



Variant FCC RF Test Report

APPLICANT : Samsung Electronics Co Ltd
EQUIPMENT : Verizon 4G LTE Network Extender
BRAND NAME : SAMSUNG
MODEL NAME : SLS-BU103
FCC ID : A3LSLS-BU103
STANDARD : 47 CFR Part 2, 27
CLASSIFICATION : Licensed Non-Broadcast Station Transmitter (TNB)

This is a variant report which is only valid together with the original test report. The product was received on Aug. 20, 2015 and completely tested on Aug. 29, 2015. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the test procedures given in ANSI / TIA / EIA-603-C-2004 and the testing has shown the tested sample to be in compliance with the applicable technical standards. The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.

Reviewed by: Joseph Lin / Supervisor

Approved by: Jones Tsai / Manager



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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FG542147-01	Rev. 01	This is a variant report which can be referred change list to section 1.3. All the test cases were performed on original report which can be referred to Sporton Report Number FG542147. Based on the original report, only worst case was verified.	Sep. 11, 2015
FG542147-01	Rev. 02	Revising the standard information in section 1.8	Sep. 16, 2015

**SUMMARY OF TEST RESULT**

Report Section	FCC Rule	Description	Limit	Result	Remark
3.4	§2.1046	Conducted Output Power	Reporting Only	PASS	-
3.5	§2.1051 §27.53(c)(2)(4) §27.53(h)	Conducted Band Edge Measurement (Band 4) (Band 13)	$< 43+10\log_{10}(P[\text{Watts}])$	PASS	-
3.6	§2.1051 §27.53(c)(2) §27.53(h)	Conducted Spurious Emission (Band 4) (Band 13)	$< 43+10\log_{10}(P[\text{Watts}])$	PASS	-
4.4	§2.1053 §27.53(c)(2) §27.53(f) §27.53(h)	Radiated Spurious Emission (Band 4) (Band 13)	$< 43+10\log_{10}(P[\text{Watts}])$	PASS	Under limit 15.31 dB at 8460.000 MHz



1 General Description

1.1 Applicant

Samsung Electronics Co Ltd

19 Chapin Rd., Building D, Pine Brook, NJ 07058

1.2 Manufacturer

MitraStar Technology Corporation

No. 6, Innovation Rd II, Hsinchu Science Park, Hsinchu 30076, Taiwan

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	Verizon 4G LTE Network Extender
Brand Name	SAMSUNG
Model Name	SLS-BU103
FCC ID	A3LSLS-BU103
EUT supports Radios application	LTE
EUT Stage	Production Unit

Detail changes list as below :

1. Remove Resistor at CPU heat sink for GPS degradation
2. Add CAP and SCHOTTKY DIODES for GPIO issue
3. Add resistor at GPS bias choke for inductor damage
4. Move CAP forward for TSSI accuracy issue
5. PAM change from richwave to anadigics
6. Add inductor to GND
7. Add EMI plate on antenna casing

1.4 Product Specification subjective to this standard

Product Specification subjective to this standard	
Tx Frequency	LTE Band 4 : 2110 MHz ~ 2155 MHz LTE Band 13 : 746 MHz ~ 756 MHz
Rx Frequency	LTE Band 4 : 1710 MHz ~ 1755 MHz LTE Band 13 : 777 MHz ~ 787 MHz
Bandwidth	LTE Band 4 : 10MHz LTE Band 13 : 10MHz
Maximum Output Power to Antenna	<Long Antenna> LTE Band 4 : 18.88 dBm LTE Band 13 : 16.77 dBm <Short Antenna> TE Band 4 : 17.22 dBm LTE Band 13 : 17.04 dBm <MIMO Antenna> TE Band 4 : 21.14 dBm LTE Band 13 : 19.92 dBm
Antenna Gain	LTE Band 4 : Long Antenna : 2.00 dBi (Peak Gain) Short Antenna : 3.50 dBi (Peak Gain) LTE Band 13 : Long Antenna : 1.70 dBi (Peak Gain) Short Antenna : 2.50 dBi (Peak Gain)
Type of Modulation	QPSK / 16QAM/64QAM



1.5 Modification of EUT

No modifications are made to the EUT during all test items.

1.6 Emission Designator

LTE Band 4	Test QPSK for Long Antenna			Test QPSK for Short Antenna			
BW(MHz)	Emission Designator (99%OBW)	Frequency Tolerance (ppm)	Maximum EIRP(W)	Emission Designator (99%OBW)	Frequency Tolerance (ppm)	Maximum EIRP(W)	MIMO Maximum EIRP(W)
10	-	-	0.1130	-	-	0.1069	0.1887
LTE Band 4	Test 16QAM for Long Antenna			Test 16QAM for Short Antenna			
BW(MHz)	Emission Designator (99%OBW)	Frequency Tolerance (ppm)	Maximum EIRP(W)	Emission Designator (99%OBW)	Frequency Tolerance (ppm)	Maximum EIRP(W)	MIMO Maximum EIRP(W)
10	-	-	0.1180	-	-	0.1122	0.1975
LTE Band 4	Test 64QAM for Long Antenna			Test 64QAM for Short Antenna			
BW(MHz)	Emission Designator (99%OBW)	Frequency Tolerance (ppm)	Maximum EIRP(W)	Emission Designator (99%OBW)	Frequency Tolerance (ppm)	Maximum EIRP(W)	MIMO Maximum EIRP(W)
10	-	-	0.1225	-	-	0.1180	0.2060
LTE Band 13	Test QPSK for Long Antenna			Test QPSK for Short Antenna			
BW(MHz)	Emission Designator (99%OBW)	Frequency Tolerance (ppm)	Maximum ERP(W)	Emission Designator (99%OBW)	Frequency Tolerance (ppm)	Maximum ERP(W)	MIMO Maximum ERP(W)
10	-	-	0.0411	-	-	0.0441	0.0852
LTE Band 13	Test 16QAM for Long Antenna			Test 16QAM for Short Antenna			
BW(MHz)	Emission Designator (99%OBW)	Frequency Tolerance (ppm)	Maximum ERP(W)	Emission Designator (99%OBW)	Frequency Tolerance (ppm)	Maximum ERP(W)	MIMO Maximum ERP(W)
10	-	-	0.0387	-	-	0.0415	0.0802
LTE Band 13	Test 64QAM for Long Antenna			Test 64QAM for Short Antenna			
BW(MHz)	Emission Designator (99%OBW)	Frequency Tolerance (ppm)	Maximum ERP(W)	Emission Designator (99%OBW)	Frequency Tolerance (ppm)	Maximum ERP(W)	MIMO Maximum ERP(W)
10	-	-	0.0429	-	-	0.0456	0.0885

1.7 Testing Location

Sporton Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code : 1190) and the FCC designation No. TW1022 under the FCC 2.948(e) by Mutual Recognition Agreement (MRA) in FCC Test.

Test Site	SPORTON INTERNATIONAL INC.	
Test Site Location	No. 52, Hwa Ya 1 st Rd., Hwa Ya Technology Park, Kwei-Shan District, Tao Yuan City, Taiwan, R.O.C. TEL: +886-3-327-3456 FAX: +886-3-328-4978	
Test Site No.	Sporton Site No.	
	TH05-HY	03CH07-HY

1.8 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ 47 CFR Part 2, 27
- ♦ ANSI / TIA / EIA-603-C-2004
- ♦ FCC KDB 971168 D01 Power Meas. License Digital Systems v02r02
- ♦ FCC KDB 412172 D01 Determining ERP and EIRP v01r01

Remark: All test items were verified and recorded according to the standards and without any deviation during the test.

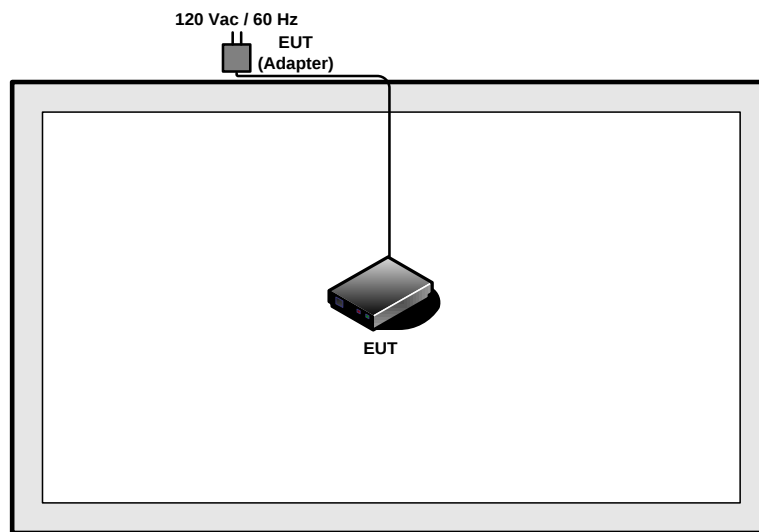
2 Test Configuration of Equipment Under Test

2.1 Test Mode

Antenna port conducted and radiated test items listed below are performed according to KDB 971168 D01 Power Meas. License Digital Systems v02r02 with maximum output power.

Test Items	Band	Bandwidth (MHz)						Modulation			RB #			Test Channel		
		1.4	3	5	10	15	20	QPSK	16QAM	64QAM	1	Half	Full	L	M	H
Max. Output Power	4	-	-	-	✓	-	-	✓	✓	✓			✓	✓	✓	✓
	13	-	-	-	✓	-	-	✓	✓	✓			✓		✓	
Conducted Band Edge	4	-	-	-	✓	-	-	✓	✓	✓			✓	✓		✓
	13	-	-	-	✓	-	-	✓	✓	✓			✓			✓
Conducted Spurious Emission	4	-	-	-	✓	-	-	✓	✓	✓			✓	✓	✓	✓
	13	-	-	-	✓	-	-	✓	✓	✓			✓		✓	
E.R.P./ E.I.R.P.	4	-	-	-	✓	-	-	✓	✓	✓			✓	✓	✓	✓
	13	-	-	-	✓	-	-	✓	✓	✓			✓		✓	
Radiated Spurious Emission	4	-	-	-	✓	-	-	✓	✓	✓			✓	✓	✓	✓
	13	-	-	-	✓	-	-	✓	✓	✓			✓		✓	
Note	1. The mark “✓” means that this configuration is chosen for testing 2. The mark “-” means that this bandwidth is not supported. 3. The device is investigated from 30MHz to 10 times of fundamental signal for radiated spurious emission test under different RB size/offset and modulations in exploratory test. Subsequently, only the worst case emissions are reported.															

2.2 Connection Diagram of Test System



2.3 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 4.2 dB and 10dB attenuator.

Example :

$$\begin{aligned} \text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)}. \\ &= 4.2 + 10 = 14.2 \text{ (dB)} \end{aligned}$$

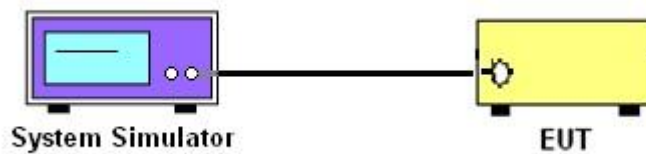
3 Conducted Test Items

3.1 Measuring Instruments

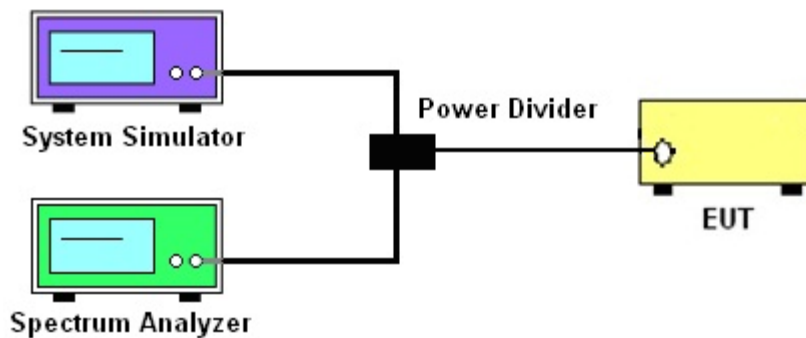
See list of measuring instruments of this test report.

3.2 Test Setup

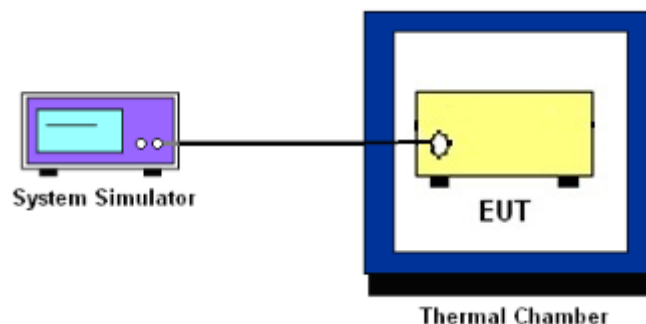
3.2.1 Conducted Output Power



3.2.2 Peak-to-Average Ratio, Occupied Bandwidth ,Conducted Band-Edge and Conducted Spurious Emission



3.2.3 Frequency Stability



3.3 Test Result of Conducted Test

Please refer to Appendix A.



3.4 Conducted Output Power and ERP/EIRP

3.4.1 Description of the Conducted Output Power Measurement and ERP/EIRP Measurement

A system simulator was used to establish communication with the EUT. Its parameters were set to force the EUT transmitting at maximum output power. The measured power in the radio frequency on the transmitter output terminals shall be reported.

The ERP of mobile transmitters must not exceed 3 Watts for LTE Band 13

The EIRP of mobile transmitters must not exceed 1 Watts for LTE Band 4.

According to KDB 412172 D01 Power Approach,

$EIRP = P_T + G_T - L_C$, $ERP = EIRP - 2.15$, where

P_T = transmitter output power in dBm

G_T = gain of the transmitting antenna in dBi

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

3.4.2 Test Procedures

1. The transmitter output port was connected to the system simulator.
2. Set EUT at maximum power through the system simulator.
3. Select lowest, middle, and highest channels for each band and different modulation.
4. Measure and record the power level from the system simulator.

3.5 Conducted Band Edge

3.5.1 Description of Conducted Band Edge Measurement

27.53 (c) for Band 13

For operations in the 776-788 MHz band, the FCC limit is $43 + 10\log_{10}(P[\text{Watts}])$ dB below the transmitter power $P(\text{Watts})$ in a 100 kHz bandwidth. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed. In addition, the power of any unwanted emissions in any 6.25 kHz bandwidth for all frequencies between 763-775 MHz and 793-806 MHz shall be attenuated below the transmitter power, P (dBW), by at least $65 + 10 \log_{10} p(\text{watts})$, dB, for mobile and portable equipment.

27.53 (h) for Band 4

For operations in the 1710 – 1755 MHz band, the FCC limit is $43 + 10\log_{10}(P[\text{Watts}])$ dB below the transmitter power $P(\text{Watts})$ in a 1 MHz bandwidth. However, in the 1MHz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

3.5.2 Test Procedures

1. The testing follows FCC KDB 971168 v02r02 Section 6.0.
2. The EUT was connected to spectrum analyzer and system simulator via a power divider.
3. The band edges of low and high channels for the highest RF powers were measured.
4. Set RBW $\geq 1\%$ EBW in the 1MHz band immediately outside and adjacent to the band edge.
5. Beyond the 1 MHz band from the band edge, RBW=1MHz was used .
6. Set spectrum analyzer with RMS detector.
7. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
8. Checked that all the results comply with the emission limit line.

Example:

The limit line is derived from $43 + 10\log(P)\text{dB}$ below the transmitter power $P(\text{Watts})$
 $= P(\text{W}) - [43 + 10\log(P)] (\text{dB})$
 $= [30 + 10\log(P)] (\text{dBm}) - [43 + 10\log(P)] (\text{dB}) = -13\text{dBm}.$

3.6 Conducted Spurious Emission

3.6.1 Description of Conducted Spurious Emission Measurement

The power of any emission outside of the authorized operating frequency ranges must be lower than the transmitter power (P) by a factor of at least $43 + 10 \log (P)$ dB.

It is measured by means of a calibrated spectrum analyzer and scanned from 30 MHz up to a frequency including its 10th harmonic.

3.6.2 Test Procedures

1. The testing follows FCC KDB 971168 v02r02 Section 6.0.
2. The EUT was connected to spectrum analyzer and system simulator via a power divider.
3. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.
The path loss was compensated to the results for each measurement.
4. The middle channel for the highest RF power within the transmitting frequency was measured.
5. The conducted spurious emission for the whole frequency range was taken.
6. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz.
7. Set spectrum analyzer with RMS detector.
8. Taking the record of maximum spurious emission.
9. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
10. The limit line is derived from $43 + 10\log(P)$ 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.

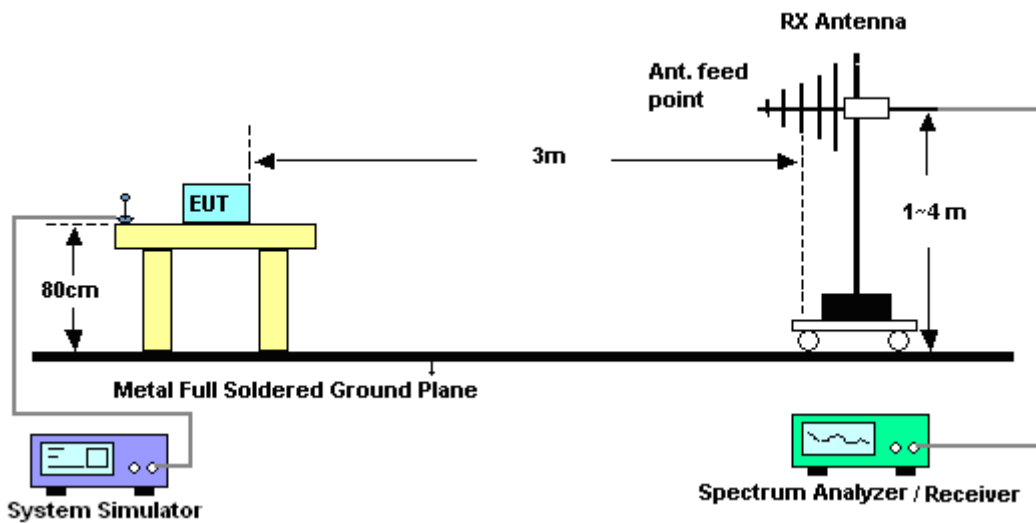
4 Radiated Test Items

4.1 Measuring Instruments

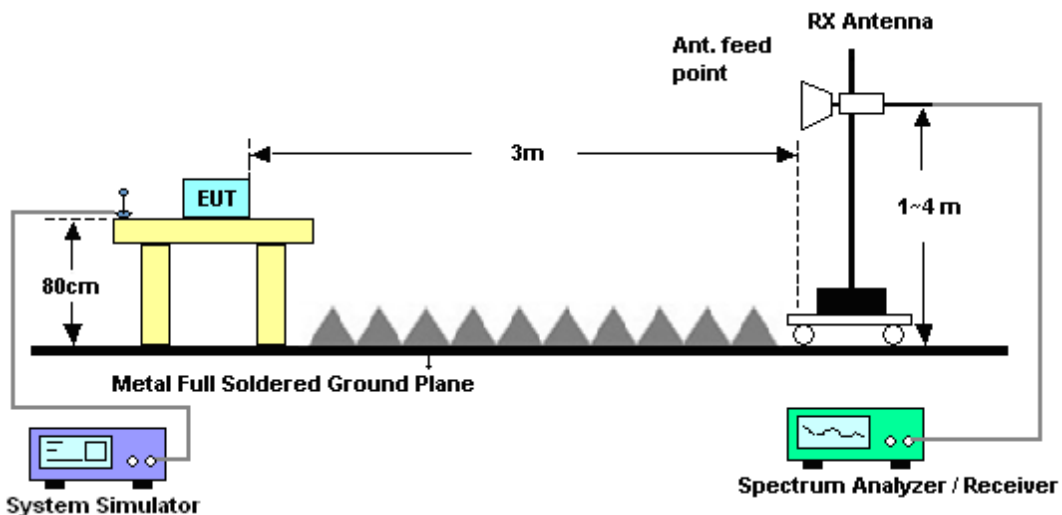
See list of measuring instruments of this test report.

4.2 Test Setup

4.2.1 For radiated test from 30MHz to 1GHz



4.2.2 For radiated test above 1GHz



4.3 Test Result of Radiated Test

Please refer to Appendix B.

4.4 Radiated Spurious Emission

4.4.1 Description of Radiated Spurious Emission

The radiated spurious emission was measured by substitution method according to ANSI / TIA / EIA-603-C-2004. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitter power (P) by a factor of at least $43 + 10 \log (P)$ dB.

For LTE Band 13

For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth.

The spectrum is scanned from 30 MHz up to a frequency including its 10th harmonic.

4.4.2 Test Procedures

1. The testing follows FCC KDB 971168 v02r02 Section 5.8 and ANSI / TIA-603-C-2004 Section 2.2.12.
2. The EUT was placed on a rotatable wooden table with 0.8 meter above ground.
3. The EUT was set 3 meters from the receiving antenna, which was mounted on the antenna tower.
4. The table was rotated 360 degrees to determine the position of the highest spurious emission.
5. The height of the receiving antenna is varied between one meter and four meters to search the maximum spurious emission for both horizontal and vertical polarizations.
6. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, taking the record of maximum spurious emission.
7. A horn antenna was substituted in place of the EUT and was driven by a signal generator.
8. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission.
9. Taking the record of output power at antenna port.
10. Repeat step 7 to step 8 for another polarization.
11. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

The limit line is derived from $43 + 10\log(P)$ 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.

12. EIRP (dBm) = S.G. Power – Tx Cable Loss + Tx Antenna Gain
13. ERP (dBm) = EIRP - 2.15



5 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Signal Analyzer	Rohde & Schwarz	FSV40	101397	10Hz~40GHz	Sep. 17, 2014	Aug. 26, 2015~ Aug. 31, 2015	Sep. 16, 2015	Conducted (TH05-HY)
Bilog Antenna	Schaffner	CBL6111C	2726	30MHz ~ 1GHz	Sep. 27, 2014	Aug 29. 2015	Sep. 26, 2015	Radiation (03CH07-HY)
Double Ridge Horn Antenna	ESCO	3117	00075962	1GHz ~ 18GHz	Aug. 21, 2015	Aug 29. 2015	Aug. 20, 2016	Radiation (03CH07-HY)
EMI Test Receiver	Rohde & Schwarz	ESCI 7	100724	9kHz~7GHz	Aug. 25, 2015	Aug 29. 2015	Aug. 24, 2016	Radiation (03CH07-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-1328	1GHz ~ 18GHz	Nov. 05, 2014	Aug 29. 2015	Nov. 04, 2015	Radiation (03CH07-HY)
Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170584	18GHz- 40GHz	Nov. 03, 2014	Aug 29. 2015	Nov. 02, 2015	Radiation (03CH07-HY)
Hygrometer	Testo	608-H1	34897197	N/A	May 06, 2014	Aug 29. 2015	May 03, 2016	Radiation (03CH07-HY)
Preamplifier	COM-POWER	PA-103A	161241	10MHz-1000MHz	Mar. 12, 2015	Aug 29. 2015	Mar. 11, 2016	Radiation (03CH07-HY)
Preamplifier	Agilent	8449B	3008A02362	1GHz~ 26.5GHz	Oct. 21, 2014	Aug 29. 2015	Oct. 20, 2015	Radiation (03CH07-HY)
Signal Analyzer	Rohde & Schwarz	FSV 30	101749	10Hz~30GHz	Mar. 10, 2015	Aug 29. 2015	Mar. 09, 2016	Radiation (03CH07-HY)
Controller	ChainTek	Chaintek 3000	N/A	Control Turn table	N/A	Aug 29. 2015	N/A	Radiation (03CH07-HY)
Controller	Max-Full	MF7802	MF780208368	Control Ant Mast	N/A	Aug 29. 2015	N/A	Radiation (03CH07-HY)
Antenna Mast	Max-Full	MFA520BS	N/A	1m~4m	N/A	Aug 29. 2015	N/A	Radiation (03CH07-HY)
Turn Table	ChainTek	Chaintek 3000	N/A	0~360 degree	N/A	Aug 29. 2015	N/A	Radiation (03CH07-HY)
Signal Generator	Rohde & Schwarz	SMF100A	101107	100kHz~40GHz	May. 23, 2014	Aug 29. 2015	Sep. 16, 2015	Radiation (03CH07-HY)



6 Uncertainty of Evaluation

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	4.80
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Uncertainty of Radiated Emission Measurement (1 GHz ~ 40 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.10
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Appendix A. Test Results of Conducted Test

Conducted Output Power(Average power)

<Long Antenna>

LTE Band 4 Maximum Average Power [dBm]						
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest
10	50	0	QPSK	18.53	17.65	17.31

LTE Band 4 Maximum Average Power [dBm]						
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest
10	50	0	16QAM	18.72	17.77	17.8

LTE Band 4 Maximum Average Power [dBm]						
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest
10	50	0	64QAM	18.88	18.09	17.67

LTE Band 13 Maximum Average Power [dBm]						
BW [MHz]	RB Size	RB Offset	Mod	Middle		
10	25	0	QPSK	16.59		

LTE Band 13 Maximum Average Power [dBm]						
BW [MHz]	RB Size	RB Offset	Mod	Middle		
10	25	0	16QAM	16.33		

LTE Band 13 Maximum Average Power [dBm]						
BW [MHz]	RB Size	RB Offset	Mod	Middle		
10	25	0	64QAM	16.77		

**<Short Antenna>**

LTE Band 4 Maximum Average Power [dBm]						
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest
10	50	0	QPSK	16.79	15.71	15.98

LTE Band 4 Maximum Average Power [dBm]						
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest
10	50	0	16QAM	17	15.9	16.17

LTE Band 4 Maximum Average Power [dBm]						
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest
10	50	0	64QAM	17.22	16.18	16.19

LTE Band 13 Maximum Average Power [dBm]					
BW [MHz]	RB Size	RB Offset	Mod	Middle	
10	25	0	QPSK	16.89	

LTE Band 13 Maximum Average Power [dBm]					
BW [MHz]	RB Size	RB Offset	Mod	Middle	
10	25	0	16QAM	16.63	

LTE Band 13 Maximum Average Power [dBm]					
BW [MHz]	RB Size	RB Offset	Mod	Middle	
10	25	0	64QAM	17.04	

**<MIMO Antenna>**

LTE Band 4 Maximum Average Power [dBm] for QPSK						
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest
10	50	0	Signal I	20.76	19.80	19.71

LTE Band 4 Maximum Average Power [dBm] for 16QAM						
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest
10	50	0	Signal I	20.95	19.95	20.07

LTE Band 4 Maximum Average Power [dBm] for 64QAM						
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest
10	50	0	Signal I	21.14	20.25	20.00

LTE Band 13 Maximum Average Power [dBm] for QPSK					
BW [MHz]	RB Size	RB Offset	Mod	Middle	
10	25	0	Signal I	19.75	

LTE Band 13 Maximum Average Power [dBm] for 16QAM					
BW [MHz]	RB Size	RB Offset	Mod	Middle	
10	25	0	Signal I	19.49	

LTE Band 13 Maximum Average Power [dBm] for 64QAM					
BW [MHz]	RB Size	RB Offset	Mod	Middle	
10	25	0	Signal I	19.92	

ERP/EIRP

Modes	LTE Band 4 (QPSK,BW=10M)		
Antenna	MIMO Antenna		
Channel	2000 (Low)	2175 (Mid)	2350 (High)
Frequency (MHz)	2115.0	2132.5	2150.0
Conducted Power P_T (dBm)	20.76	19.80	19.71
Conducted Power P_T (Watts)	0.1190	0.0954	0.0935
EIRP(dBm)	22.76	21.80	21.71
EIRP(Watts)	0.1887	0.1513	0.1481

Modes	LTE Band 4 (16QAM,BW=10M)		
Antenna	MIMO Antenna		
Channel	2000 (Low)	2175 (Mid)	2350 (High)
Frequency (MHz)	2115.0	2132.5	2150.0
Conducted Power P_T (dBm)	20.95	19.95	20.07
Conducted Power P_T (Watts)	0.1246	0.0987	0.1017
EIRP(dBm)	22.95	21.95	22.07
EIRP(Watts)	0.1975	0.1565	0.1611

Modes	LTE Band 4 (64QAM,BW=10M)		
Antenna	MIMO Antenna		
Channel	2000 (Low)	2175 (Mid)	2350 (High)
Frequency (MHz)	2115.0	2132.5	2150.0
Conducted Power P_T (dBm)	21.14	20.25	20.00
Conducted Power P_T (Watts)	0.1300	0.1059	0.1001
EIRP(dBm)	23.14	22.25	22.00
EIRP(Watts)	0.2060	0.1679	0.1586



Modes	LTE Band 13 (QPSK,BW=10M)
Antenna	MIMO Antenna
Channel	5230 (Mid)
Frequency (MHz)	751
Conducted Power P_T (dBm)	19.75
Conducted Power P_T (Watts)	0.0945
ERP(dBm)	19.30
ERP(Watts)	0.0852

Modes	LTE Band 13 (16QAM,BW=10M)
Antenna	MIMO Antenna
Channel	5230 (Mid)
Frequency (MHz)	751
Conducted Power P_T (dBm)	19.49
Conducted Power P_T (Watts)	0.0890
ERP(dBm)	19.04
ERP(Watts)	0.0802

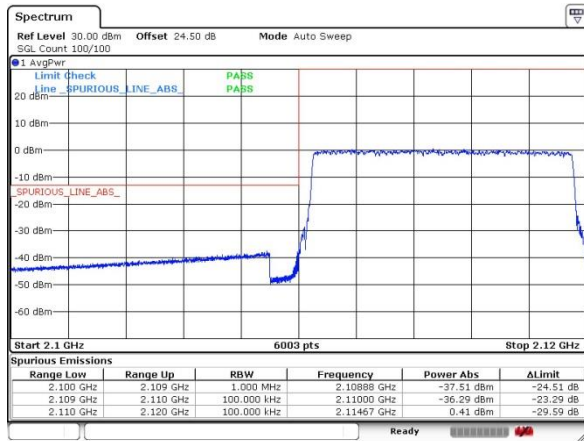
Modes	LTE Band 13 (64QAM,BW=10M)
Antenna	MIMO Antenna
Channel	5230 (Mid)
Frequency (MHz)	751
Conducted Power P_T (dBm)	19.92
Conducted Power P_T (Watts)	0.0981
ERP(dBm)	19.47
ERP(Watts)	0.0885



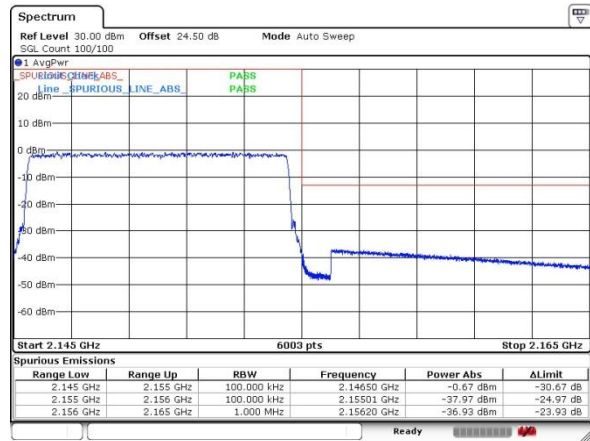
Conducted Band Edge

LTE Band 4 / 10MHz / QPSK for Long Antenna

Lowest Band Edge

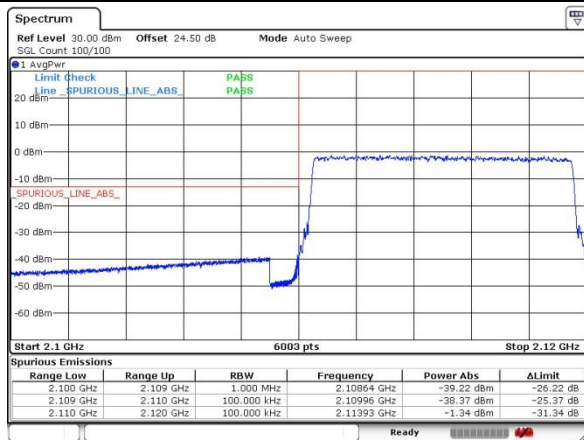


Highest Band Edge

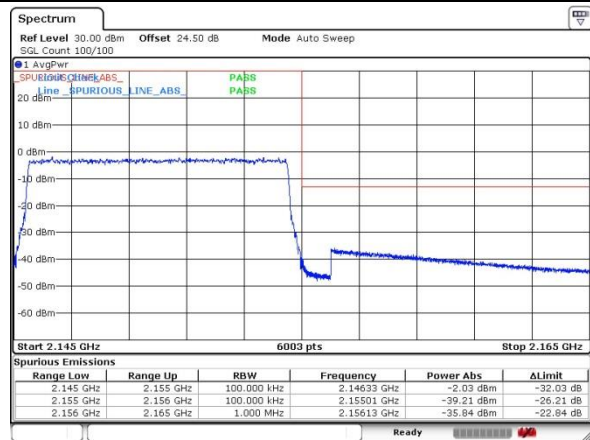


LTE Band 4 / 10MHz / QPSK for Short Antenna

Lowest Band Edge



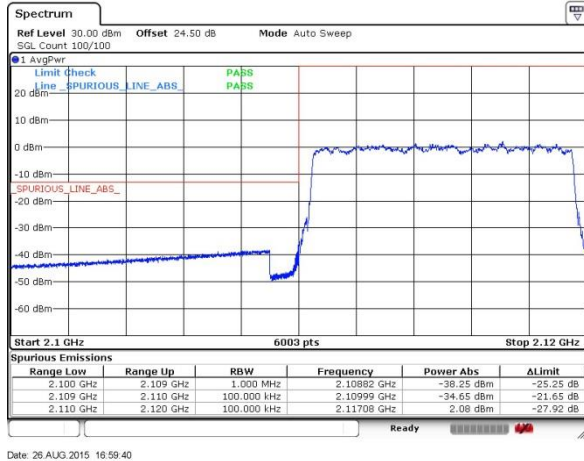
Highest Band Edge



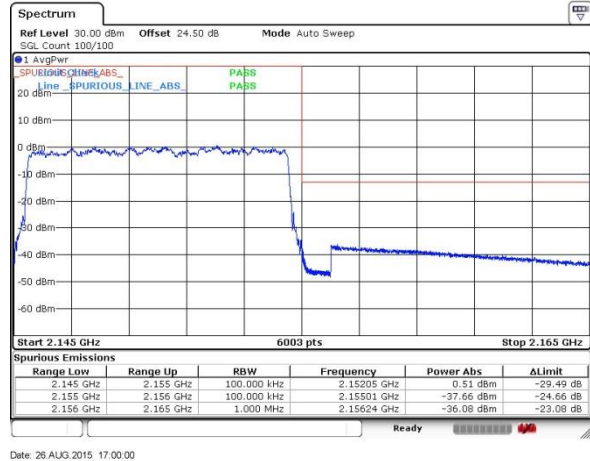


LTE Band 4 / 10MHz / 16QAM for Long Antenna

Lowest Band Edge

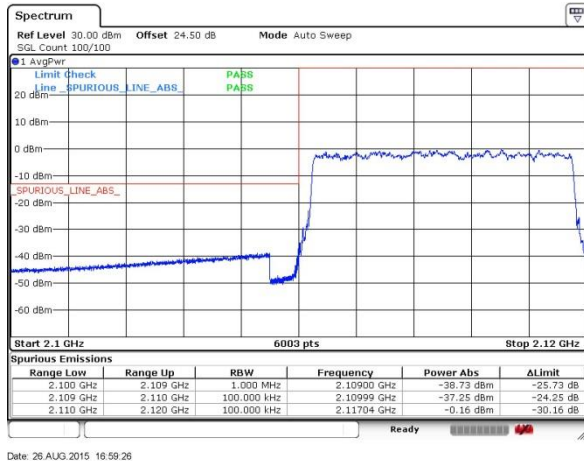


Highest Band Edge

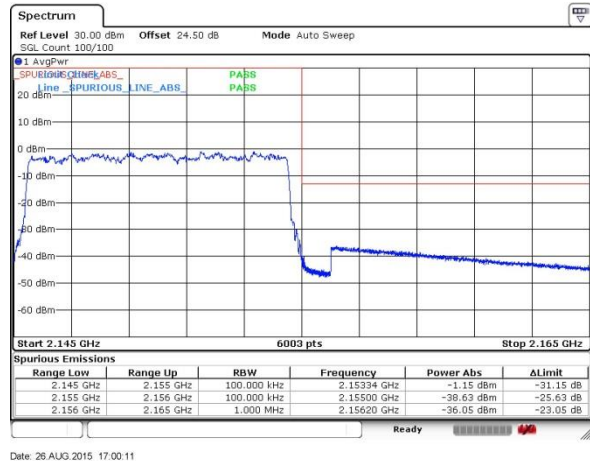


LTE Band 4 / 10MHz / 16QAM for Short Antenna

Lowest Band Edge



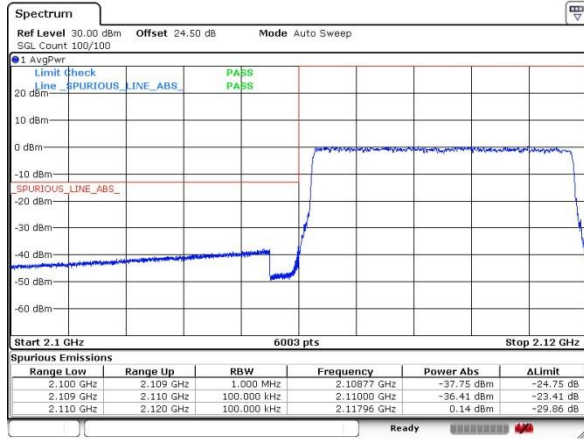
Highest Band Edge



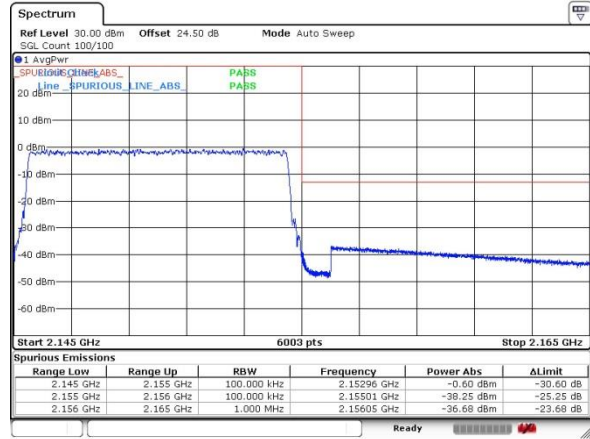


LTE Band 4 / 10MHz / 64QAM for Long Antenna

Lowest Band Edge

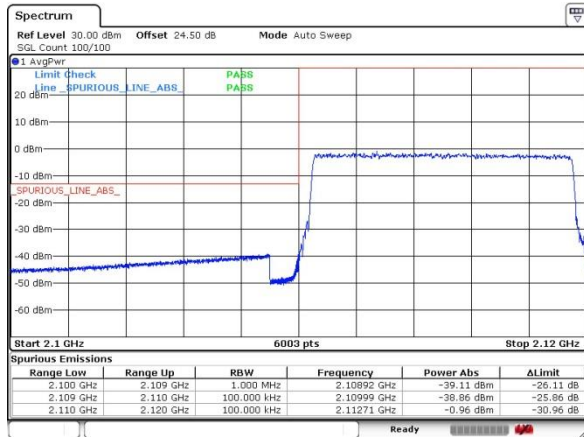


Highest Band Edge

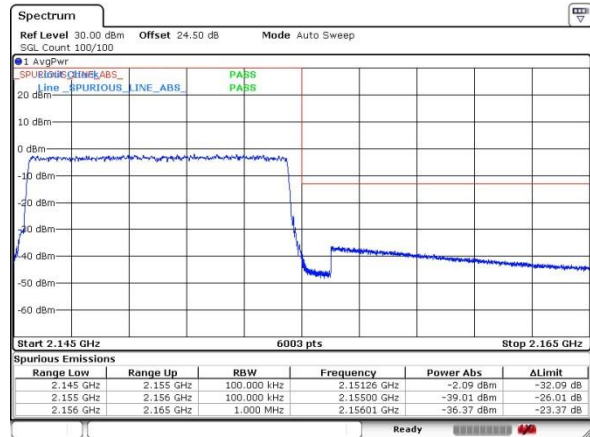


LTE Band 4 / 10MHz / 64QAM for Short Antenna

Lowest Band Edge



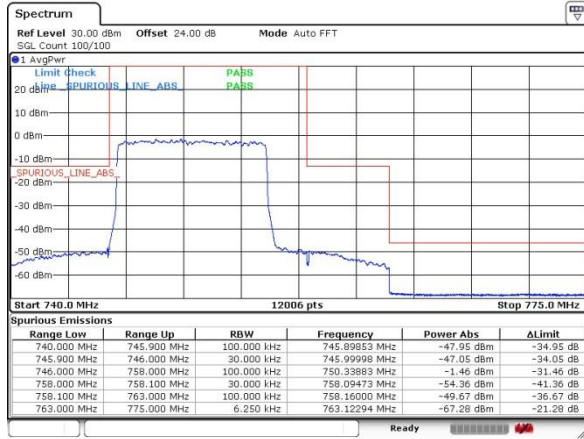
Highest Band Edge





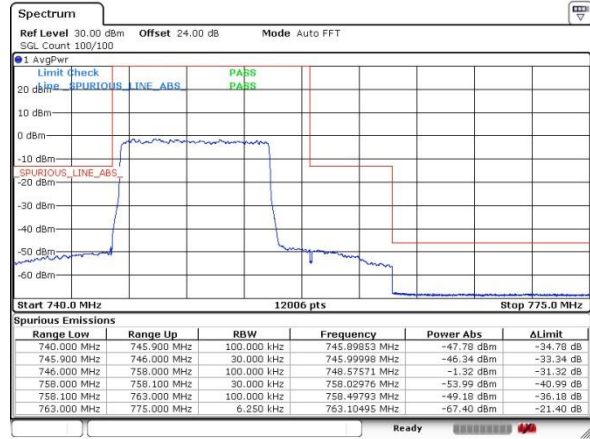
LTE Band 13 / 10MHz / QPSK

Band Edge for Long Antenna



Date: 26 AUG 2015 18:10:17

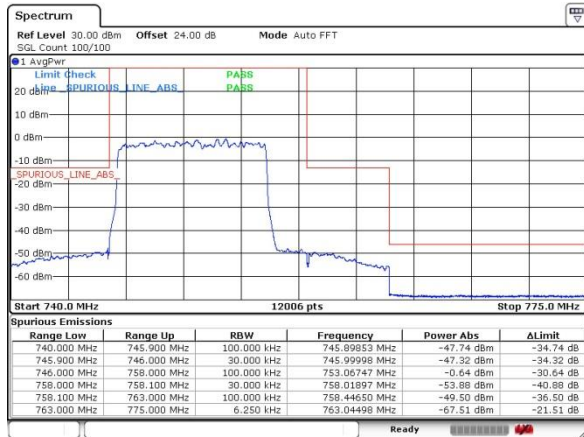
Band Edge for Short Antenna



Date: 26 AUG 2015 18:10:28

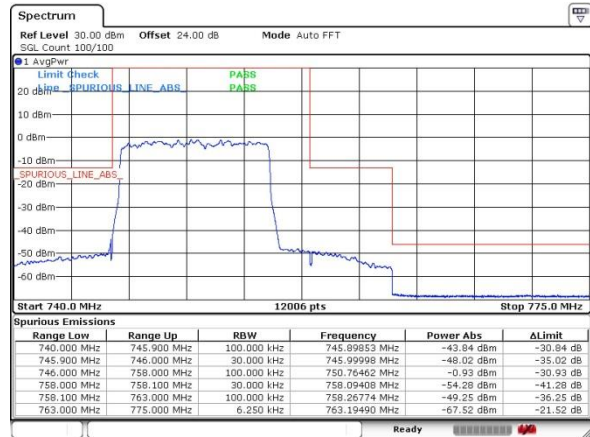
LTE Band 13 / 10MHz / 16QAM

Band Edge for Long Antenna



Date: 26 AUG 2015 17:14:04

Band Edge for Short Antenna

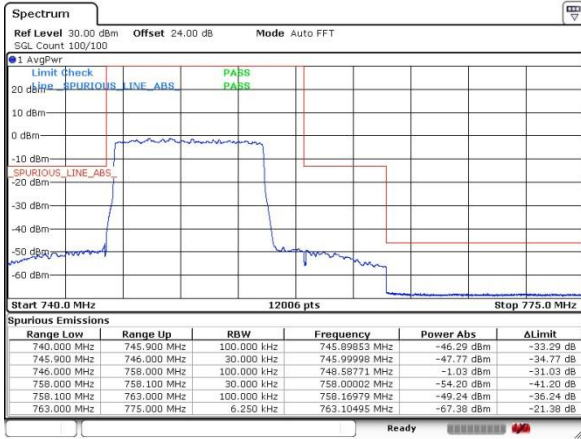


Date: 26 AUG 2015 17:13:22

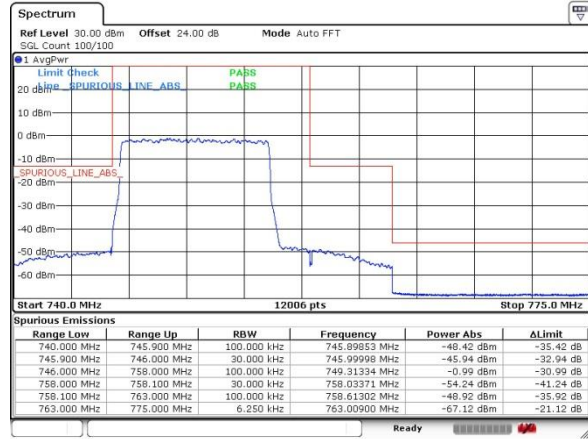


LTE Band 13 / 10MHz / 64QAM

Band Edge for Long Antenna



Band Edge for Short Antenna

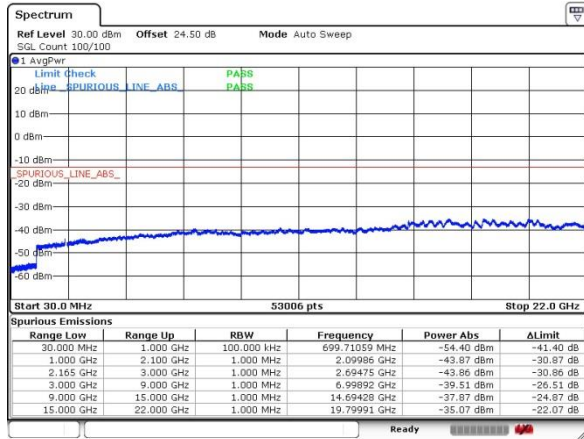




Conducted Spurious Emission

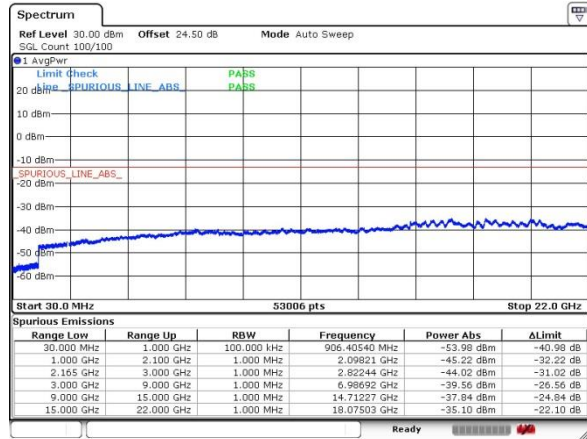
LTE Band 4 / 10MHz for Long Antenna

Lowest Channel / QPSK



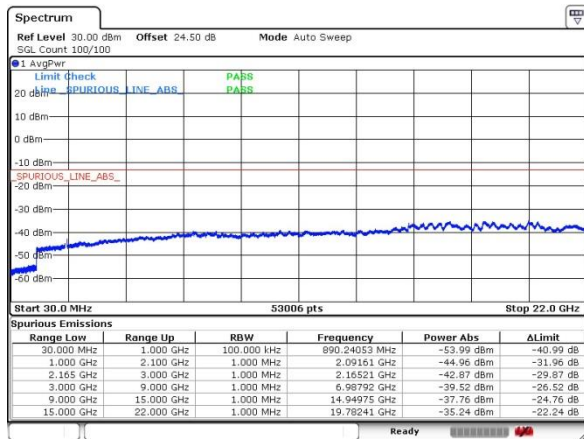
Date: 26 AUG 2015 18:21:38

Middle Channel / QPSK



Date: 26 AUG 2015 18:24:34

Highest Channel / QPSK

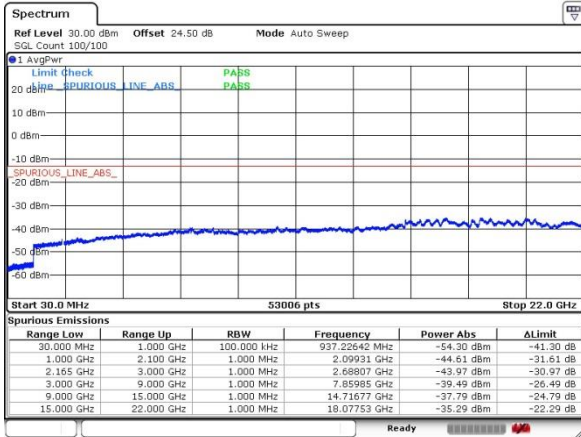


Date: 26 AUG 2015 18:25:27

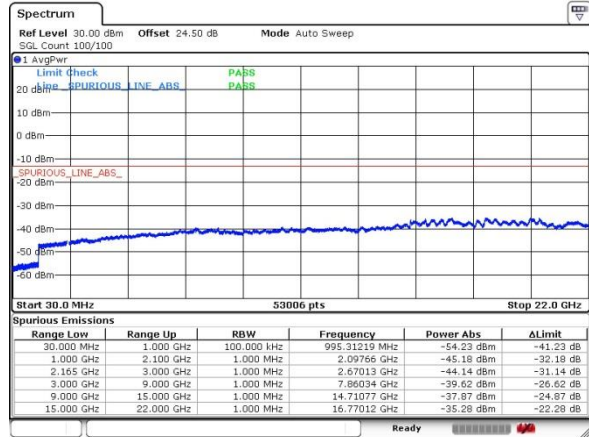


LTE Band 4 / 10MHz for Short Antenna

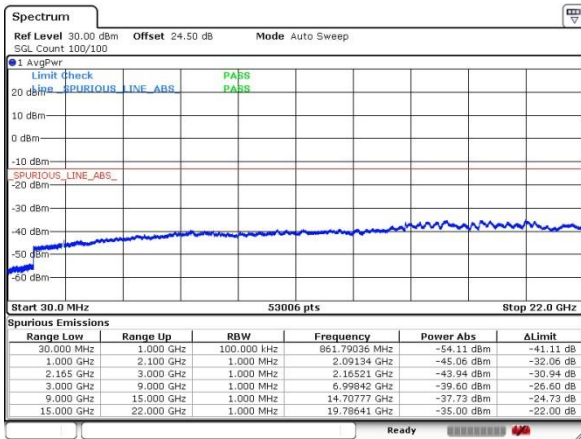
Lowest Channel / QPSK



Middle Channel / QPSK



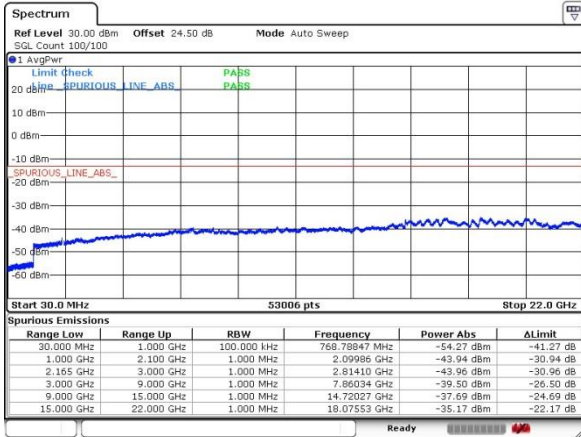
Highest Channel / QPSK





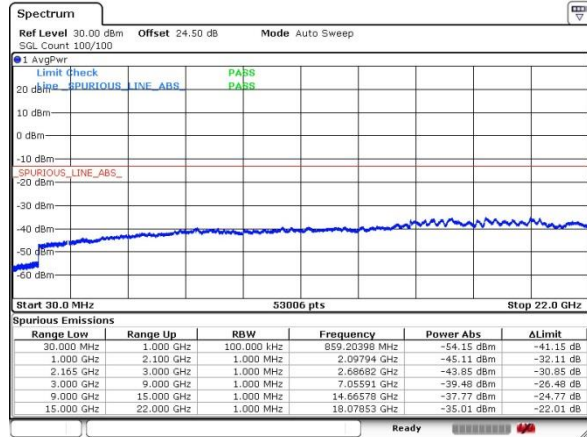
LTE Band 4 / 10MHz for Long Antenna

Lowest Channel / 16QAM



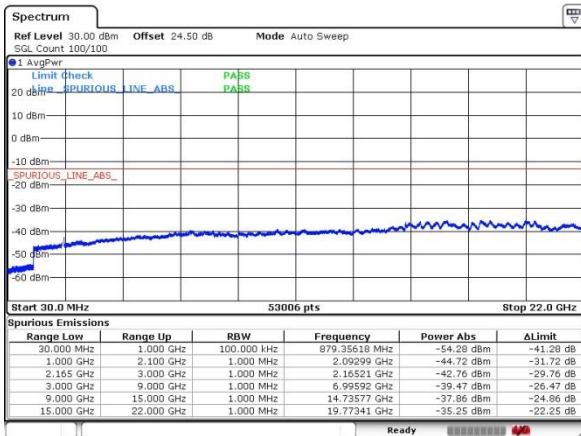
Date: 26 AUG 2015 17:05:58

Middle Channel / 16QAM



Date: 26 AUG 2015 17:03:28

Highest Channel / 16QAM

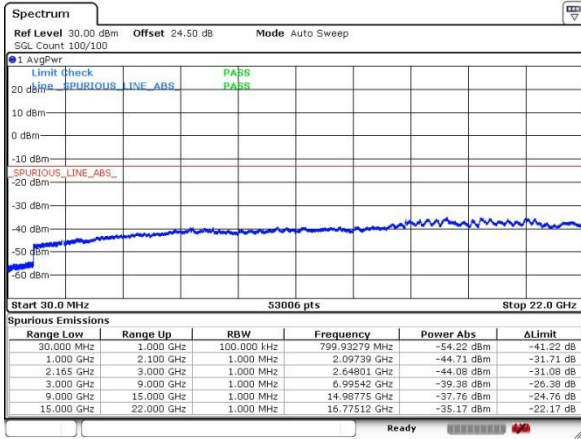


Date: 26 AUG 2015 17:02:35



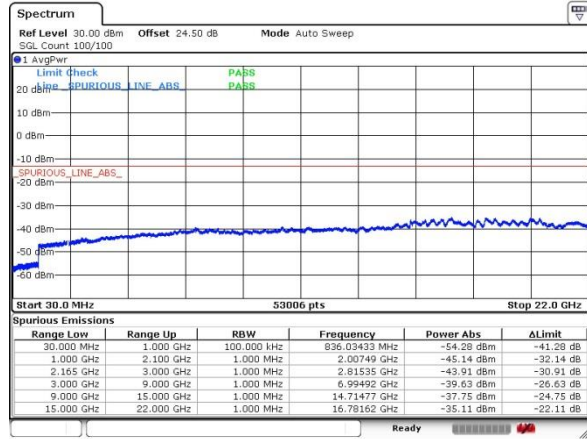
LTE Band 4 / 10MHz for Short Antenna

Lowest Channel / 16QAM



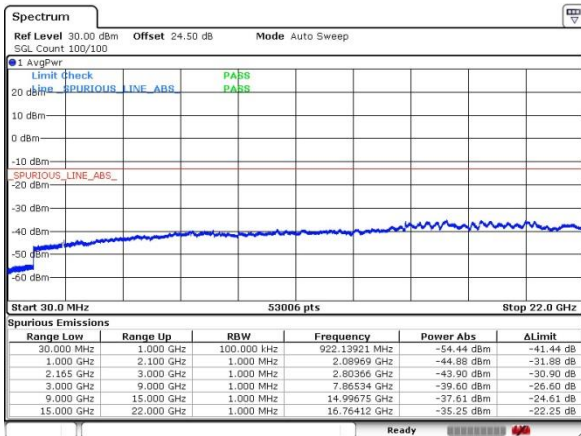
Date: 26 AUG 2015 17:05:08

Middle Channel / 16QAM



Date: 26 AUG 2015 17:04:20

Highest Channel / 16QAM

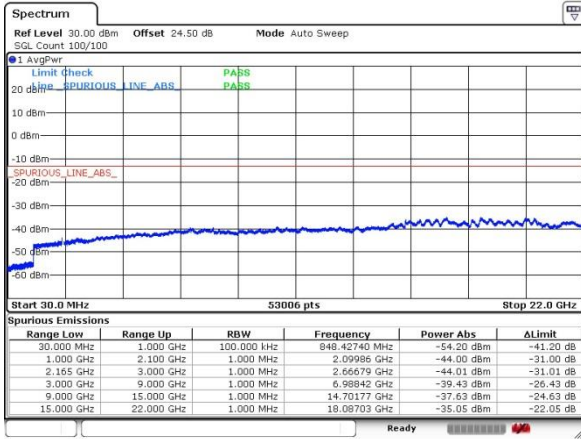


Date: 26 AUG 2015 17:01:42



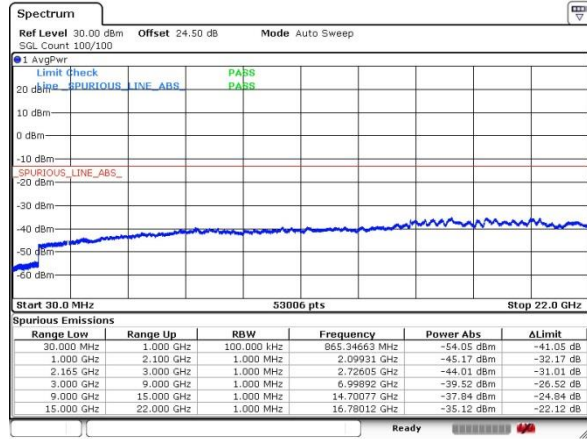
LTE Band 4 / 10MHz for Long Antenna

Lowest Channel / 64QAM



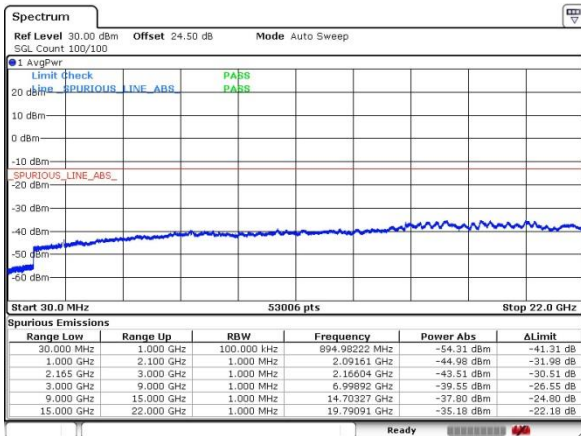
Date: 26 AUG 2015 16:17:48

Middle Channel / 64QAM



Date: 26 AUG 2015 16:15:19

Highest Channel / 64QAM

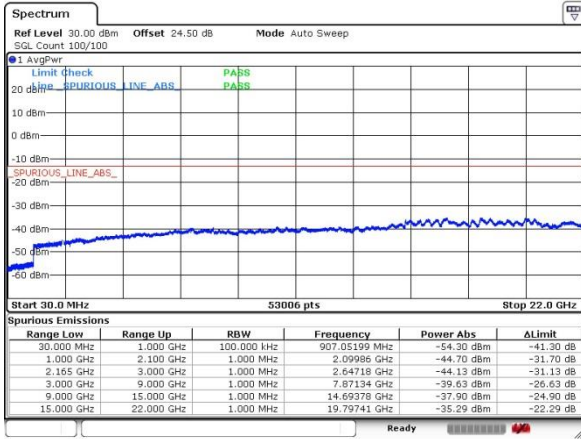


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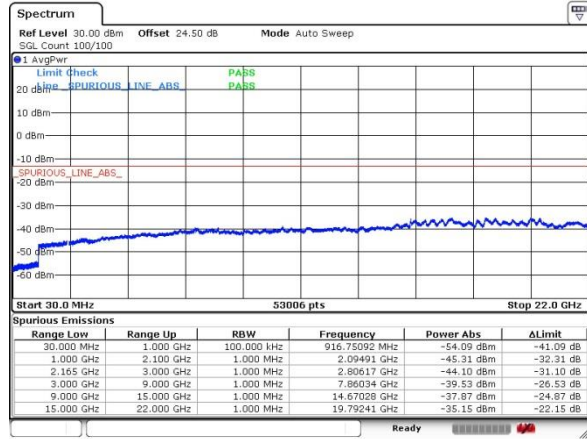
LTE Band 4 / 10MHz for Short Antenna

Lowest Channel / 64QAM



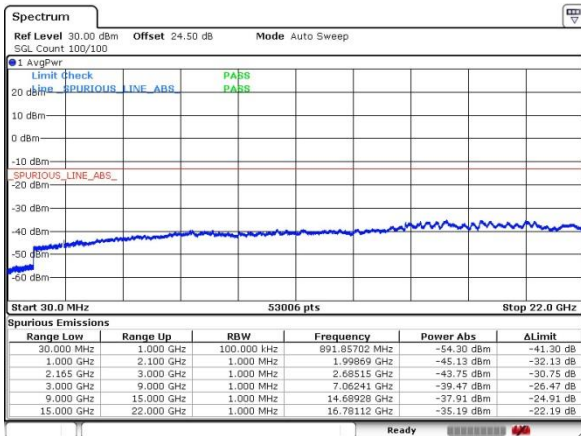
Date: 26 AUG 2015 16:17:03

Middle Channel / 64QAM



Date: 26 AUG 2015 16:16:03

Highest Channel / 64QAM

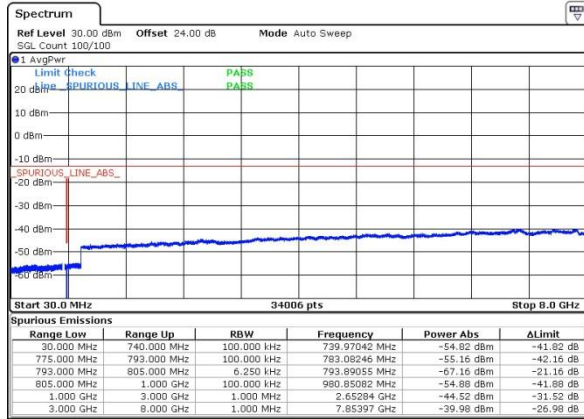


Date: 26 AUG 2015 16:13:29



LTE Band 13 / 10MHz for Long Antenna

Middle Channel / QPSK



Date: 26 AUG 2015 18:09:49

LTE Band 13 / 10MHz for Short Antenna

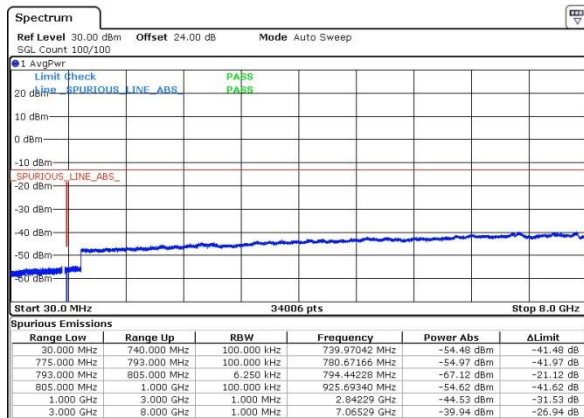
Middle Channel / QPSK



Date: 26 AUG 2015 18:09:15

LTE Band 13 / 10MHz for Long Antenna

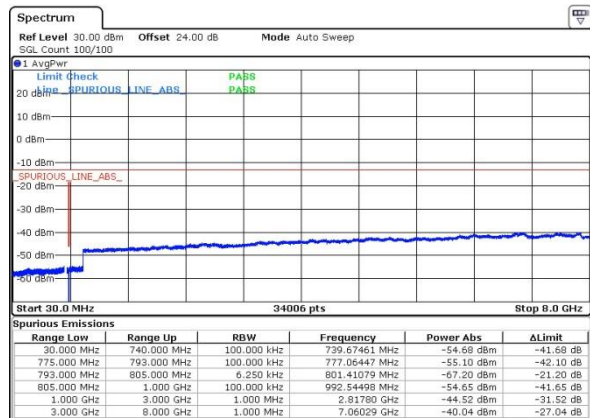
Middle Channel / 16QAM



Date: 26 AUG 2015 17:18:00

LTE Band 13 / 10MHz for Short Antenna

Middle Channel / 16QAM

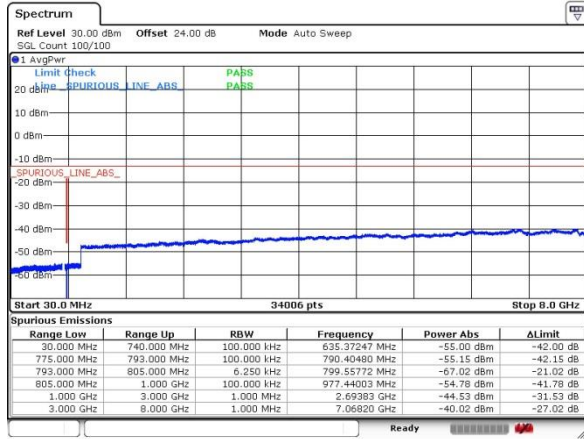


Date: 26 AUG 2015 17:18:58



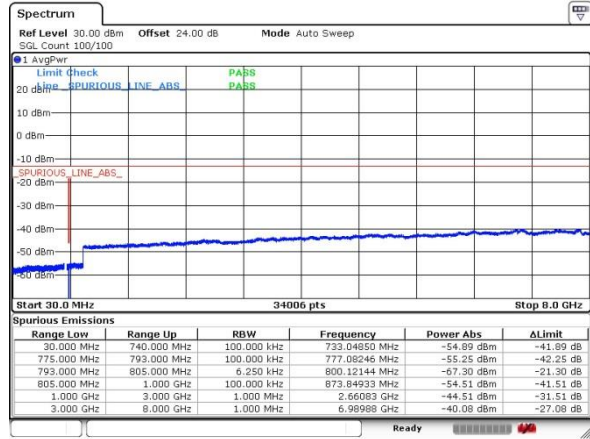
LTE Band 13 / 10MHz for Long Antenna

Middle Channel / 64QAM



LTE Band 13 / 10MHz for Short Antenna

Middle Channel / 64QAM





Appendix B. Test Results of Radiated Test

Radiated Spurious Emission

LTE Band 4 / 10MHz / QPSK / Full RB									
Channel	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Over Limit (dB)	SPA Reading (dBm)	S.G. Power (dBm)	TX Cable loss (dB)	TX Antenna Gain (dBi)	Polarization (H/V)
Lowest	4232	-58.11	-13	-45.11	-73.88	-64.86	1.89	8.65	H
	6346	-54.98	-13	-41.98	-76.39	-62.29	2.80	10.11	H
	8460	-45.03	-13	-32.03	-70.8	-55.13	2.37	12.47	H
	4232	-58.52	-13	-45.52	-74.27	-65.27	1.89	8.65	V
	6346	-52.84	-13	-39.84	-73.75	-60.15	2.80	10.11	V
	8460	-38.36	-13	-25.36	-63.46	-48.46	2.37	12.47	V
Middle	4267	-56.86	-13	-43.86	-72.74	-63.6	1.91	8.65	H
	6395	-55.92	-13	-42.92	-77.46	-63.27	2.79	10.14	H
	8530	-41.84	-13	-28.84	-68.19	-51.97	2.38	12.51	H
	4267	-57.41	-13	-44.41	-72.9	-64.15	1.91	8.65	V
	6395	-54.52	-13	-41.52	-75.7	-61.87	2.79	10.14	V
	8530	-33.89	-13	-20.89	-59.21	-44.02	2.38	12.51	V
Highest	4290	-55.12	-13	-42.12	-71.05	-61.85	1.93	8.66	H
	6435	-55.91	-13	-42.91	-77.55	-63.3	2.77	10.16	H
	8580	-40.98	-13	-27.98	-67.94	-51.12	2.39	12.53	H
	4290	-54.77	-13	-41.77	-70.16	-61.5	1.93	8.66	V
	6435	-51.69	-13	-38.69	-73.37	-59.08	2.77	10.16	V
	8580	-34.91	-13	-21.91	-60.36	-45.05	2.39	12.53	V



LTE Band 4 / 10MHz / QPSK / Full RB									
Channel	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Over Limit (dB)	SPA Reading (dBm)	S.G. Power (dBm)	TX Cable loss (dB)	TX Antenna Gain (dBi)	Polarization (H/V)
Lowest	4230	-55.83	-13	-42.83	-77.58	-62.58	1.89	8.65	H
	6345	-52.82	-13	-39.82	-78	-60.13	2.80	10.11	H
	8460	-36.26	-13	-23.26	-62.15	-46.36	2.37	12.47	H
	4230	-54.83	-13	-41.83	-77.34	-61.58	1.89	8.65	V
	6345	-51.01	-13	-38.01	-77.06	-58.32	2.80	10.11	V
	8460	-28.31	-13	-15.31	-56.41	-38.41	2.37	12.47	V
Middle	4265	-55.47	-13	-42.47	-77.23	-62.21	1.91	8.65	H
	6397	-52.66	-13	-39.66	-78.1	-60.01	2.78	10.14	H
	8530	-40.26	-13	-27.26	-66.64	-50.39	2.38	12.51	H
	4265	-55.29	-13	-42.29	-77.67	-62.03	1.91	8.65	V
	6397	-51.28	-13	-38.28	-77.68	-58.63	2.78	10.14	V
	8530	-33.44	-13	-20.44	-61.73	-43.57	2.38	12.51	V
Highest	4290	-55.45	-13	-42.45	-77.21	-62.18	1.93	8.66	H
	6435	-51.24	-13	-38.24	-76.62	-58.63	2.77	10.16	H
	8580	-37.34	-13	-24.34	-63.67	-47.48	2.39	12.53	H
	4290	-54.79	-13	-41.79	-77.32	-61.52	1.93	8.66	V
	6435	-49.93	-13	-36.93	-76.1	-57.32	2.77	10.16	V
	8580	-29.45	-13	-16.45	-57.77	-39.59	2.39	12.53	V

Remark: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.



LTE Band 4 / 10MHz / 16QAM / Full RB									
Channel	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Over Limit (dB)	SPA Reading (dBm)	S.G. Power (dBm)	TX Cable loss (dB)	TX Antenna Gain (dBi)	Polarization (H/V)
Lowest	4230	-56.23	-13	-43.23	-77.7	-62.98	1.89	8.65	H
	6345	-52.96	-13	-39.96	-78.31	-60.27	2.80	10.11	H
	8460	-43.08	-13	-30.08	-68.91	-53.18	2.37	12.47	H
	4230	-55.37	-13	-42.37	-77.56	-62.12	1.89	8.65	V
	6345	-49.88	-13	-36.88	-76.3	-57.19	2.80	10.11	V
	8460	-32.48	-13	-19.48	-60.66	-42.58	2.37	12.47	V
Middle	4265	-55.78	-13	-42.78	-77.45	-62.52	1.91	8.65	H
	6397.5	-52.86	-13	-39.86	-78.55	-60.21	2.78	10.14	H
	8530	-46.76	-13	-33.76	-72.63	-56.89	2.38	12.51	H
	4265	-55.35	-13	-42.35	-77.73	-62.09	1.91	8.65	V
	6397.5	-50.97	-13	-37.97	-77.11	-58.32	2.78	10.14	V
	8530	-35.98	-13	-22.98	-64.09	-46.11	2.38	12.51	V
Highest	4290	-55.75	-13	-42.75	-77.55	-62.48	1.93	8.66	H
	6435	-51.93	-13	-38.93	-77.54	-59.32	2.77	10.16	H
	8580	-43.43	-13	-30.43	-69.62	-53.57	2.39	12.53	H
	4290	-54.85	-13	-41.85	-77.39	-61.58	1.93	8.66	V
	6435	-49.24	-13	-36.24	-75.57	-56.63	2.77	10.16	V
	8580	-32.44	-13	-19.44	-60.61	-42.58	2.39	12.53	V

Remark: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.



LTE Band 4 / 10MHz / 64QAM / Full RB									
Channel	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Over Limit (dB)	SPA Reading (dBm)	S.G. Power (dBm)	TX Cable loss (dB)	TX Antenna Gain (dBi)	Polarization (H/V)
Lowest	4232	-55.64	-13	-42.64	-77.33	-62.39	1.89	8.65	H
	6346	-52.75	-13	-39.75	-78.5	-60.06	2.80	10.11	H
	8460	-43.78	-13	-30.78	-69.92	-53.88	2.37	12.47	H
	4232	-55.28	-13	-42.28	-77.51	-62.03	1.89	8.65	V
	6346	-49.85	-13	-36.85	-76.67	-57.16	2.80	10.11	V
	8460	-32.45	-13	-19.45	-61.01	-42.55	2.37	12.47	V
Middle	4267	-55.92	-13	-42.92	-77.75	-62.66	1.91	8.65	H
	6395	-52.42	-13	-39.42	-78.26	-59.77	2.79	10.14	H
	8530	-45.89	-13	-32.89	-72.16	-56.02	2.38	12.51	H
	4267	-55.07	-13	-42.07	-77.53	-61.81	1.91	8.65	V
	6395	-51.18	-13	-38.18	-77.84	-58.53	2.79	10.14	V
	8530	-35.54	-13	-22.54	-64.17	-45.67	2.38	12.51	V
Highest	4288	-55.56	-13	-42.56	-77.3	-62.29	1.93	8.66	H
	6435	-51.92	-13	-38.92	-77.86	-59.31	2.77	10.16	H
	8580	-41.88	-13	-28.88	-68.66	-52.02	2.39	12.53	H
	4288	-54.86	-13	-41.86	-77.37	-61.59	1.93	8.66	V
	6435	-49.56	-13	-36.56	-76.25	-56.95	2.77	10.16	V
	8580	-33.43	-13	-20.43	-62.05	-43.57	2.39	12.53	V

Remark: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.



LTE Band 13 / 10MHz / QPSK / Full RB									
Channel	Frequency (MHz)	ERP (dBm)	Limit (dBm)	Over Limit (dB)	SPA Reading (dBm)	S.G. Power (dBm)	TX Cable loss (dB)	TX Antenna Gain (dBi)	Polarization (H/V)
Middle	1502	-63.40	-13	-50.40	-73.23	-65.63	0.91	5.29	H
	2253	-61.98	-13	-48.98	-76.23	-63.28	1.21	4.66	H
	3004	-60.25	-13	-47.25	-77.25	-62.47	1.45	5.82	H
	1502	-63.29	-13	-50.29	-73.99	-65.52	0.91	5.29	V
	2253	-60.78	-13	-47.78	-76.3	-62.08	1.21	4.66	V
	3004	-58.77	-13	-45.77	-77.34	-60.99	1.45	5.82	V

LTE Band 13 / 10MHz / 16QAM / Full RB									
Channel	Frequency (MHz)	ERP (dBm)	Limit (dBm)	Over Limit (dB)	SPA Reading (dBm)	S.G. Power (dBm)	TX Cable loss (dB)	TX Antenna Gain (dBi)	Polarization (H/V)
Middle	1502	-64.09	-13	-51.09	-73.7	-66.32	0.91	5.29	H
	2253	-61.90	-13	-48.90	-76.18	-63.2	1.21	4.66	H
	3004	-59.25	-13	-46.25	-76.24	-61.47	1.45	5.82	H
	1502	-62.29	-13	-49.29	-72.8	-64.52	0.91	5.29	V
	2253	-60.73	-13	-47.73	-76.3	-62.03	1.21	4.66	V
	3004	-58.19	-13	-45.19	-76.34	-60.41	1.45	5.82	V

LTE Band 13 / 10MHz / 64QAM / Full RB									
Channel	Frequency (MHz)	ERP (dBm)	Limit (dBm)	Over Limit (dB)	SPA Reading (dBm)	S.G. Power (dBm)	TX Cable loss (dB)	TX Antenna Gain (dBi)	Polarization (H/V)
Middle	1504	-63.79	-13	-50.79	-74.02	-66.02	0.91	5.29	H
	2253	-61.92	-13	-48.92	-76.18	-63.22	1.21	4.66	H
	3004	-58.83	-13	-45.83	-75.88	-61.05	1.45	5.82	H
	1504	-62.88	-13	-49.88	-73.82	-65.11	0.91	5.29	V
	2253	-59.92	-13	-46.92	-76.06	-61.22	1.21	4.66	V
	3004	-57.84	-13	-44.84	-76.04	-60.06	1.45	5.82	V

Remark: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

