RB Size			Test Channel		
		1.4	3	5	10	15	20	QPSK	16QAM	1	Half	Full	L	M	H
RF Power Output	5	V	V	V	V	-	-	V	V	V	V	V	V	V	V
Occupied Bandwidth	5	V	V	V	V	-	-	V	V			V	V	V	V
Out of Band Emissions	5	V	V	V	V	-	-	V	V	V		V	V		V
Spurious Emissions at Antenna Terminals	5	V	V	V	V	-	-	V	V	V				V	
Field strength of spurious radiation	5				V	-	-	V		V				V	
Frequency stability	5	V	V	V	V	-	-	V		V				V	

NOTE:
(1) The marker “V” means this configuration is used for testing.
(2) The gray marker “-“ means this bandwidth is not supported.

EUT TEST CONDITIONS:

Test Item	Environmental Conditions	Test Voltage
RF Power Output	25 °C, 60 % RH	AC 120V/60Hz
Occupied Bandwidth	25 °C, 60 % RH	AC 120V/60Hz
Out of Band Emissions	25 °C, 60 % RH	AC 120V/60Hz
Spurious Emissions at Antenna Terminals	25 °C, 60 % RH	AC 120V/60Hz
Field strength of spurious radiation	23 °C, 70 % RH	AC 120V/60Hz
Frequency stability	Normal and Extreme	Normal and Extreme

3.3 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED



3.4 SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Brand	Model/Type No.	FCC ID	Series No.
-	-	-	-	-	-

Item	Shielded Type	Ferrite Core	Length	Note
1	YES	NO	1.5 m	Power Cable
2	NO	NO	3.0 m	LAN Cable

4 RF POWER OUTPUT TEST

4.1 LIMIT

The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 watts.

4.2 TEST PROCEDURE

EIRP / ERP Power Measurement:

EIRP = Conducted Power + Antenna gain.
ERP power = EIPR power - 2.15 dBi.

Conducted Power Measurement:

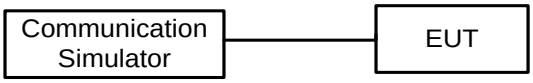
The EUT was set up for the maximum power with WCDMA and LTE link data modulation and link up with simulator. Set the EUT to transmit under low, middle and high channel and record the power level shown on simulator.

4.3 DEVIATION FROM TEST STANDARD

No deviation.

4.4 TEST SETUP

Conducted Power Measurement:



4.5 TEST RESULT

Please refer to the APPENDIX A.

5 OCCUPIED BANDWIDTH TEST

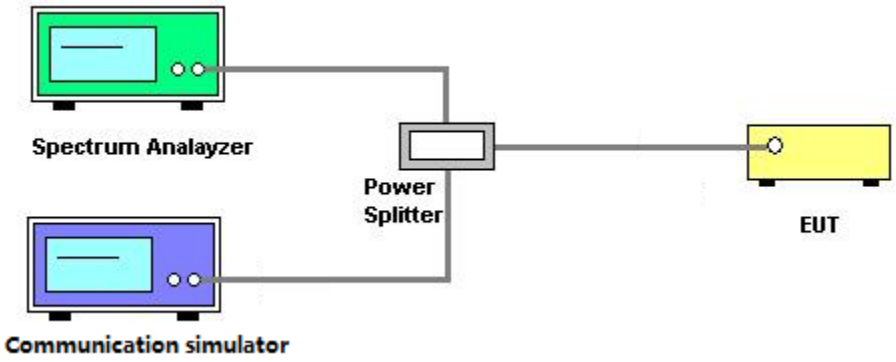
5.1 TEST PROCEDURE

The EUT makes a call to the communication simulator. All measurements were done at low, middle and high operational frequency range. The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency. Use OBW measurement function of Spectrum analyzer to measure 99 % occupied bandwidth and 26 dB bandwidth.

5.2 DEVIATION FROM TEST STANDARD

No deviation.

5.3 TEST SETUP



5.4 TEST RESULT

Please refer to the APPENDIX B.

6 OUT OF BAND EMISSIONS TEST

6.1 LIMIT

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

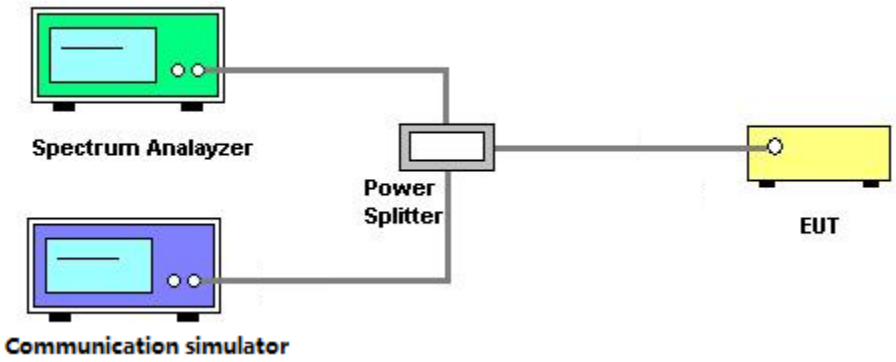
6.2 TEST PROCEDURE

a. All measurements were done at low and high operational frequency range.
b. The center frequency of spectrum is the band edge frequency and span is 5 MHz. RB of the spectrum is 100 kHz and VB of the spectrum is 300 kHz (WCDMA).
c. The center frequency of spectrum is the band edge frequency and span is 1 MHz. RB of the spectrum is 13 kHz and VB of the spectrum is 51 kHz (LTE Bandwidth 1.4MHz).
d. The center frequency of spectrum is the band edge frequency and span is 1 MHz. RB of the spectrum is 30 kHz and VB of the spectrum is 100 kHz (LTE Bandwidth 3MHz).
e. The center frequency of spectrum is the band edge frequency and span is 1 MHz. RB of the spectrum is 100 kHz and VB of the spectrum is 300 kHz (LTE Bandwidth 5MHz/10MHz).
f. Record the max trace plot into the test report.

6.3 DEVIATION FROM TEST STANDARD

No deviation.

6.4 TEST SETUP



6.5 TEST RESULT

Please refer to the APPENDIX C.

7 SPURIOUS EMISSIONS AT ANTENNA TERMINALS TEST

7.1 LIMIT

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.
The emission limit is equal to -13 dBm.

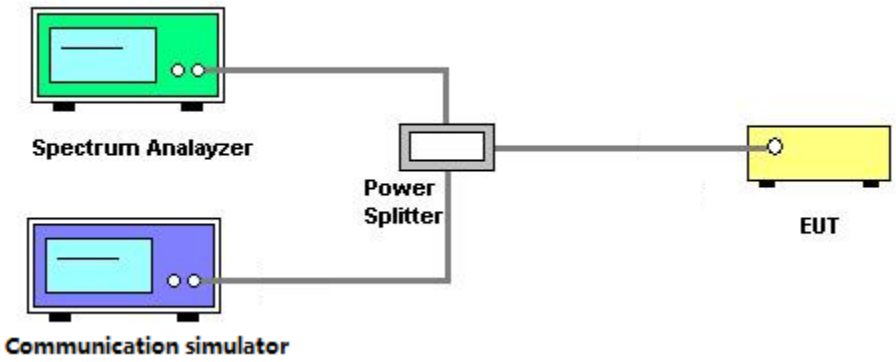
7.2 TEST PROCEDURE

a. The testing follows FCC KDB 971168 D01 Power Meas License Digital Systems v03r01.
b. The EUT was connected to spectrum analyzer and system simulator via a power divider.
c. The band edges of low and high channels for the highest RF powers were measured. Set RBW ≥ 1% EBW in the 1 MHz band immediately outside and adjacent to the band edge.
d. Set spectrum analyzer with RMS detector.
e. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
f. The limit line is derived from 43 + 10log(P) dB below the transmitter power P (Watts)
= P(W) - [43 + 10 log(P)] (dB)
= [30 + 10 log(P)] (dBm) - [43 + 10 log(P)] (dB)
= - 13 dBm

7.3 DEVIATION FROM TEST STANDARD

No deviation.

7.4 TEST SETUP



7.5 TEST RESULT

Please refer to the APPENDIX D.

8 FIELD STRENGTH OF SPURIOUS RADIATION TEST

8.1 LIMIT

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.
The emission limit is equal to -13 dBm.

8.2 TEST PROCEDURE

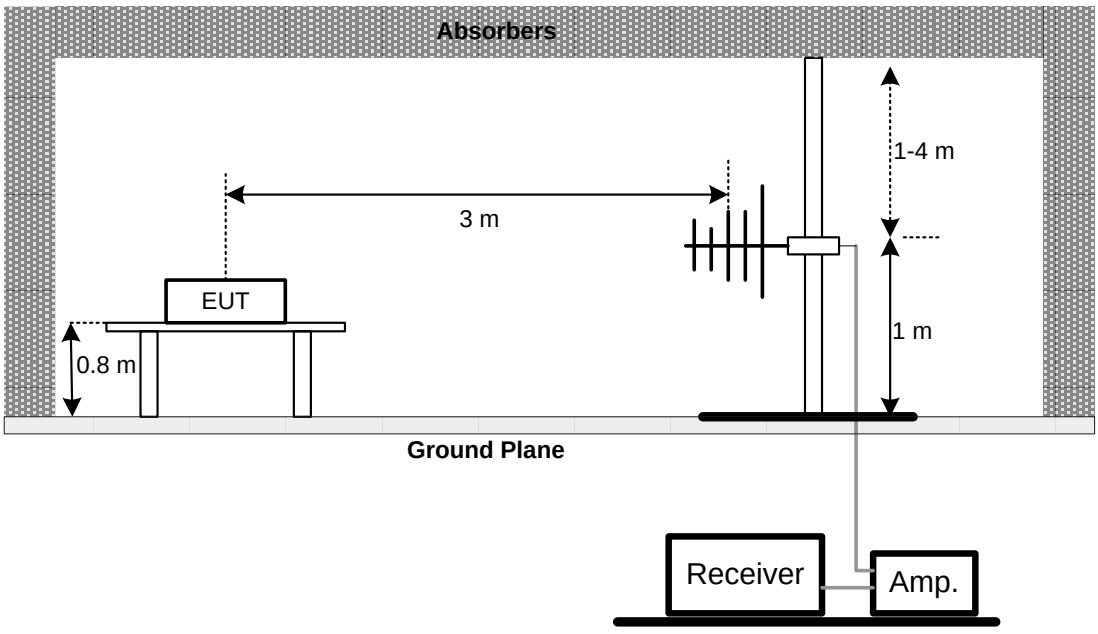
a. In the semi-anechoic chamber, EUT placed on the 0.8 m height of Turn Table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1 m to 4 m to find the maximum polar radiated power. The “Read Value” is the spectrum reading the maximum power value.
b. The substitution horn antenna is substituted for EUT at the same position and signals generator export the CW signal to the substitution antenna via a TX cable. Rotated the Turn Table and moved receiving antenna to find the maximum radiation power. Adjust output power level of S.G to get a Value of spectrum reading equal to “Read Value “ of step a. Record the power level of S.G.
c. EIRP = Output power level of S.G - TX cable loss + Antenna gain of substitution horn.
d. ERP power can be calculated form EIRP power by subtracting the gain of dipole, ERP power = EIRP power - 2.15 dBi.
e. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz / 3 MHz.

8.3 DEVIATION FROM TEST STANDARD

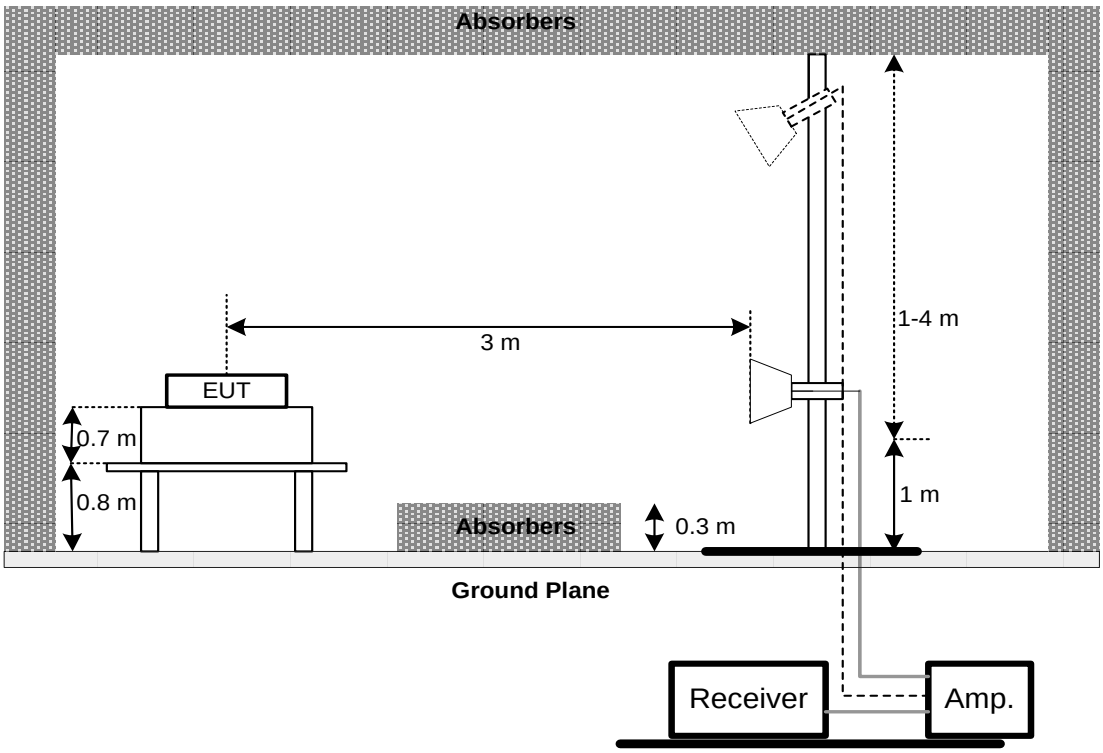
No deviation.

8.4 TEST SETUP

30 MHz to 1 GHz



Above 1 GHz



8.5 TEST RESULT

Please refer to the APPENDIX E.

9 FREQUENCY STABILITY TEST

9.1 LIMIT

Frequency range (MHz)	Base, fixed (ppm)	Mobile > 3 watts (ppm)	Mobile ≤ 3 watts (ppm)
821 to 896	1.5	2.5	2.5

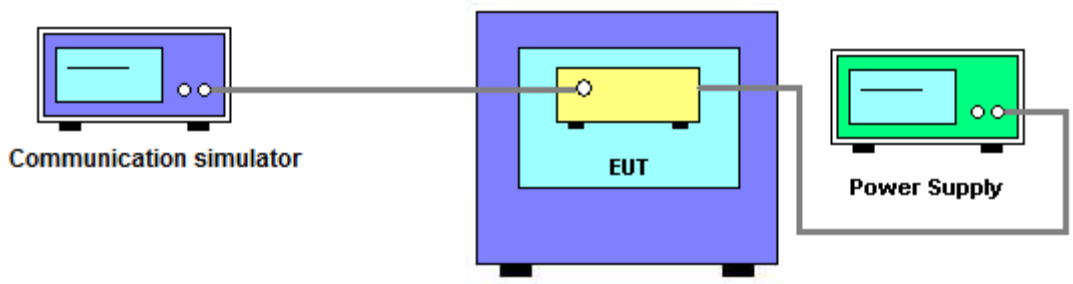
9.2 TEST PROCEDURE

a. Device is placed at the oven room. The oven room could control the temperatures and humidity. Power warm up is at least 15 min and power applied should perform before recording frequency error.
b. EUT is connected the external power supply to control the DC input power. The test voltage range is from minimum to maximum working voltage. Each step shall be record the frequency error rate.
c. The temperature range step is 10 degrees in this test items. All temperature levels shall be hold the ± 0.5°C during the measurement testing. The each temperature step shall be at least 0.5 hours, consider the EUT could be test under the stability condition.
d. The frequency error was recorded frequency error from the communication simulator.

9.3 DEVIATION FROM TEST STANDARD

No deviation.

9.4 TEST SETUP



9.5 TEST RESULT

Please refer to the APPENDIX F.

10 LIST OF MEASURING EQUIPMENTS

RF Power Output and Frequency stability					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Wireless Communications Test Set (WCDMA)	Agilent	8960	US38080149	Oct. 16, 2018
2	Radio Communication Analyzer (LTE)	Anritsu	MT8820C	6201525878	Nov. 04, 2018

Occupied Bandwidth, Out of Band Emissions and Spurious Emissions at Antenna Terminals					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	EXA Signal Analyzer	Agilent	N9010A	MY54200240	Oct. 01, 2018
2	Wireless Communications Test Set (WCDMA)	Agilent	8960	US38080149	Oct. 16, 2018
3	Radio Communication Analyzer (LTE)	Anritsu	MT8820C	6201525878	Nov. 04, 2018

Field strength of spurious radiation					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Preamplifier	EMCI	012645B	980267	Feb. 27, 2019
2	Preamplifier	EMCI	EMC02325	980217	Dec. 27, 2018
3	Preamplifier	EMCI	EMC2654045	980030	Feb. 13, 2019
4	Test Cable	EMCI	EMC104-SM-SM-8000	8m	Jan. 03, 2019
5	Test Cable	EMCI	EMC104-SM-SM-800	150207	Jan. 03, 2019
6	Test Cable	EMCI	EEMC104-SM-SM-3000	151205	Jan. 03, 2019
7	MXE EMI Receiver	Agilent	N9038A	MY55420127	Jan. 08, 2019
8	Signal Analyzer	Agilent	N9010A	MY52220990	Feb. 21, 2019
9	Loop Ant	EMCI	LPA600	274	May 03, 2019
10	Horm Ant	SCHWARZBECK	BBHA 9120D	9120D-1342	Feb. 27, 2019
11	Horm Ant	Schwarzbeck	BBHA 9170	187	Dec. 05, 2018
12	Trilog-Broadband Antenna	Schwarzbeck	VULB 9168	9168-548	Jan. 15, 2019
13	5dB Attenuator	EMCI	EMCI-N-6-05	AT-N0623	Jan. 15, 2019
14	Wireless Communications Test Set (WCDMA)	Agilent	8960	US38080149	Oct. 16, 2018
15	Radio Communication Analyzer (LTE)	Anritsu	MT8820C	6201525878	Nov. 04, 2018

Remark: "N/A" denotes no model name, no serial no. or no calibration specified.
All calibration period of equipment list is one year.

APPENDIX A RF POWER OUTPUT

CONTINUE ON NEXT PAGE

Band		WCDMA Band V					
Antenna Gain (dBi)	-0.06	Conducted Power (dBm)			ERP Power (dBm)		
Tx Channel		4132	4183	4233	4132	4182	4233
Rx Channel		4357	4407	4458	4357	4407	4458
Frequency (MHz)		826.4	836.4	846.6	826.4	836.4	846.6
RMC 12.2K		22.36	**22.37**	22.33	20.15	**20.16**	20.12
HSDPA Subtest-1		21.49	21.33	21.30	19.28	19.12	19.09
HSDPA Subtest-2		21.61	21.37	21.38	19.40	19.16	19.17
HSDPA Subtest-3		21.02	20.88	20.89	18.81	18.67	18.68
HSDPA Subtest-4		21.01	20.85	20.82	18.80	18.64	18.61
HSUPA Subtest-1		21.36	21.30	21.30	19.15	19.09	19.09
HSUPA Subtest-2		20.32	20.19	20.21	18.11	17.98	18.00
HSUPA Subtest-3		19.92	19.89	19.91	17.71	17.68	17.70
HSUPA Subtest-4		20.72	20.62	20.56	18.51	18.41	18.35
HSUPA Subtest-5		21.22	21.18	21.07	19.01	18.97	18.86

Remark: ERP power = Conducted Power + Antenna gain - 2.15.

Band			LTE Band 5					
Antenna Gain (dBi)	-0.06		Conducted Power (dBm)			ERP Power (dBm)		
Channel Bandwidth (MHz)	Modulation	RB Size/Offset	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
			20407	20525	20643	20407	20525	20643
			824.7 MHz	836.5 MHz	848.3 MHz	824.7 MHz	836.5 MHz	848.3 MHz
1.4	QPSK	1/0	22.44	**22.50**	22.42	20.23	**20.29**	20.21
		1/2	22.17	22.37	22.46	19.96	20.16	20.25
		1/5	22.18	22.30	22.31	19.97	20.09	20.10
		3/0	21.11	21.17	21.23	18.90	18.96	19.02
		3/1	21.20	21.29	21.30	18.99	19.08	19.09
		3/3	21.10	21.18	21.14	18.89	18.97	18.93
		6/0	21.12	21.30	21.21	18.91	19.09	19.00
	16QAM	1/0	21.46	21.86	**21.88**	19.25	19.65	**19.67**
		1/2	21.87	21.67	21.52	19.66	19.46	19.31
		1/5	21.10	21.46	21.75	18.89	19.25	19.54
		3/0	20.01	20.25	20.33	17.80	18.04	18.12
		3/1	20.18	20.31	20.22	17.97	18.10	18.01
		3/3	20.01	20.24	20.09	17.80	18.03	17.88
		6/0	20.18	20.19	20.14	17.97	17.98	17.93

Band			LTE Band 5					
Antenna Gain (dBi)	-0.06		Conducted Power (dBm)			ERP Power (dBm)		
Channel Bandwidth (MHz)	Modulation	RB Size/Offset	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
			20415	20525	20635	20415	20525	20635
			825.5 MHz	836.5 MHz	847.5 MHz	825.5 MHz	836.5 MHz	847.5 MHz
3	QPSK	1/0	22.56	**22.62**	22.54	20.35	**20.41**	20.33
		1/7	22.29	22.49	22.58	20.08	20.28	20.37
		1/14	22.30	22.42	22.43	20.09	20.21	20.22
		8/0	21.24	21.30	21.36	19.03	19.09	19.15
		8/3	21.32	21.41	21.42	19.11	19.20	19.21
		8/7	21.22	21.30	21.26	19.01	19.09	19.05
		15/0	21.24	21.42	21.33	19.03	19.21	19.12
	16QAM	1/0	21.59	21.99	**22.01**	19.38	19.78	**19.80**
		1/7	21.99	21.79	21.64	19.78	19.58	19.43
		1/14	21.22	21.58	21.87	19.01	19.37	19.66
		8/0	20.13	20.37	20.45	17.92	18.16	18.24
		8/3	20.30	20.43	20.34	18.09	18.22	18.13
		8/7	20.13	20.36	20.21	17.92	18.15	18.00
		15/0	20.30	20.31	20.26	18.09	18.10	18.05

Remark: ERP power = Conducted Power + Antenna gain - 2.15.

Band			LTE Band 5					
Antenna Gain (dBi)	-0.06		Conducted Power (dBm)			ERP Power (dBm)		
Channel Bandwidth (MHz)	Modulation	RB Size/Offset	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
			20425	20525	20625	20425	20525	20625
			826.5 MHz	836.5 MHz	846.5 MHz	826.5 MHz	836.5 MHz	846.5 MHz
5	QPSK	1/0	22.69	**22.75**	22.67	20.48	**20.54**	20.46
		1/12	22.42	22.62	22.71	20.21	20.41	20.50
		1/24	22.43	22.55	22.56	20.22	20.34	20.35
		12/0	21.37	21.43	21.49	19.16	19.22	19.28
		12/6	21.47	21.56	21.57	19.26	19.35	19.36
		12/13	21.37	21.45	21.41	19.16	19.24	19.20
		25/0	21.39	21.57	21.48	19.18	19.36	19.27
	16QAM	1/0	21.74	22.14	**22.16**	19.53	19.93	**19.95**
		1/12	22.10	21.90	21.75	19.89	19.69	19.54
		1/24	21.33	21.69	21.98	19.12	19.48	19.77
		12/0	20.24	20.48	20.56	18.03	18.27	18.35
		12/6	20.50	20.63	20.54	18.29	18.42	18.33
		12/13	20.33	20.56	20.41	18.12	18.35	18.20
		25/0	20.50	20.51	20.46	18.29	18.30	18.25

Band			LTE Band 5					
Antenna Gain (dBi)	-0.06		Conducted Power (dBm)			ERP Power (dBm)		
Channel Bandwidth (MHz)	Modulation	RB Size/Offset	Low CH	Mid CH	High CH	Low CH	Mid CH	High CH
			20450	20525	20600	20450	20525	20600
			829 MHz	836.5 MHz	844 MHz	829 MHz	836.5 MHz	844 MHz
10	QPSK	1/0	22.82	**22.88**	22.80	20.61	**20.67**	20.59
		1/24	22.55	22.75	22.84	20.34	20.54	20.63
		1/49	22.56	22.68	22.69	20.35	20.47	20.48
		25/0	21.50	21.56	21.62	19.29	19.35	19.41
		25/12	21.59	21.68	21.69	19.38	19.47	19.48
		25/25	21.49	21.57	21.53	19.28	19.36	19.32
		50/0	21.51	21.69	21.60	19.30	19.48	19.39
	16QAM	1/0	21.86	22.26	**22.28**	19.65	20.05	**20.07**
		1/24	22.27	22.07	21.92	20.06	19.86	19.71
		1/49	21.50	21.86	22.15	19.29	19.65	19.94
		25/0	20.41	20.65	20.73	18.20	18.44	18.52
		25/12	20.59	20.72	20.63	18.38	18.51	18.42
		25/25	20.42	20.65	20.50	18.21	18.44	18.29
		50/0	20.59	20.60	20.55	18.38	18.39	18.34

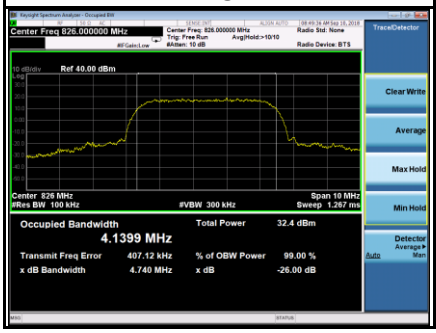
Remark: ERP power = Conducted Power + Antenna gain - 2.15.

APPENDIX B OCCUPIED BANDWIDTH

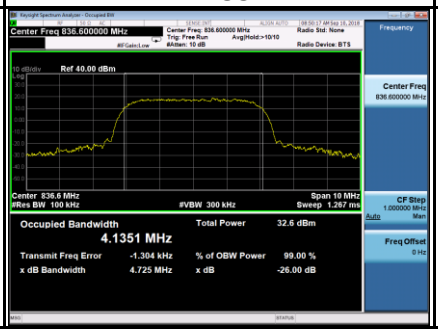
CONTINUE ON NEXT PAGE

Band	WCDMA Band V		
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)	26 dB Bandwidth (MHz)
4132	826.0	4.1399	4.740
4183	836.6	4.1351	4.725
4233	846.6	4.1251	4.706

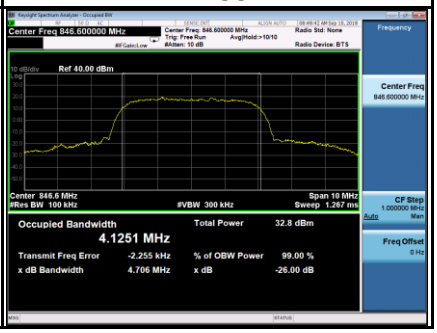
4132



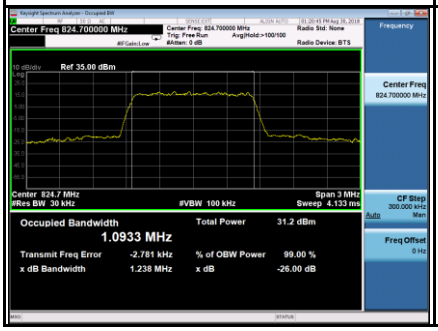
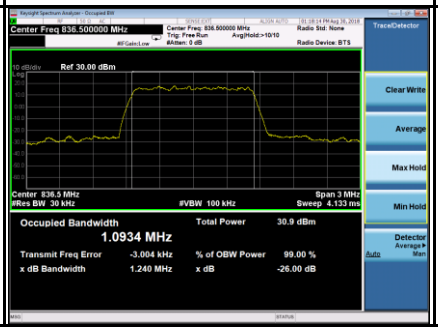
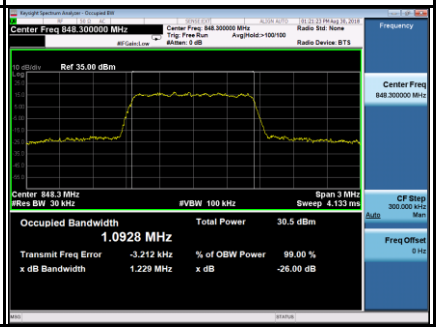
4183



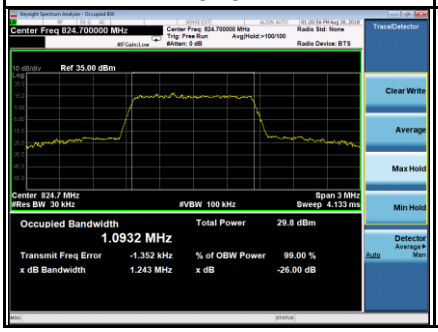
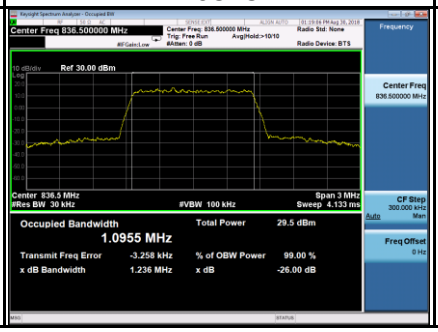
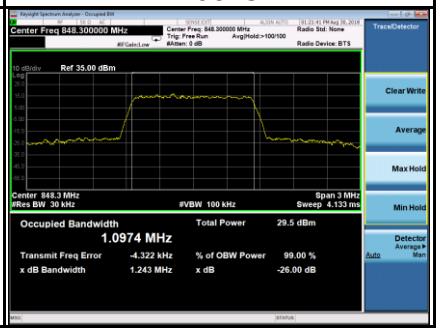
4233



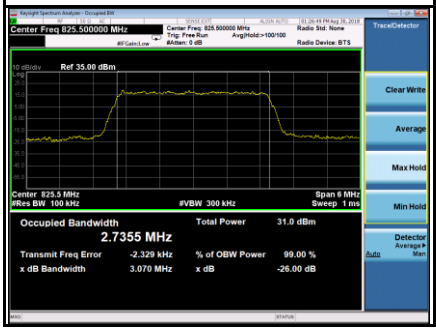
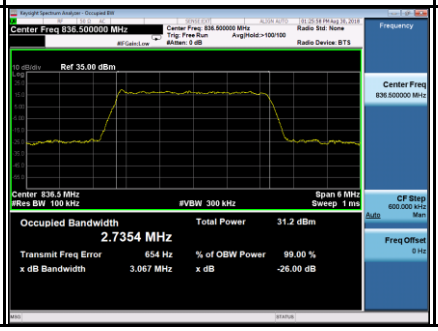
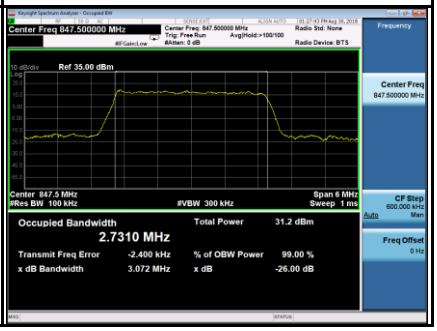
Band	LTE Band 5		
Channel Bandwidth (MHz)	1.4	Modulation	QPSK
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)	26 dB Bandwidth (MHz)
20407	824.7	1.0933	1.238
20525	836.5	1.0934	1.240
20643	848.3	1.0928	1.229

20407	20525	20643
		

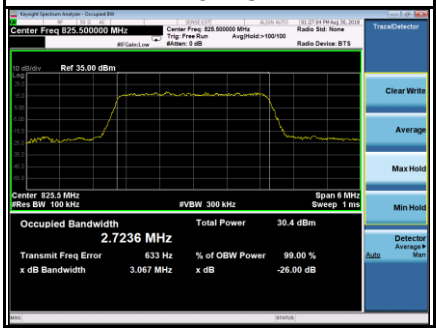
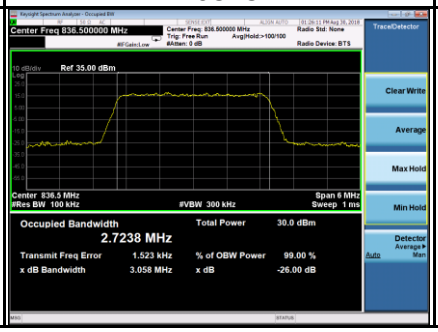
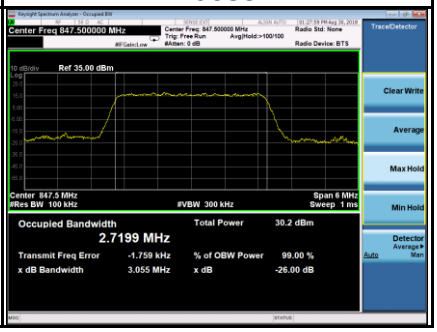
Band	LTE Band 5		
Channel Bandwidth (MHz)	1.4	Modulation	16QAM
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)	26 dB Bandwidth (MHz)
20407	824.7	1.0932	1.243
20525	836.5	1.0955	1.236
20643	848.3	1.0974	1.243

20407	20525	20643
		

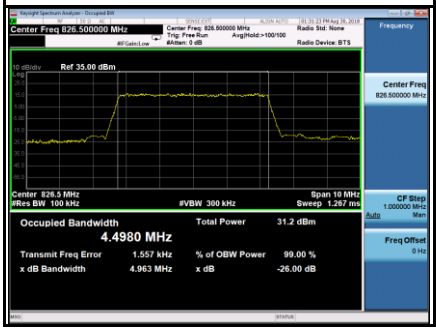
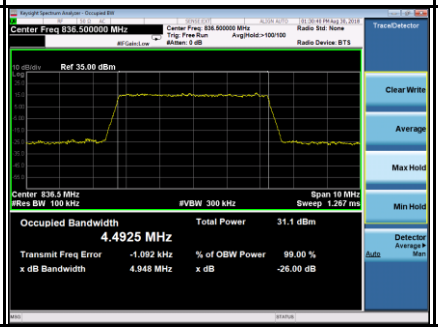
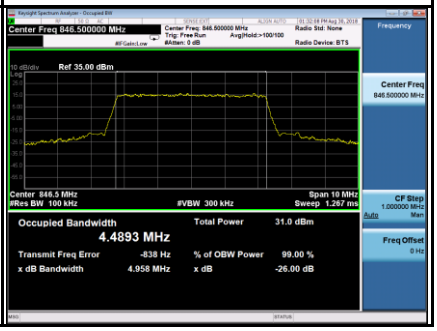
Band	LTE Band 5		
Channel Bandwidth (MHz)	3	Modulation	QPSK
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)	26 dB Bandwidth (MHz)
20415	825.5	2.7355	3.070
20525	836.5	2.7354	3.067
20635	847.5	2.7310	3.072

20415	20525	20635
		

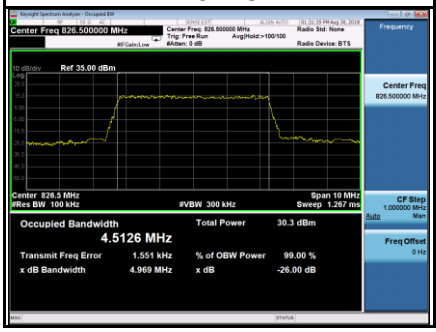
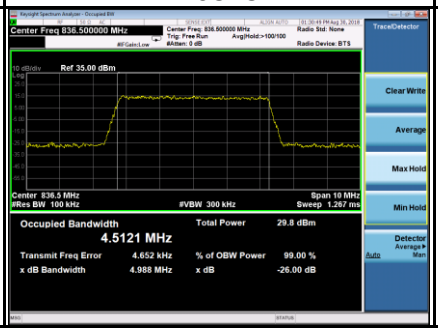
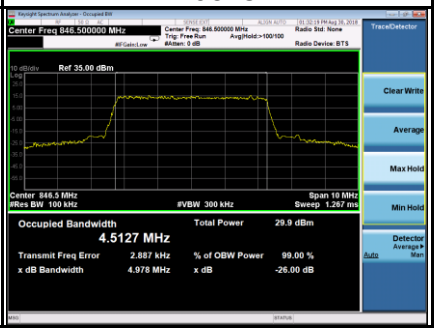
Band	LTE Band 5		
Channel Bandwidth (MHz)	3	Modulation	16QAM
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)	26 dB Bandwidth (MHz)
20415	825.5	2.7236	3.067
20525	836.5	2.7238	3.058
20635	847.5	2.7199	3.055

20415	20525	20635
		

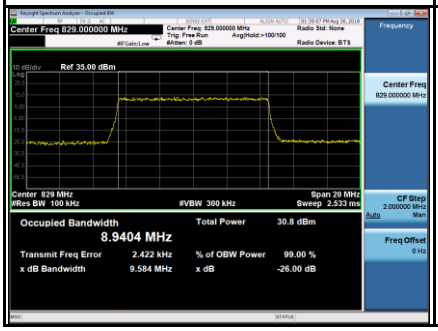
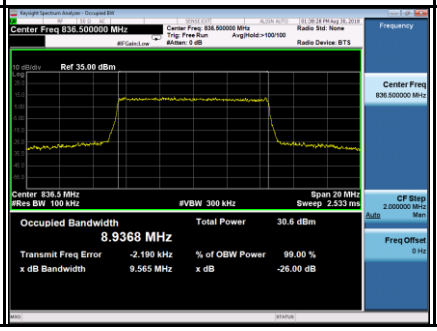
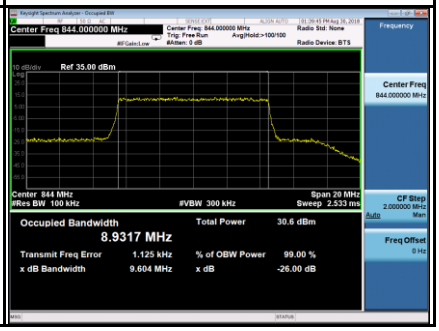
Band	LTE Band 5		
Channel Bandwidth (MHz)	5	Modulation	QPSK
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)	26 dB Bandwidth (MHz)
20425	826.5	4.4980	4.963
20525	836.5	4.4925	4.948
20625	846.5	4.4893	4.958

20425	20525	20625
		

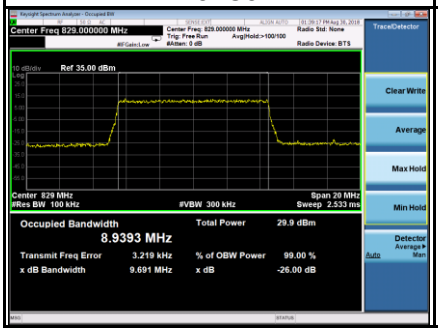
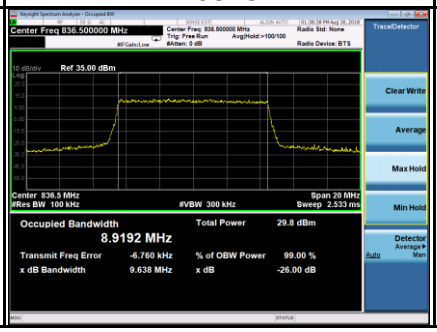
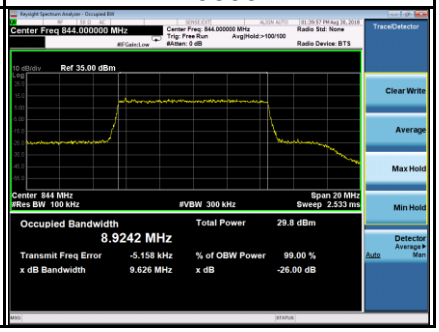
Band	LTE Band 5		
Channel Bandwidth (MHz)	5	Modulation	16QAM
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)	26 dB Bandwidth (MHz)
20425	826.5	4.5126	4.969
20525	836.5	4.5121	4.988
20625	846.5	4.5127	4.978

20425	20525	20625
		

Band	LTE Band 5		
Channel Bandwidth (MHz)	10	Modulation	QPSK
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)	26 dB Bandwidth (MHz)
20450	829.0	8.9404	9.584
20525	836.5	8.9368	9.565
20600	844.0	8.9317	9.604

20450	20525	20600
		

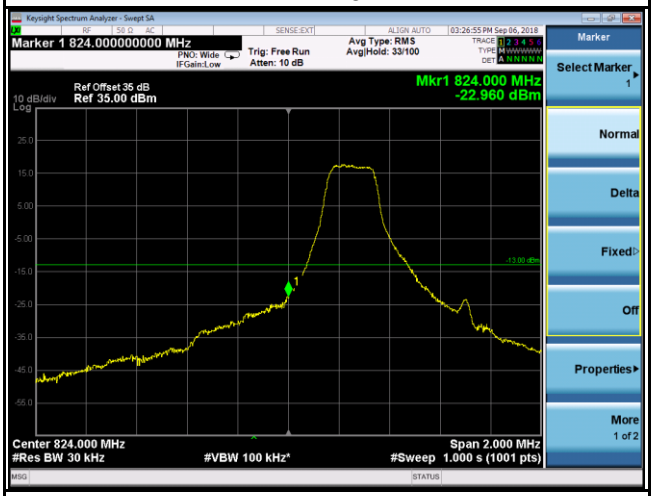
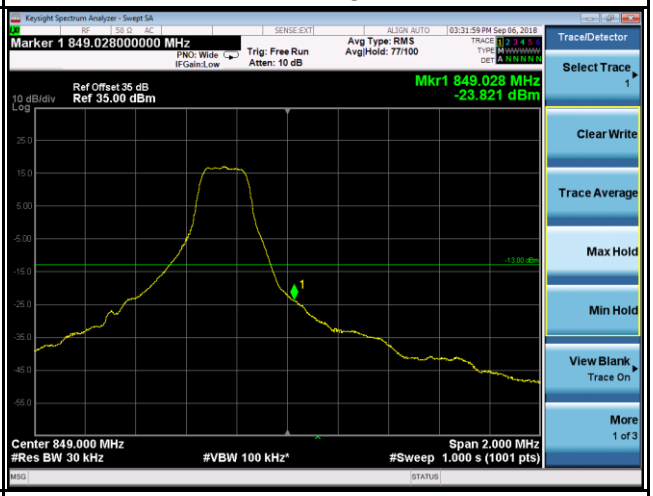
Band	LTE Band 5		
Channel Bandwidth (MHz)	10	Modulation	16QAM
Channel	Frequency (MHz)	99 % Occupied Bandwidth (MHz)	26 dB Bandwidth (MHz)
20450	829.0	8.9393	9.691
20525	836.5	8.9192	9.638
20600	844.0	8.9242	9.262

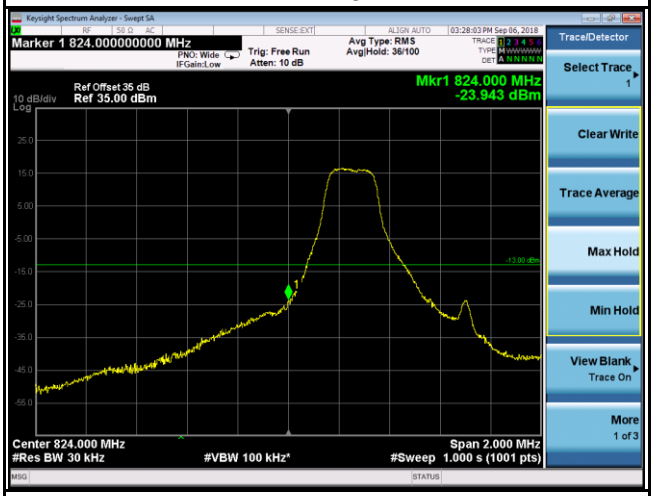
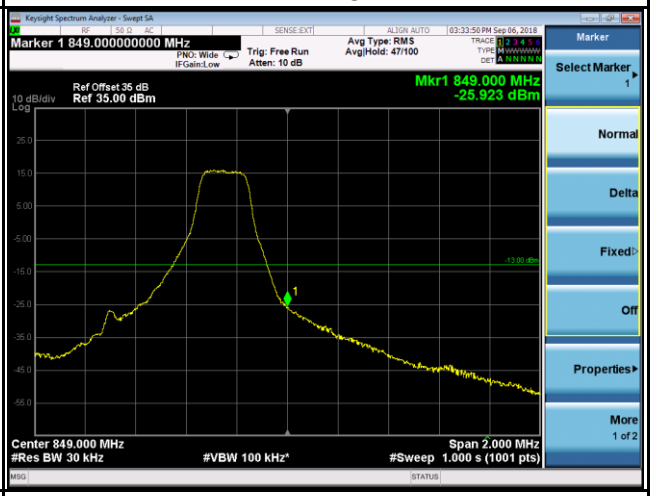
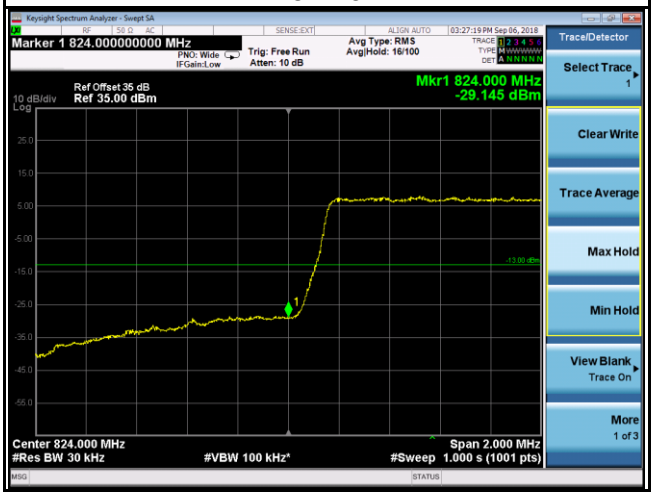
20450	20525	20600
		

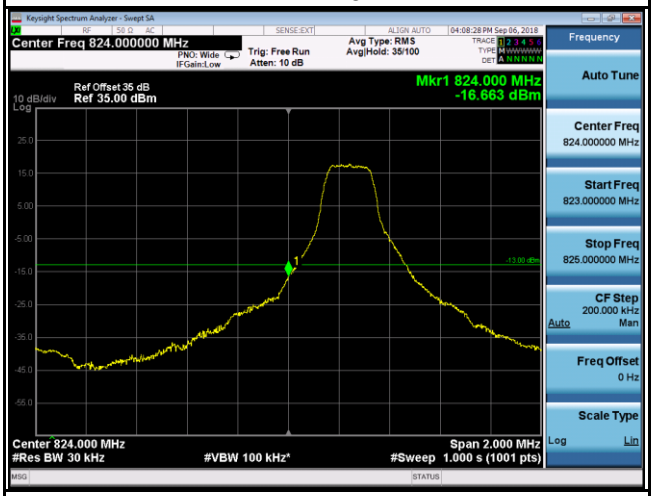
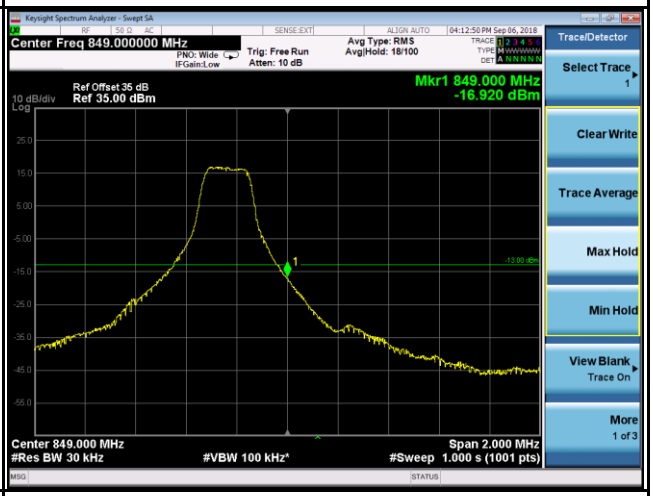
APPENDIX C OUT OF BAND EMISSIONS

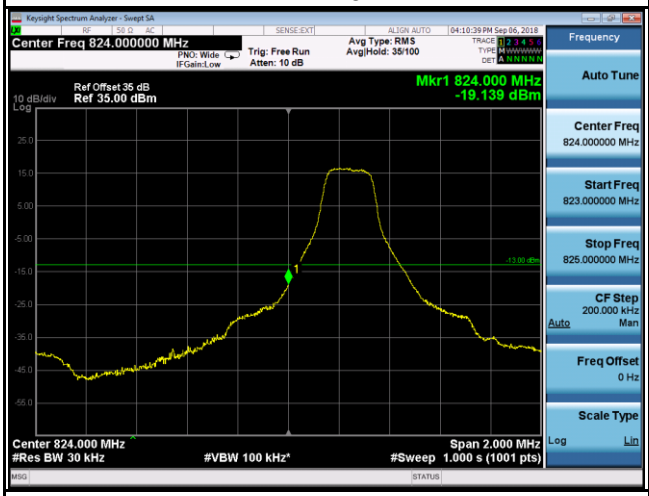
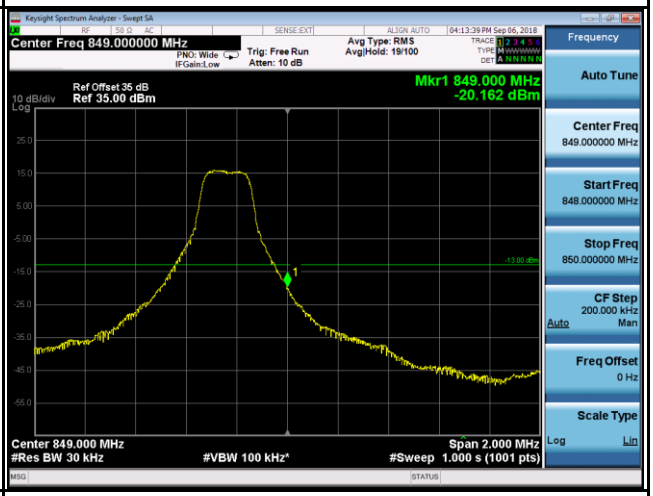
CONTINUE ON NEXT PAGE

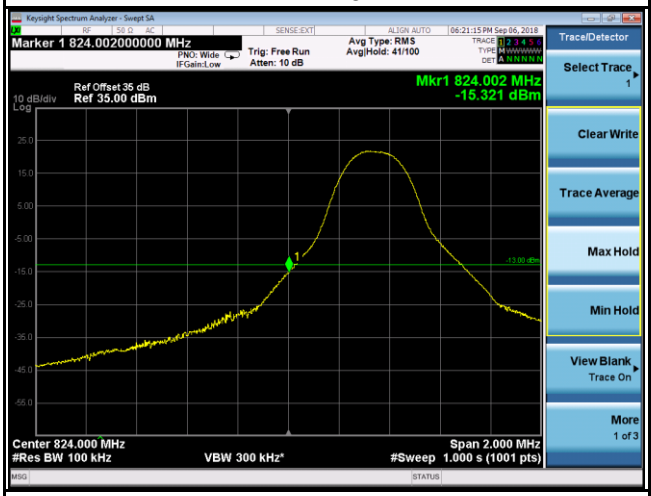
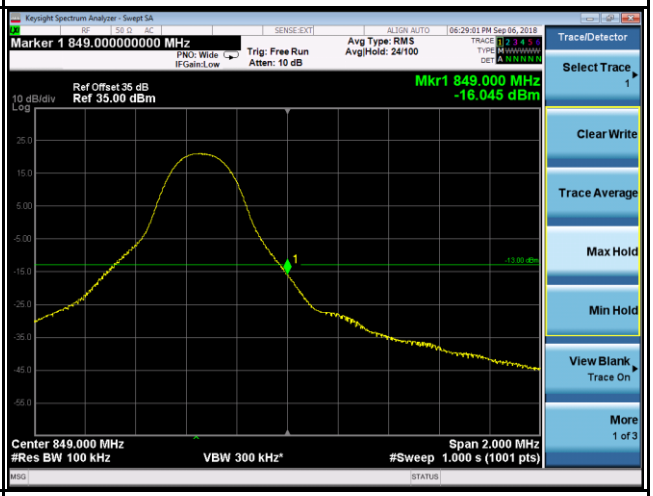
Band	WCDMA Band V
4132	**4233**
	

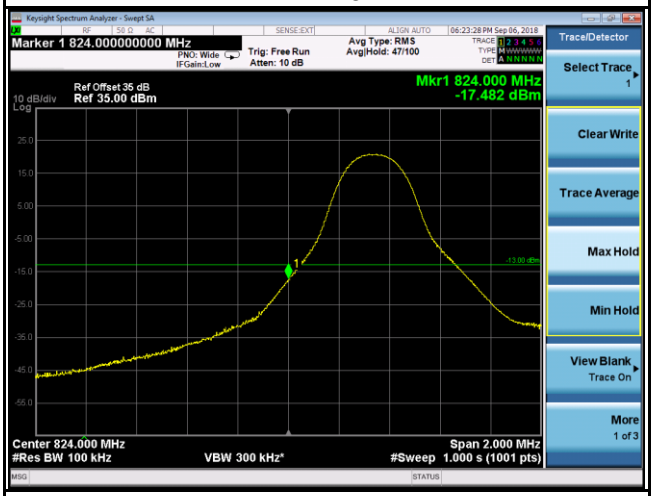
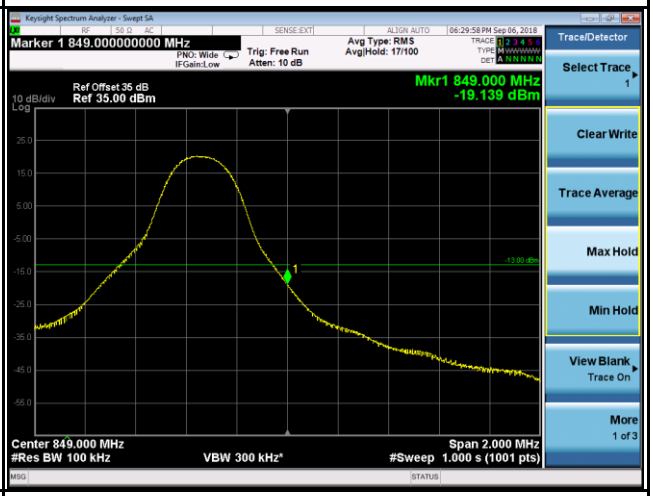
Band	LTE Band 5		
Channel Bandwidth (MHz)	1.4	Modulation	QPSK
20407		**20643**	
1RB0		**1RB5**	
			
6RB0		**6RB0**	
			

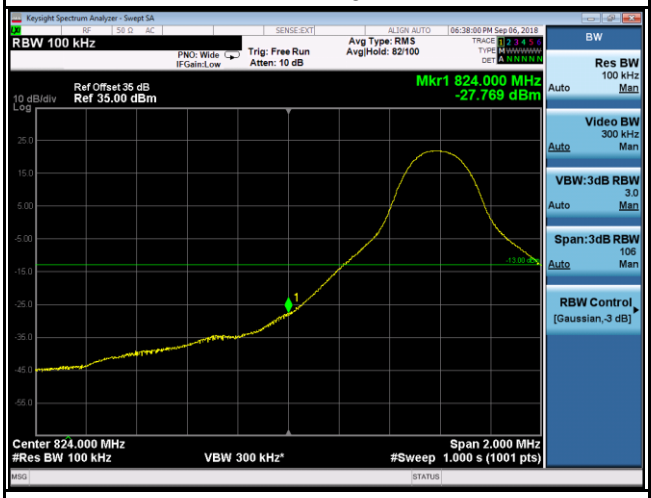
Band	LTE Band 5		
Channel Bandwidth (MHz)	1.4	Modulation	16QAM
20407		**20643**	
1RB0		**1RB5**	
			
6RB0		**6RB0**	
			

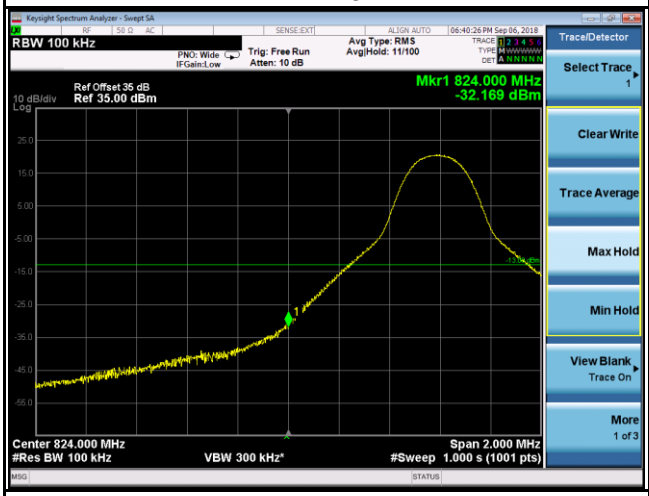
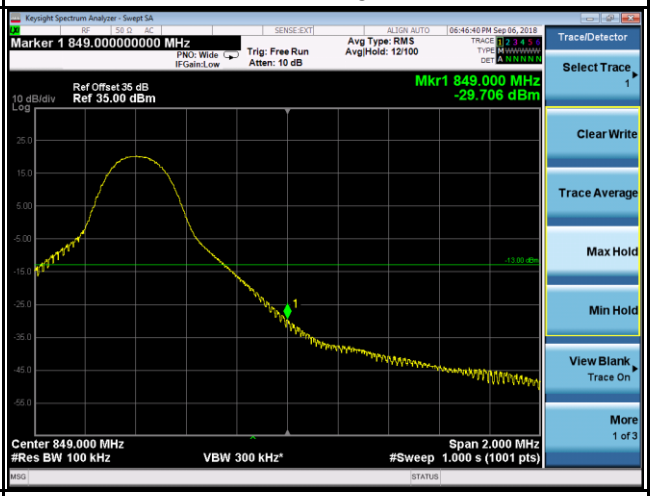
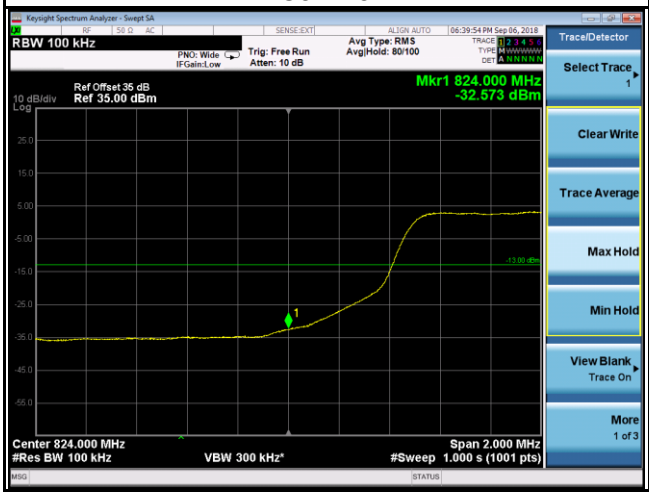
Band	LTE Band 5		
Channel Bandwidth (MHz)	3	Modulation	QPSK
20415		**20635**	
1RB0		**1RB14**	
			
15RB0		**15RB0**	
			

Band	LTE Band 5		
Channel Bandwidth (MHz)	3	Modulation	16QAM
20415		**20635**	
1RB0		**1RB14**	
			
15RB0		**15RB0**	
			

Band	LTE Band 5		
Channel Bandwidth (MHz)	5	Modulation	QPSK
20425		**20625**	
1RB0		**1RB24**	
			
25RB0		**25RB0**	
			

Band	LTE Band 5		
Channel Bandwidth (MHz)	5	Modulation	16QAM
20425		**20625**	
1RB0		**1RB24**	
			
25RB0		**25RB0**	
			

Band	LTE Band 5		
Channel Bandwidth (MHz)	10	Modulation	QPSK
20450		**20600**	
1RB0		**1RB49**	
			
50RB0		**50RB0**	
			

Band	LTE Band 5		
Channel Bandwidth (MHz)	10	Modulation	16QAM
20450		**20600**	
1RB0		**1RB49**	
			
50RB0		**50RB0**	
			

APPENDIX D SPURIOUS EMISSIONS AT ANTENNA TERMINALS

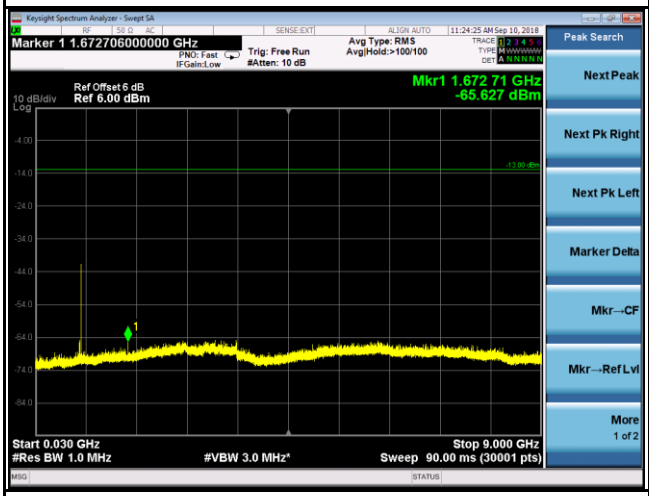
CONTINUE ON NEXT PAGE

Band	WCDMA Band V	Channel	4183
			

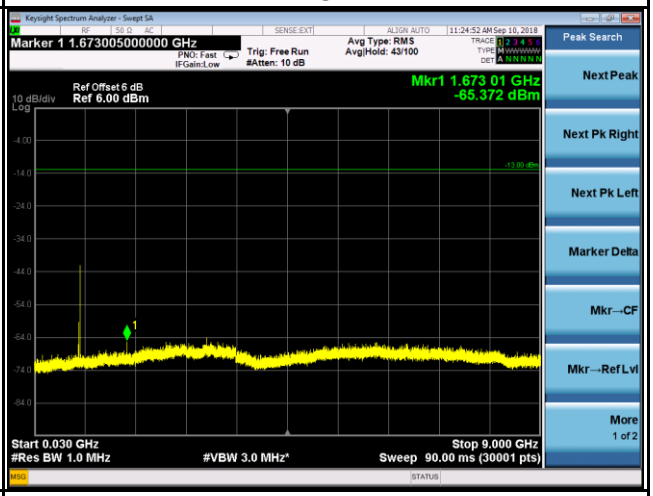
Band	LTE Band 5	Channel	20525

Channel Bandwidth (MHz)

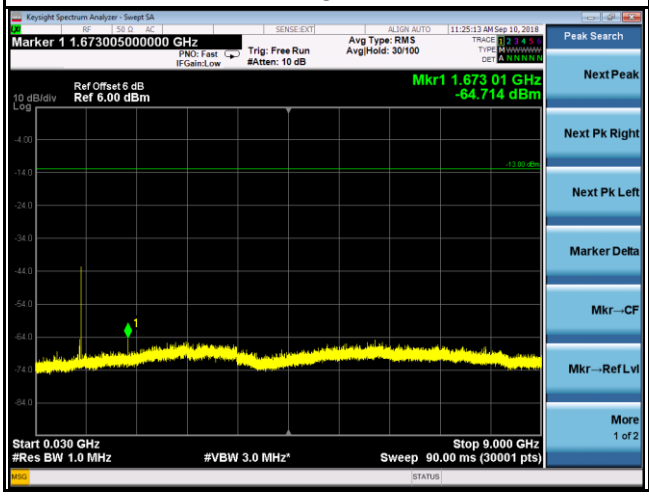
1.4



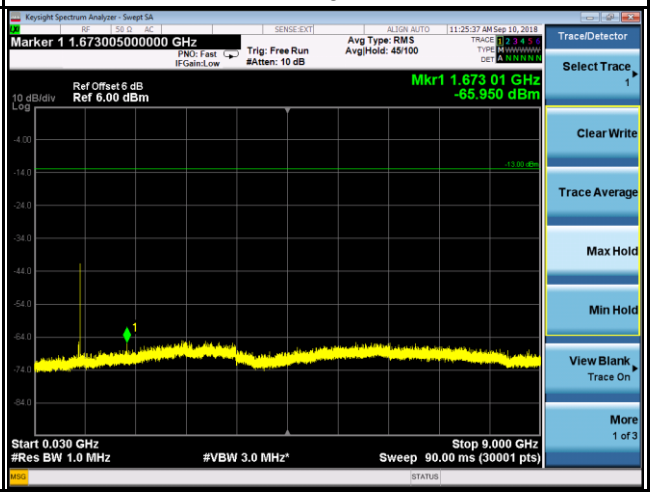
3



5



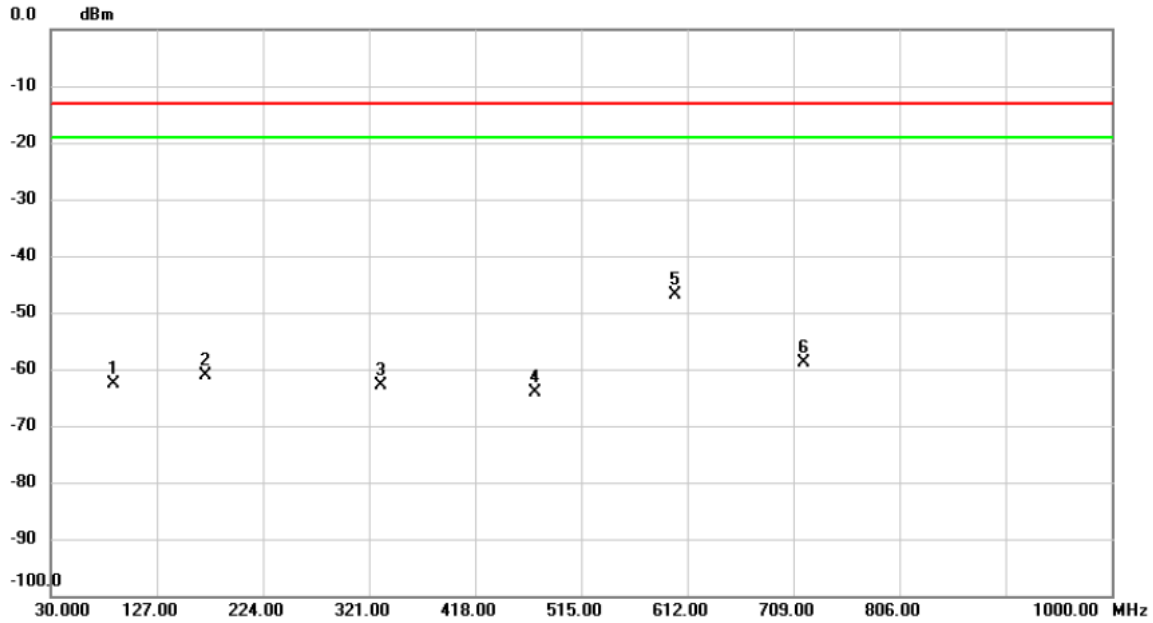
10



APPENDIX E FIELD STRENGTH OF SPURIOUS RADIATION

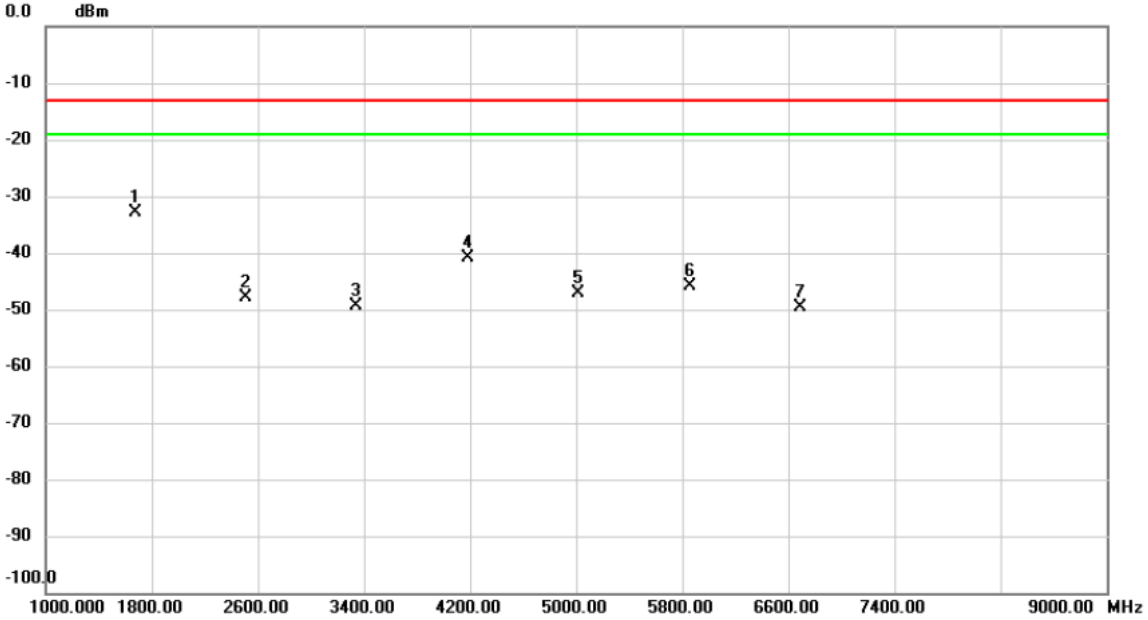
CONTINUE ON NEXT PAGE

Test Mode	WCDMA Band V Link	Polarization	Vertical



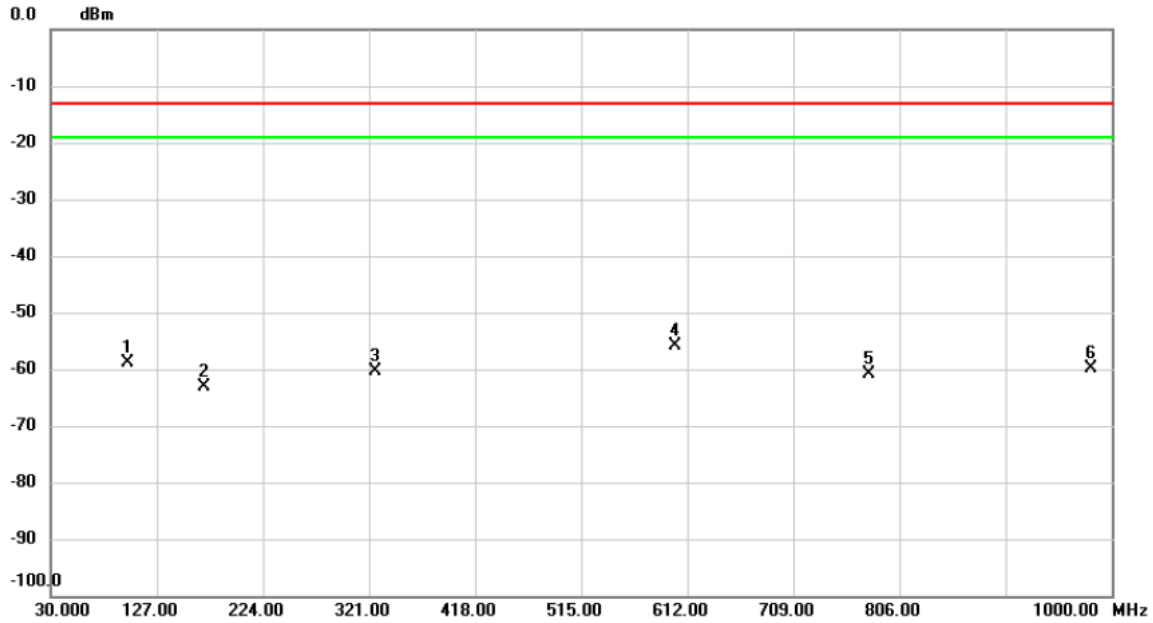
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1		87.2300	-60.62	-2.01	-62.63	-13.00	-49.63	peak	
2		171.6200	-67.72	6.59	-61.13	-13.00	-48.13	peak	
3		331.6700	-64.22	1.27	-62.95	-13.00	-49.95	peak	
4		472.3200	-67.46	3.45	-64.01	-13.00	-51.01	peak	
5	*	600.3600	-54.75	7.92	-46.83	-13.00	-33.83	peak	
6		718.7000	-67.00	8.24	-58.76	-13.00	-45.76	peak	

Test Mode	WCDMA Band V Link	Polarization	Vertical



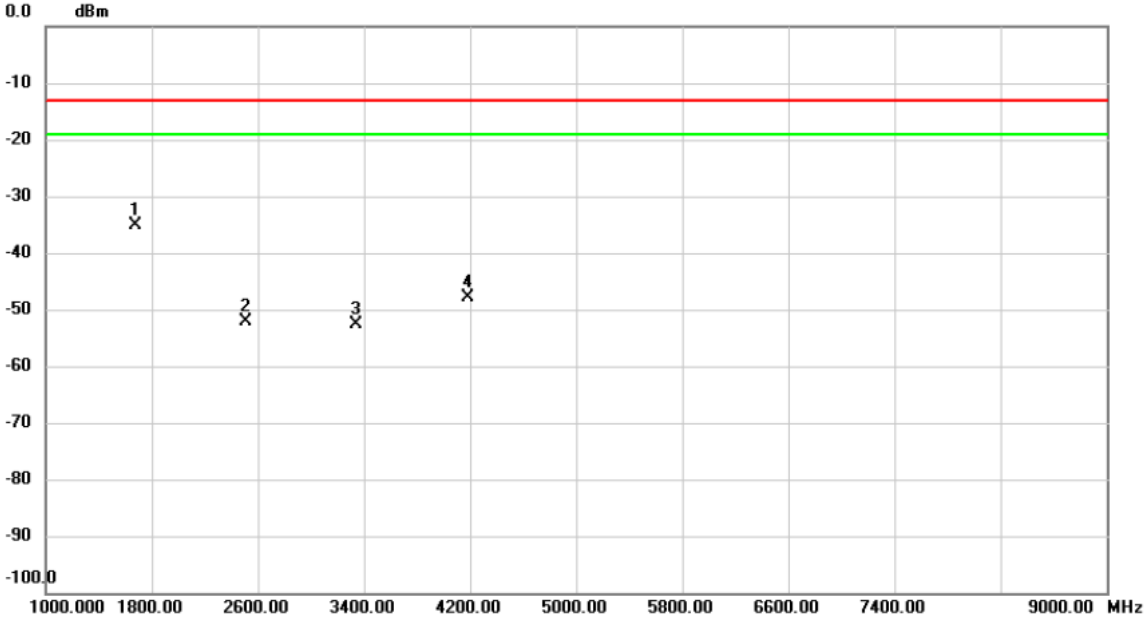
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1	*	1672.800	-32.78	0.00	-32.78	-13.00	-19.78	peak	
2		2509.200	-47.75	0.00	-47.75	-13.00	-34.75	peak	
3		3345.600	-49.47	0.00	-49.47	-13.00	-36.47	peak	
4		4182.000	-40.99	0.00	-40.99	-13.00	-27.99	peak	
5		5018.400	-47.16	0.00	-47.16	-13.00	-34.16	peak	
6		5854.800	-45.93	0.00	-45.93	-13.00	-32.93	peak	
7		6691.200	-49.56	0.00	-49.56	-13.00	-36.56	peak	

Test Mode	WCDMA Band V Link	Polarization	Horizontal



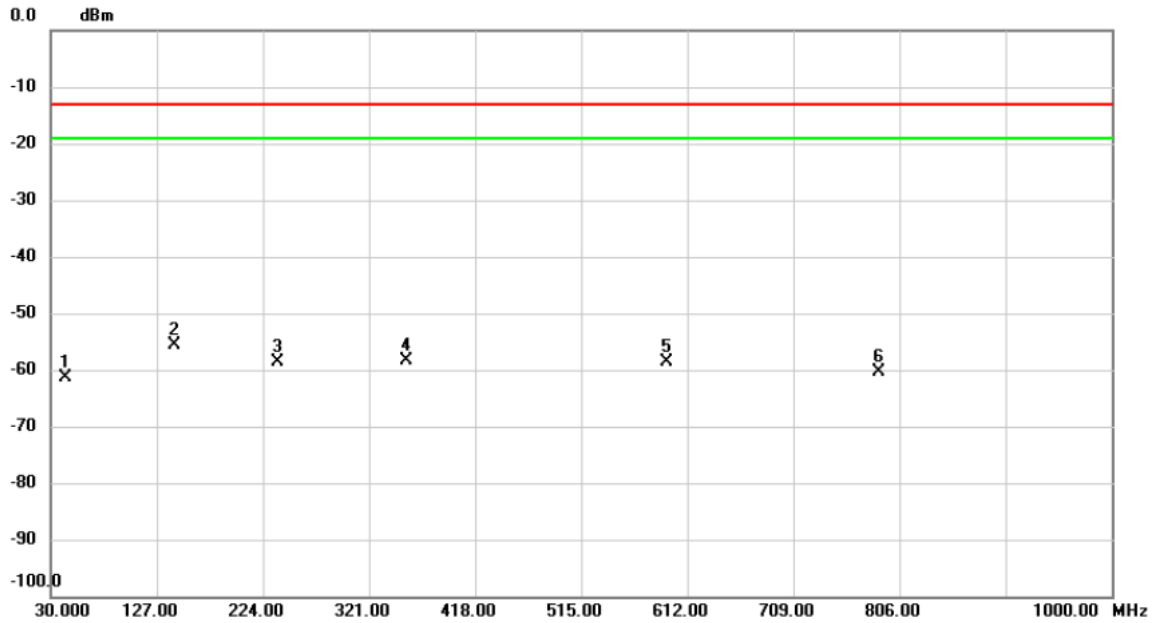
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1		100.8100	-57.93	-1.03	-58.96	-13.00	-45.96	peak	
2		170.6500	-65.88	2.68	-63.20	-13.00	-50.20	peak	
3		326.8200	-60.35	0.04	-60.31	-13.00	-47.31	peak	
4	*	600.3600	-60.42	4.51	-55.91	-13.00	-42.91	peak	
5		777.8700	-69.31	8.55	-60.76	-13.00	-47.76	peak	
6		980.6000	-70.14	10.34	-59.80	-13.00	-46.80	peak	

Test Mode	WCDMA Band V Link	Polarization	Horizontal



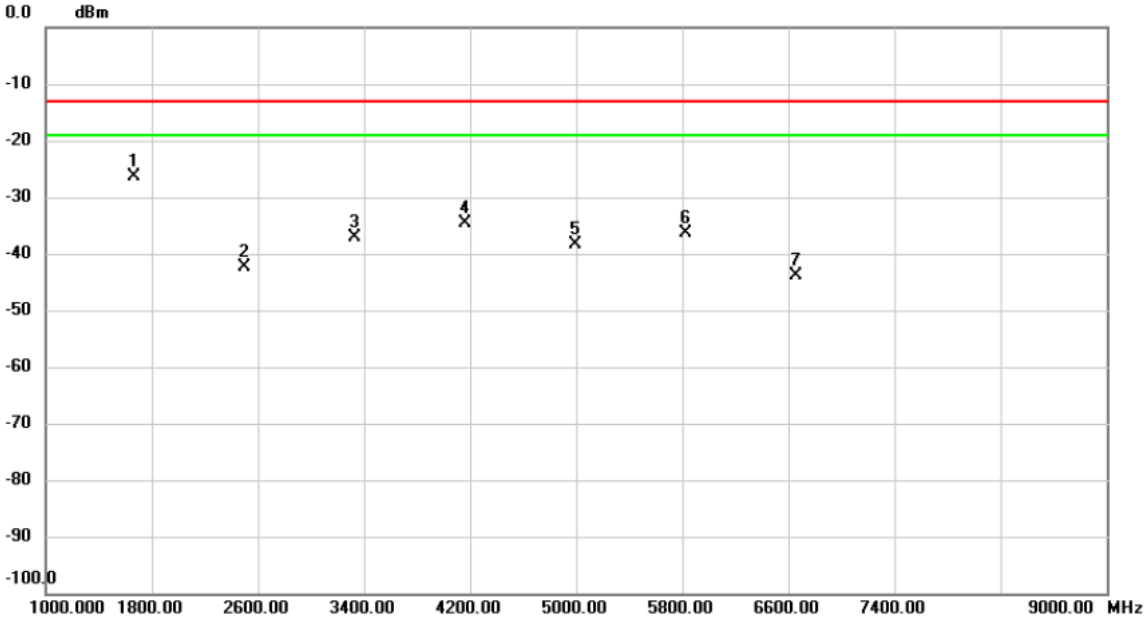
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1	*	1672.800	-35.05	0.00	-35.05	-13.00	-22.05	peak	
2		2509.200	-52.23	0.00	-52.23	-13.00	-39.23	peak	
3		3345.600	-52.69	0.00	-52.69	-13.00	-39.69	peak	
4		4182.000	-47.86	0.00	-47.86	-13.00	-34.86	peak	

Test Mode	LTE Band 5_Channel Bandwidth 10 MHz_QPSK_1RB0	Polarization	Vertical



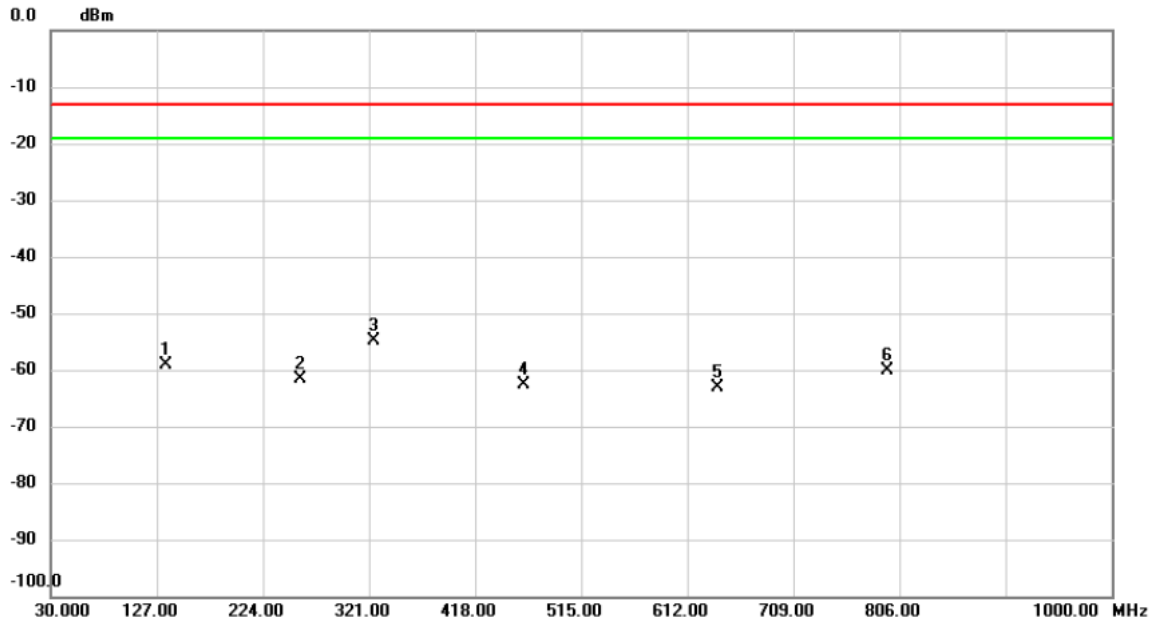
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1		43.5800	-53.00	-8.48	-61.48	-13.00	-48.48	peak	
2	*	142.5200	-59.13	3.46	-55.67	-13.00	-42.67	peak	
3		237.5800	-60.19	1.45	-58.74	-13.00	-45.74	peak	
4		354.9500	-59.76	1.39	-58.37	-13.00	-45.37	peak	
5		593.5700	-66.58	7.87	-58.71	-13.00	-45.71	peak	
6		786.6000	-69.03	8.59	-60.44	-13.00	-47.44	peak	

Test Mode	LTE Band 5_Channel Bandwidth 10 MHz_QPSK_1RB0	Polarization	Vertical



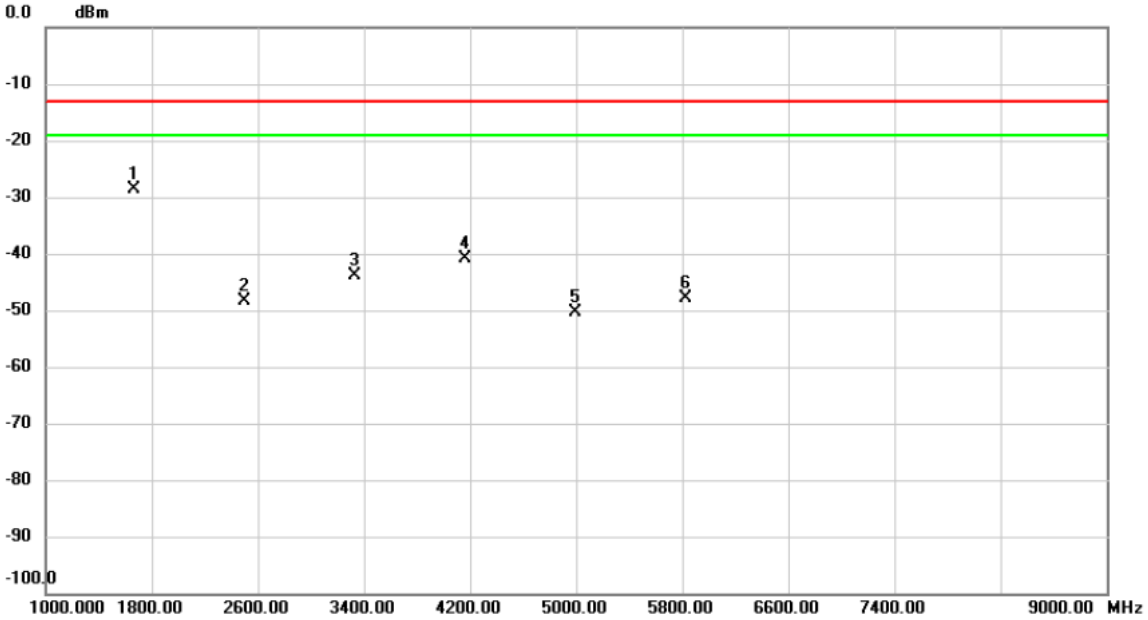
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1	*	1664.200	-26.48	0.00	-26.48	-13.00	-13.48	peak	
2		2496.300	-42.36	0.00	-42.36	-13.00	-29.36	peak	
3		3328.400	-37.04	0.00	-37.04	-13.00	-24.04	peak	
4		4160.500	-34.55	0.00	-34.55	-13.00	-21.55	peak	
5		4992.600	-38.27	0.00	-38.27	-13.00	-25.27	peak	
6		5824.700	-36.30	0.00	-36.30	-13.00	-23.30	peak	
7		6656.800	-43.83	0.00	-43.83	-13.00	-30.83	peak	

Test Mode	LTE Band 5_Channel Bandwidth 10 MHz_QPSK_1RB0	Polarization	Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1		134.7600	-59.52	0.46	-59.06	-13.00	-46.06	peak	
2		257.9500	-58.17	-3.36	-61.53	-13.00	-48.53	peak	
3	*	324.8800	-54.75	-0.10	-54.85	-13.00	-41.85	peak	
4		462.6200	-65.73	3.17	-62.56	-13.00	-49.56	peak	
5		640.1300	-68.33	5.25	-63.08	-13.00	-50.08	peak	
6		795.3300	-68.98	8.95	-60.03	-13.00	-47.03	peak	

Test Mode	LTE Band 5_Channel Bandwidth 10 MHz_QPSK_1RB0	Polarization	Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1	*	1664.200	-28.53	0.00	-28.53	-13.00	-15.53	peak	
2		2496.300	-48.49	0.00	-48.49	-13.00	-35.49	peak	
3		3328.400	-43.94	0.00	-43.94	-13.00	-30.94	peak	
4		4160.500	-40.82	0.00	-40.82	-13.00	-27.82	peak	
5		4992.600	-50.46	0.00	-50.46	-13.00	-37.46	peak	
6		5824.700	-47.99	0.00	-47.99	-13.00	-34.99	peak	

APPENDIX F FREQUENCY STABILITY

CONTINUE ON NEXT PAGE

Band	WCDMA Band V	
Temperature vs. Frequency Stability		
Temperature (°C)	Frequency Error (ppm)	Limit (ppm)
55	0.0008	± 2.5
50	0.0003	± 2.5
40	0.0001	± 2.5
30	0.0008	± 2.5
20	-0.0002	± 2.5
10	0.0006	± 2.5
0	0.0010	± 2.5
Maximum Deviation (ppm)	0.0010	± 2.5

Band	WCDMA Band V	
Voltage vs. Frequency Stability		
Voltage (V)	Frequency Error (ppm)	Limit (ppm)
138.00	-0.0008	± 2.5
120.00	-0.0002	± 2.5
102.00	-0.0005	± 2.5
Maximum Deviation (ppm)	-0.0002	± 2.5

Band			LTE Band 5		
Temperature vs. Frequency Stability					
Channel Bandwidth (MHz)	Frequency Error (ppm)				Limit (ppm)
Temperature (°C)	1.4	3	5	10	
55	0.0002	0.0005	0.0011	-0.0011	± 2.5
50	0.0000	0.0001	0.0004	-0.0001	± 2.5
40	0.0005	-0.0005	-0.0008	0.0011	± 2.5
30	0.0005	-0.0007	0.0009	0.0010	± 2.5
20	-0.0012	0.0000	0.0010	0.0005	± 2.5
10	0.0000	0.0003	0.0003	-0.0001	± 2.5
0	-0.0011	0.0000	-0.0006	-0.0001	± 2.5
Maximum Deviation (ppm)	-0.0012				± 2.5

Band			LTE Band 5		
Voltage vs. Frequency Stability					
Channel Bandwidth (MHz)	Frequency Error (ppm)				Limit (ppm)
Voltage (V)	1.4	3	5	10	
138.00	-0.0008	0.0000	0.0005	0.0008	± 2.5
120.00	-0.0012	0.0000	0.0010	0.0005	± 2.5
102.00	-0.0012	-0.0007	0.0003	-0.0007	± 2.5
Maximum Deviation (ppm)	0.0010				± 2.5