



FCC RF Test Report

APPLICANT : SHARP CORPORATION, IoT Communication BU
EQUIPMENT : Smart Phone
FCC ID : APYHRO00245
STANDARD : 47 CFR Part 2, 27
CLASSIFICATION : PCS Licensed Transmitter Held to Ear (PCE)

The product was received on Oct. 15, 2016 and completely tested on Nov. 07, 2016. 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-D-2010 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



Testing Laboratory
1190

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SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.4	§2.1046	Conducted Output Power	Reporting Only	PASS	-
3.5	N/A	Peak-to-Average Ratio	<13 dB	PASS	-
3.6	§2.1049	Occupied Bandwidth	Reporting Only	PASS	-
3.7	§2.1051 §27.53(g)	Conducted Band Edge Measurement (Band 17)	< 43+10log10(P[Watts])	PASS	-
3.8	§2.1051 §27.53(g)	Conducted Spurious Emission (Band 17)	< 43+10log10(P[Watts])	PASS	-
3.9	§2.1055 §2.1055 §27.54	Frequency Stability Temperature & Voltage	Within Authorized Band	PASS	-
	§27.50(c)(10)	Effective Radiated Power (Band 17)	ERP < 3 Watt	PASS	-
4.5	§2.1053 §27.53(g)	Radiated Spurious Emission (Band 17)	< 43+10log ₁₀ (P[Watts])	PASS	Under limit 36.53 dB at 2112.000 MHz

1 General Description

1.1 Applicant

SHARP CORPORATION, IoT Communication BU

2-13-1, Hachihonmatsu-lida, Higashi-hiroshima-shi, Hiroshima pref. 739-0192, Japan

1.2 Manufacturer

SHARP CORPORATION, IoT Communication BU

2-13-1, Hachihonmatsu-lida, Higashi-hiroshima-shi, Hiroshima pref. 739-0192, Japan

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	Smart Phone
FCC ID	APYHRO00245
Sample 1	eMMC Brand Name : Samsung
Sample 2	eMMC Brand Name : hynix
EUT supports Radios application	GSM/GPRS/WCDMA/HSPA/LTE/NFC WLAN 11b/g/n HT20 WLAN 11a/n HT20/HT40 WLAN 11ac VHT20/VHT40/VHT80 Bluetooth BR/EDR/LE
HW Version	PP1
SW Version	CA240
EUT Stage	Identical Prototype

Remark:

1. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.
2. All tests were performed with sample 1.

1.4 Product Specification of Equipment Under Test

Standards-related Product Specification	
Tx Frequency	LTE Band 17 : 706.5 MHz ~ 713.5 MHz
Rx Frequency	LTE Band 17 : 736.5 MHz ~ 743.5 MHz
Bandwidth	LTE Band 17 : 5MHz / 10MHz
Maximum Output Power to Antenna	LTE Band 17 : 23.16 dBm
Antenna Gain	LTE Band 17 : 2.0 dBi
Type of Modulation	QPSK / 16QAM

1.5 Modification of EUT

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



1.6 Emission Designator

LTE Band 17		QPSK			16QAM		
BW (MHz)	Frequency Range (MHz)	Emission Designator (99%OBW)	Frequency Tolerance (ppm)	Maximum ERP(W)	Emission Designator (99%OBW)	Frequency Tolerance (ppm)	Maximum ERP(W)
5	706.5 ~ 713.5	4M49G7D	-	0.0200	4M51W7D	-	0.0177
10	709.0 ~ 711.0	9M03G7D	0.0048	0.0183	9M01W7D	-	0.0140

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.
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Test Site No.	Sporton Site No. TH05-HY

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Test Site No.	Sporton Site No. 03CH12-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-D-2010
- ♦ FCC KDB 971168 D01 Power Meas. License Digital Systems v02r02

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.



2 Test Configuration of Equipment Under Test

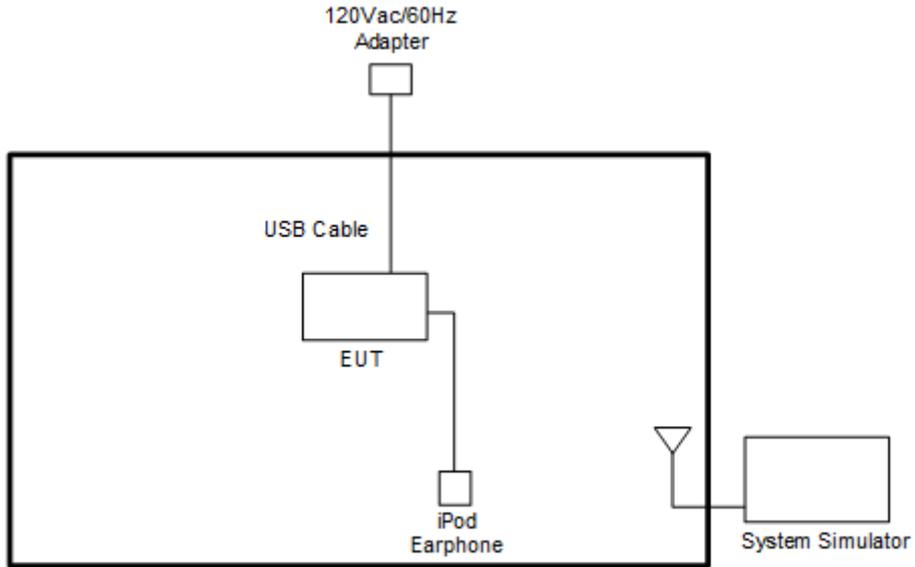
2.1 Test Mode

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.

Radiated measurements are performed by rotating the EUT in three different orthogonal test planes to find the maximum emission.

Test Items	Band	Bandwidth (MHz)						Modulation		RB #			Test Channel		
		1.4	3	5	10	15	20	QPSK	16QAM	1	Half	Full	L	M	H
Max. Output Power	17	-	-	✓	✓	-	-	✓	✓	✓	✓	✓	✓	✓	✓
Peak-to-Average Ratio	17	-	-	✓	✓	-	-	✓	✓	✓	-	✓	✓	✓	✓
26dB and 99% Bandwidth	17	-	-	✓	✓	-	-	✓	✓	-	-	✓	✓	✓	✓
Conducted Band Edge	17	-	-	✓	✓	-	-	✓	✓	✓	-	✓	✓	-	✓
Conducted Spurious Emission	17	-	-	✓	✓	-	-	✓	✓	✓	-	-	✓	✓	✓
Frequency Stability	17	-	-	✓	✓	-	-	✓	-	-	-	✓	-	✓	-
E.R.P./ E.I.R.P.	17	-	-	✓	✓	-	-	✓	✓	✓	-	-	✓	✓	✓
Radiated Spurious Emission	17	-	-	✓	✓	-	-	✓	-	✓	✓	✓	✓	✓	✓
Note	<ol style="list-style-type: none"> The mark "✓" means that this configuration is chosen for testing The mark "-" means that this bandwidth is not supported. 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 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model No.	FCC ID	Data Cable	Power Cord
1.	System Simulator	R&S	CMU 200	N/A	N/A	Unshielded, 1.8 m
2.	iPod Earphone	Apple	N/A	Verification	Unshielded, 1.0 m	N/A
3.	USB Cable	SHARP (P1X accessory)	CUBB01M-FA00 2-DH	N/A	Shielded, 0.9m	N/A
4.	Adapter	SHARP	DSA-10PFL-05 FUS 050200	N/A	N/A	N/A



2.4 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.

$$\text{Offset} = \text{RF cable loss} + \text{attenuator factor}.$$

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

Example :

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

2.5 Frequency List of Low/Middle/High Channels

LTE Band 17 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
10	Channel	23780	23790	23800
	Frequency	709	710	711
5	Channel	23755	23790	23825
	Frequency	706.5	710	713.5

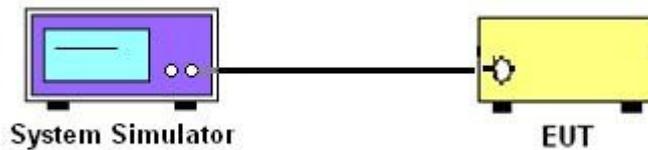
3 Conducted Test Items

3.1 Measuring Instruments

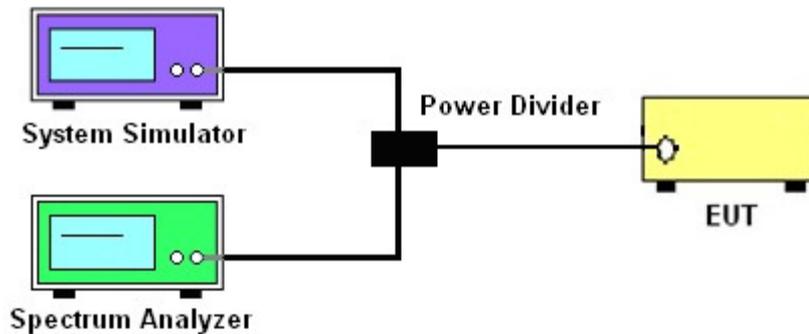
See list of measuring instruments of this test report.

3.2 Test Setup

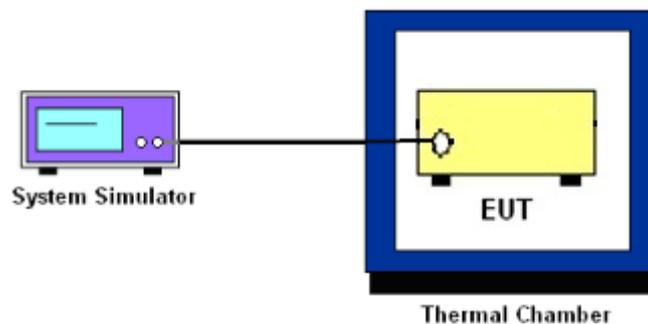
3.2.1 Conducted Output Power



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

3.4.1 Description of the Conducted Output Power 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.

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 Peak-to-Average Ratio

3.5.1 Description of the PAR Measurement

Power Complementary Cumulative Distribution Function (CCDF) curves provide a means for characterizing the power peaks of a digitally modulated signal on a statistical basis. A CCDF curve depicts the probability of the peak signal amplitude exceeding the average power level. Most contemporary measurement instrumentation include the capability to produce CCDF curves for an input signal provided that the instrument's resolution bandwidth can be set wide enough to accommodate the entire input signal bandwidth. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

3.5.2 Test Procedures

1. The testing follows FCC KDB 971168 v02r02 Section 5.7.1.
2. The EUT was connected to spectrum and system simulator via a power divider.
3. Set the CCDF (Complementary Cumulative Distribution Function) option in spectrum analyzer.
4. The highest RF powers were measured and recorded the maximum PAPR level associated with a probability of 0.1 %.
5. Record the deviation as Peak to Average Ratio.



3.6 Occupied Bandwidth

3.6.1 Description of Occupied Bandwidth Measurement

The occupied bandwidth is the width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5% of the total mean transmitted power.

The 26 dB emission bandwidth is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated 26 dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth equal to approximately 1.0% of the emission bandwidth.

3.6.2 Test Procedures

1. The testing follows FCC KDB 971168 v02r02 Section 4.2.
2. The EUT was connected to spectrum analyzer and system simulator via a power divider.
3. The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the spectrum analyzer shall be between two and five times the anticipated OBW.
4. The nominal resolution bandwidth (RBW) shall be in the range of 1 to 5 % of the anticipated OBW, and the VBW shall be at least 3 times the RBW.
5. Set the detection mode to peak, and the trace mode to max hold.
6. Determine the reference value: Set the EUT to transmit a modulated signal. Allow the trace to stabilize. Set the spectrum analyzer marker to the highest level of the displayed trace.
(this is the reference value)
7. Determine the “-26 dB down amplitude” as equal to (Reference Value – X).
8. Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display such that each marker is at or slightly below the “-X dB down amplitude” determined in step 6. If a marker is below this “-X dB down amplitude” value it shall be placed as close as possible to this value. The OBW is the positive frequency difference between the two markers.
9. Use the 99 % power bandwidth function of the spectrum analyzer and report the measured bandwidth.



3.7 Conducted Band Edge

3.7.1 Description of Conducted Band Edge Measurement

27.53 (g)

For operations in the 698 -746 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 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

3.7.2 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 $P(\text{Watts})$
 $= P(\text{W}) - [43 + 10\log(P)] (\text{dB})$
 $= [30 + 10\log(P)] (\text{dBm}) - [43 + 10\log(P)] (\text{dB}) = -13\text{dBm}.$



3.8 Conducted Spurious Emission

3.8.1 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.

3.8.2 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 + 10log(P)] (dB)
= [30 + 10log(P)] (dBm) - [43 + 10log(P)] (dB)
= -13dBm.



3.9 Frequency Stability

3.9.1 Description of Frequency Stability Measurement

The frequency stability shall be measured by variation of ambient temperature and variation of primary supply voltage to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within $\pm 0.00025\%$ ($\pm 2.5\text{ppm}$) of the center frequency.

3.9.2 Test Procedures for Temperature Variation

1. The testing follows FCC KDB 971168 v02r02 Section 9.0.
2. The EUT was set up in the thermal chamber and connected with the system simulator.
3. With power OFF, the temperature was decreased to -30°C and the EUT was stabilized before testing. Power was applied and the maximum change in frequency was recorded within one minute.
4. With power OFF, the temperature was raised in 10°C step up to 50°C . The EUT was stabilized at each step for at least half an hour. Power was applied and the maximum frequency change was recorded within one minute.

3.9.3 Test Procedures for Voltage Variation

1. The testing follows FCC KDB 971168 v02r02 Section 9.0.
2. The EUT was placed in a temperature chamber at $20\pm 5^{\circ}\text{C}$ and connected with the system simulator.
3. The power supply voltage to the EUT was varied from 85% to 115% of the nominal value measured at the input to the EUT.
4. The variation in frequency was measured for the worst case.

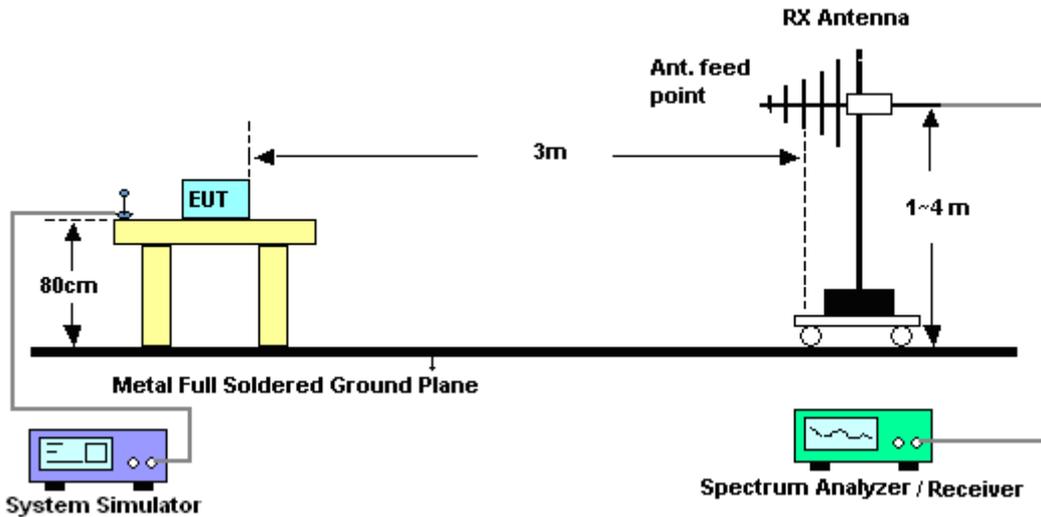
4 Radiated Test Items

4.1 Measuring Instruments

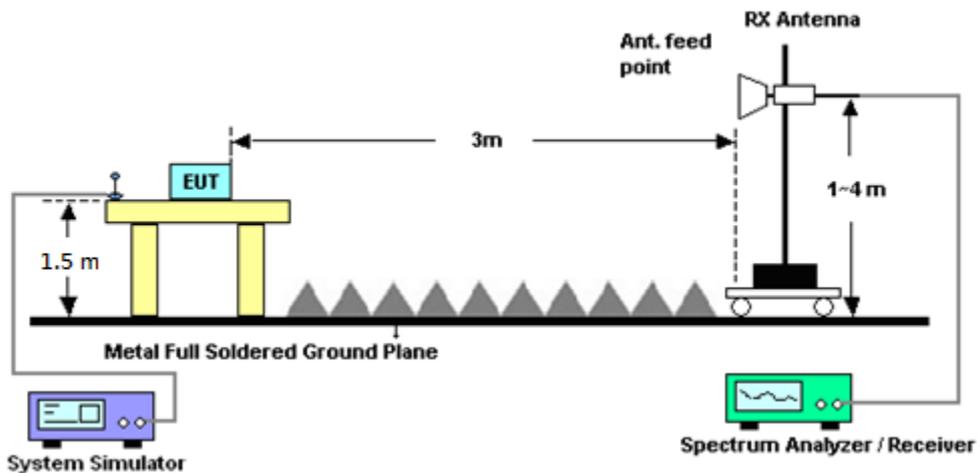
See list of measuring instruments of this test report.

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 Effective Radiated Power and Effective Isotropic Radiated Power

4.4.1 Description of the ERP/EIRP Measurement

Effective radiated power output measurements by substitution method according to ANSI / TIA / EIA-603-D-2010, and the spectrum analyzer configuration follows KDB 971168 D01 Power Meas. License Digital Systems v02r02. Mobile and portable (hand-held) stations operating are limited to average ERP of 3 watts with LTE band 17.

4.4.2 Test Procedures

1. The EUT was placed on a non-conductive rotating platform (0.8 meters for frequency below 1GHz and 1.5 meter for frequency above 1GHz) in a semi-anechoic chamber. The radiated emission at the fundamental frequency was measured at 3 m with a test antenna and a spectrum analyzer with RMS detector per section 5. of KDB 971168 D01.
2. During the measurement, the system simulator parameters were set to force the EUT transmitting at maximum output power. The maximum emission was recorded from analyzer power level (LVL) from the 360 degrees rotation of the turntable and the test antenna raised and lowered over a range from 1 to 4 meters in both horizontally and vertically polarized orientations.
3. Effective Isotropic Radiated Power (EIRP) was measured by substitution method according to TIA/EIA-603-D. The EUT was replaced by the substitution antenna at same location, and then a known power from S.G. was applied into the dipole antenna through a Tx cable, and then recorded the maximum Analyzer reading through raised and lowered the test antenna. The correction factor (in dB) = S.G. - Tx Cable loss + Substitution antenna gain - Analyzer reading. Then the EUT's EIRP was calculated with the correction factor, $EIRP = LVL + \text{Correction factor}$ and $ERP = EIRP - 2.15$. Take the record of the output power at substitution antenna.

	LTE Average					
LTE BW	1.4M	3M	5M	10M	15M	20M
Span	3MHz	6MHz	10MHz	20MHz	30MHz	40MHz
RBW	30kHz	100kHz	100kHz	300kHz	300kHz	300kHz
VBW	100kHz	300kHz	300kHz	1MHz	1MHz	1MHz
Detector	RMS	RMS	RMS	RMS	RMS	RMS
Trace	Average	Average	Average	Average	Average	Average
Average Type	Power	Power	Power	Power	Power	Power
Sweep Count	100	100	100	100	100	100



4.5 Radiated Spurious Emission

4.5.1 Description of Radiated Spurious Emission

The radiated spurious emission was measured by substitution method according to ANSI / TIA / EIA-603-D-2010. 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.

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

4.5.2 Test Procedures

1. The testing follows FCC KDB 971168 v02r02 Section 5.8 and ANSI / TIA-603-D-2010 Section 2.2.12.
2. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively 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 + 10log(P)] (dB)
= [30 + 10log(P)] (dBm) - [43 + 10log(P)] (dB)
= -13dBm.



5 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
LTE Base Station	Anritsu	MT8820C	6201432821	GSM/GPRS /WCDMA/LTE	Oct. 11, 2016	Oct. 15, 2016 ~ Nov. 07, 2016	Oct. 10, 2017	Conducted (TH05-HY)
Spectrum Analyzer	Rohde & Schwarz	FSV30	100895	9kHz~30GHz	Apr. 26, 2016	Oct. 15, 2016 ~ Nov. 07, 2016	Apr. 25, 2017	Conducted (TH05-HY)
Temperature Chamber	ESPEC	SH-641	92013720	-30°C ~70°C	Sep. 01, 2016	Oct. 15, 2016 ~ Nov. 07, 2016	Aug. 31, 2017	Conducted (TH05-HY)
Programmable Power Supply	GW Instek	PSS-2005	EL890001	1V~20V 0.5A~5A	Oct. 03, 2016	Oct. 15, 2016 ~ Nov. 07, 2016	Oct. 02, 2017	Conducted (TH05-HY)
Amplifier	SONOMA	310N	187312	9kHz~1GHz	Nov. 20, 2015	Nov. 04, 2016 ~ Nov. 05, 2016	Nov. 19, 2016	Radiation (03CH12-HY)
Bilog Antenna	TESEQ	CBL 6111D&008	37059&01	30MHz~1GHz	Oct. 15, 2016	Nov. 04, 2016 ~ Nov. 05, 2016	Oct. 14, 2017	Radiation (03CH12-HY)
EMI Test Receiver	Rohde & Schwarz	ESU26	100390	20Hz~26.5GHz	Dec. 21, 2015	Nov. 04, 2016 ~ Nov. 05, 2016	Dec. 20, 2016	Radiation (03CH12-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-1328	1GHz ~ 18GHz	Oct. 25, 2016	Nov. 04, 2016 ~ Nov. 05, 2016	Oct. 24, 2017	Radiation (03CH12-HY)
Preamplifier	MITEQ	AMF-7D-00 101800-30-1	1815698	1GHz~18GHz	Dec. 14, 2015	Nov. 04, 2016 ~ Nov. 05, 2016	Dec. 13, 2016	Radiation (03CH12-HY)
Antenna Mast	EMEC	AM-BS-450 0-B	N/A	1m~4m	N/A	Nov. 04, 2016 ~ Nov. 05, 2016	N/A	Radiation (03CH12-HY)
Turn Table	EMEC	TT2000	N/A	0~360 Degree	N/A	Nov. 04, 2016 ~ Nov. 05, 2016	N/A	Radiation (03CH12-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170576	18GHz ~ 40GHz	Apr. 15, 2016	Nov. 04, 2016 ~ Nov. 05, 2016	Apr. 14, 2017	Radiation (03CH12-HY)
Preamplifier	MITEQ	JS44-18004 000-33-8P	1840917	18GHz ~ 40GHz	Jun. 14, 2016	Nov. 04, 2016 ~ Nov. 05, 2016	Jun. 13, 2017	Radiation (03CH12-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170251	18GHz- 40GHz	Oct. 07, 2016	Nov. 04, 2016 ~ Nov. 05, 2016	Oct. 06, 2017	Radiation (03CH12-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1522	1G~18GHz	Mar. 31, 2016	Nov. 04, 2016 ~ Nov. 05, 2016	Mar. 30, 2017	Radiation (03CH12-HY)
Signal Generator	Anritsu	MG3694C	163401	0.1Hz~40GHz	Aug. 19, 2016	Nov. 04, 2016 ~ Nov. 05, 2016	Aug. 18, 2017	Radiation (03CH12-HY)



6 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.1
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Uncertainty of Radiated Emission Measurement (1 GHz ~ 40 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.2
---	-----



Appendix A. Test Results of Conducted Test

Conducted Output Power(Average power)

LTE Band 17 Maximum Average Power [dBm]						
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest
10	1	0	QPSK	23.16	23.15	23.09
10	1	25		22.76	22.66	22.67
10	1	49		22.84	22.80	22.72
10	25	0		22.10	22.04	22.05
10	25	12		22.08	22.05	22.05
10	25	25		22.06	22.04	22.04
10	50	0		22.11	22.05	22.02
10	1	0	16-QAM	21.97	21.73	21.88
10	1	25		21.75	21.53	21.51
10	1	49		21.66	21.48	21.56
10	25	0		21.09	21.04	21.04
10	25	12		21.19	21.03	21.15
10	25	25		21.04	21.17	21.25
10	50	0		21.02	21.04	21.01
5	1	0	QPSK	23.08	23.09	23.10
5	1	12		22.82	22.73	22.79
5	1	24		22.68	22.71	22.74
5	12	0		22.12	22.05	22.01
5	12	7		22.14	22.12	22.11
5	12	13		22.07	22.08	22.04
5	25	0		22.11	22.08	22.02
5	1	0	16-QAM	21.70	21.49	21.61
5	1	12		21.66	21.62	21.75
5	1	24		21.71	21.52	21.72
5	12	0		20.97	20.82	21.00
5	12	7		21.01	20.87	20.94
5	12	13		20.87	20.87	20.91
5	25	0		20.88	21.01	20.97



LTE Band 17

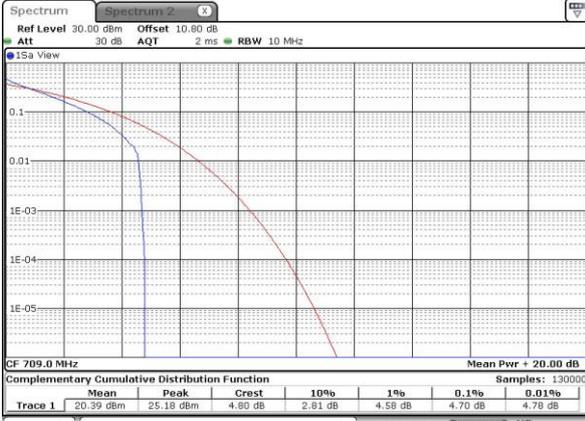
Peak-to-Average Ratio

Mode	LTE Band 17 / 10MHz				
Mod.	QPSK		16QAM		Limit: 13dB
RB Size	1RB	Full RB	1RB	Full RB	Result
Lowest CH	4.7	4.96	5.33	6.03	PASS
Middle CH	4.67	4.93	5.57	6.06	
Highest CH	4.64	4.9	5.39	5.88	



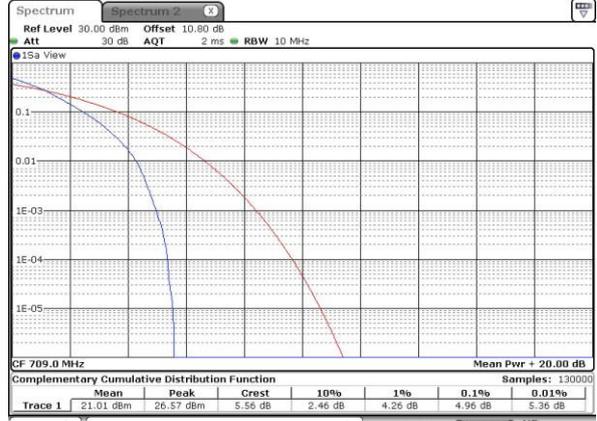
LTE Band 17 / 10MHz / QPSK

Lowest Channel / 1RB



Date: 7,NOV,2016 21:47:53

Lowest Channel / Full RB



Date: 7,NOV,2016 21:48:07

Middle Channel/ 1RB



Date: 7,NOV,2016 21:48:21

Middle Channel / Full RB



Date: 7,NOV,2016 21:48:38

Highest Channel/ 1RB



Date: 7,NOV,2016 21:48:54

Highest Channel / Full RB

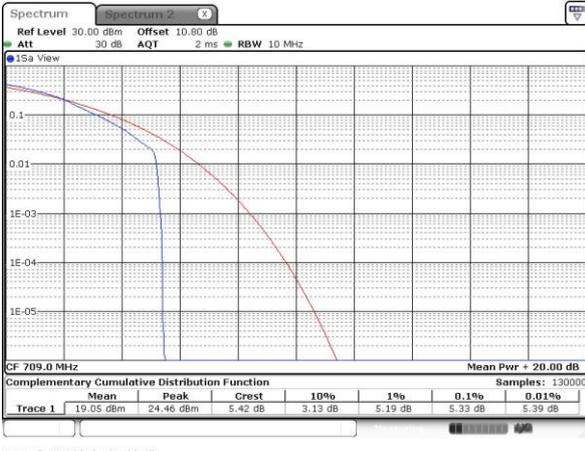


Date: 7,NOV,2016 21:49:06



LTE Band 17 / 10MHz / 16QAM

Lowest Channel / 1RB



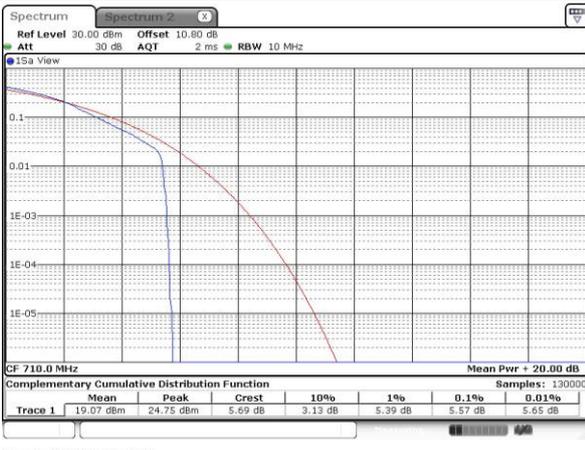
Date: 7,NOV,2016 21:46:47

Lowest Channel / Full RB



Date: 7,NOV,2016 21:46:58

Middle Channel / 1RB



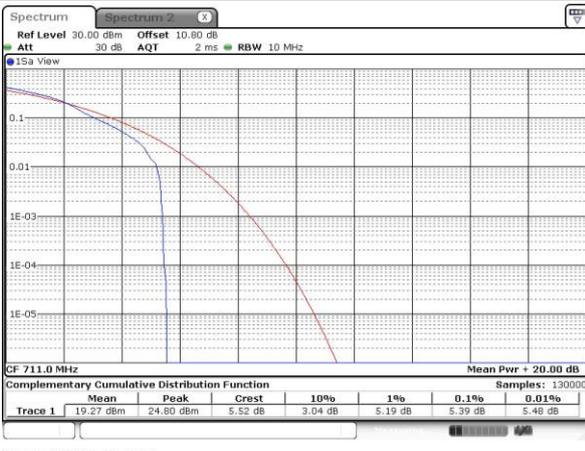
Date: 7,NOV,2016 21:47:09

Middle Channel / Full RB



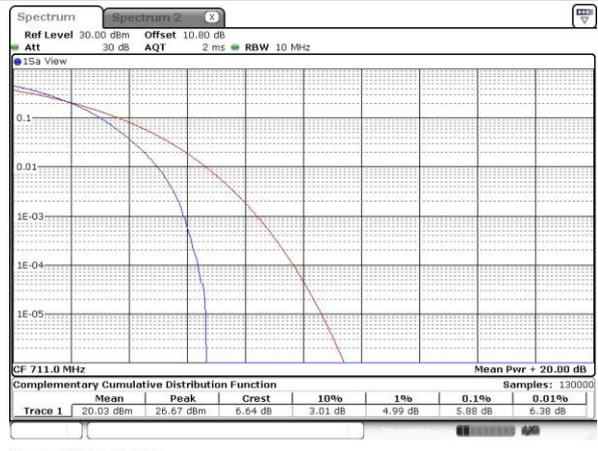
Date: 7,NOV,2016 21:47:20

Highest Channel / 1RB



Date: 7,NOV,2016 21:47:31

Highest Channel / Full RB



Date: 7,NOV,2016 21:47:42



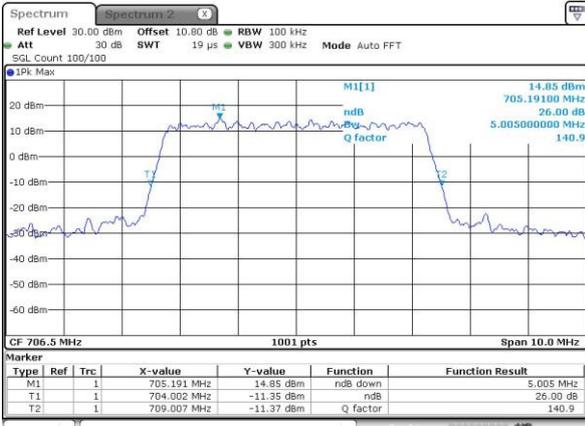
26dB Bandwidth

Mode	LTE Band 17 : 26dB BW(MHz)											
	1.4MHz		3MHz		5MHz		10MHz		15MHz		20MHz	
BW	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Mod.	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Lowest CH	-	-	-	-	5.005	4.825	9.93	9.73	-	-	-	-
Middle CH	-	-	-	-	4.935	4.895	9.69	9.67	-	-	-	-
Highest CH	-	-	-	-	4.965	4.975	9.69	9.81	-	-	-	-



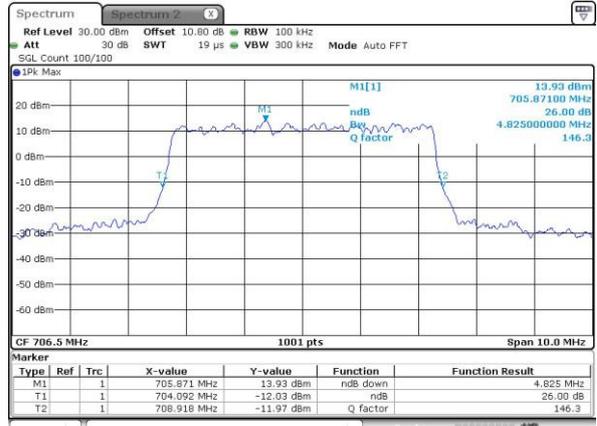
LTE Band 17

Lowest Channel / 5MHz / QPSK



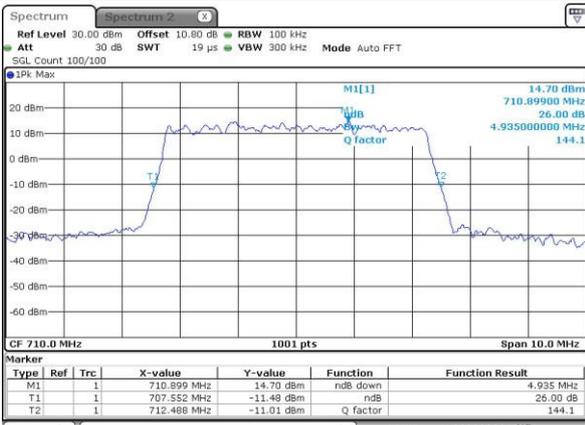
Date: 7,NOV,2016 21:06:12

Lowest Channel / 5MHz / 16QAM



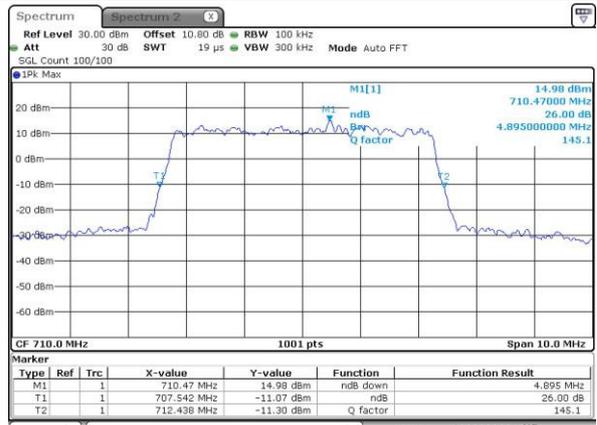
Date: 7,NOV,2016 21:06:24

Middle Channel / 5MHz / QPSK



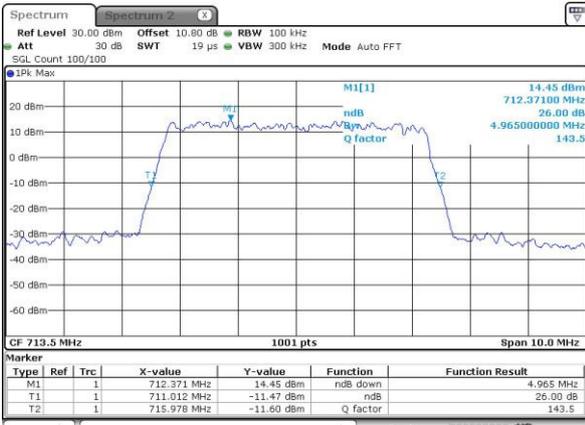
Date: 7,NOV,2016 21:13:33

Middle Channel / 5MHz / 16QAM



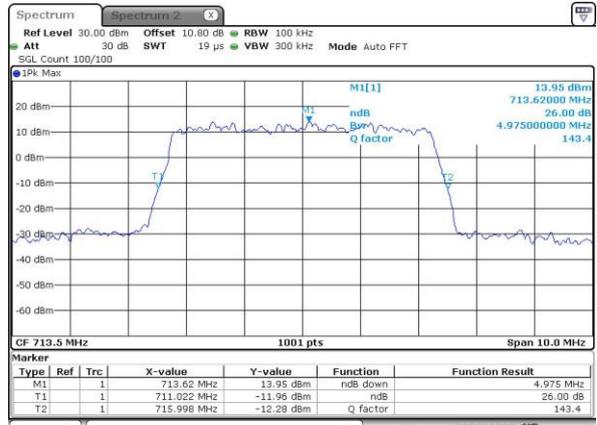
Date: 7,NOV,2016 21:13:44

Highest Channel / 5MHz / QPSK



Date: 7,NOV,2016 21:16:15

Highest Channel / 5MHz / 16QAM

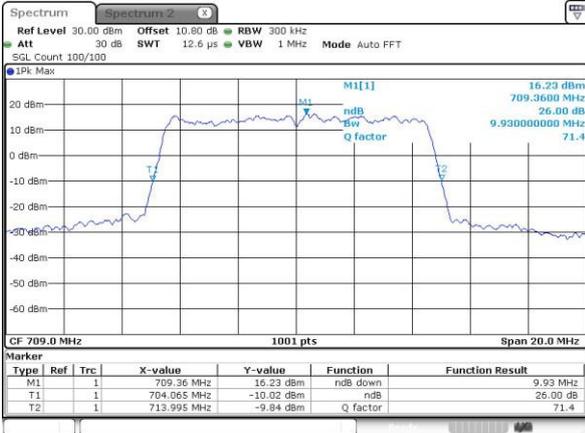


Date: 7,NOV,2016 21:16:27



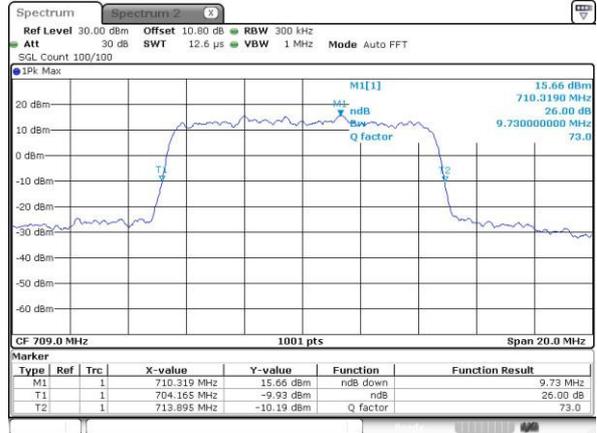
LTE Band 17

Lowest Channel / 10MHz / QPSK



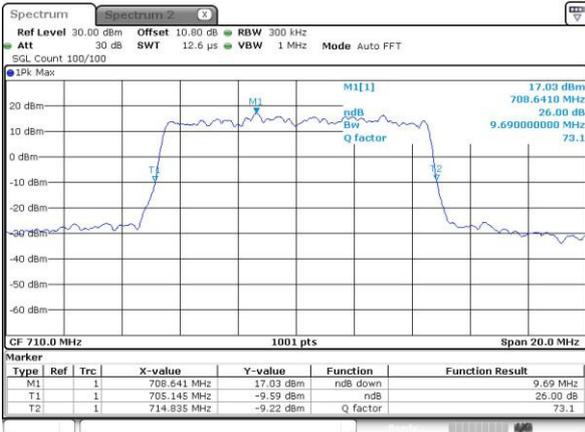
Date: 7.NOV.2016 21:23:34

Lowest Channel / 10MHz / 16QAM



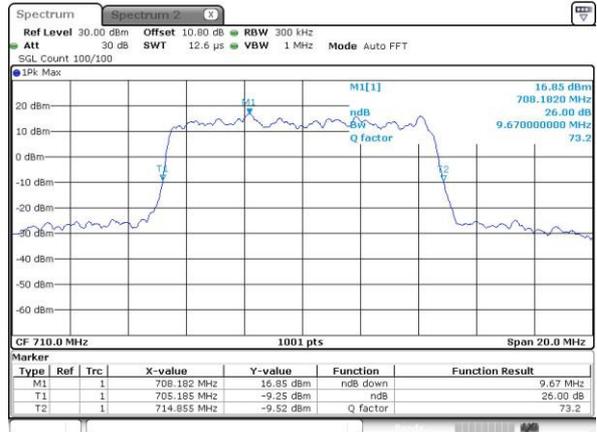
Date: 7.NOV.2016 21:23:46

Middle Channel / 10MHz / QPSK



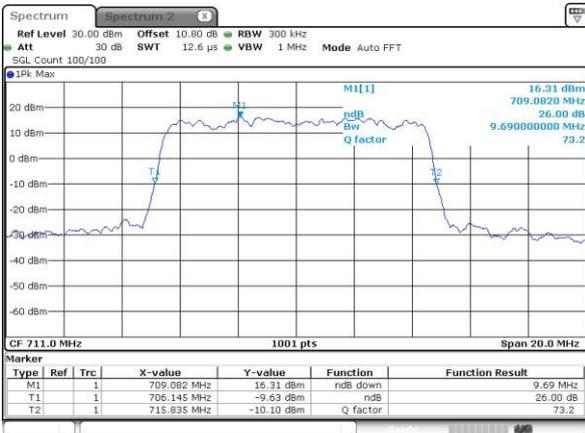
Date: 7.NOV.2016 21:50:31

Middle Channel / 10MHz / 16QAM



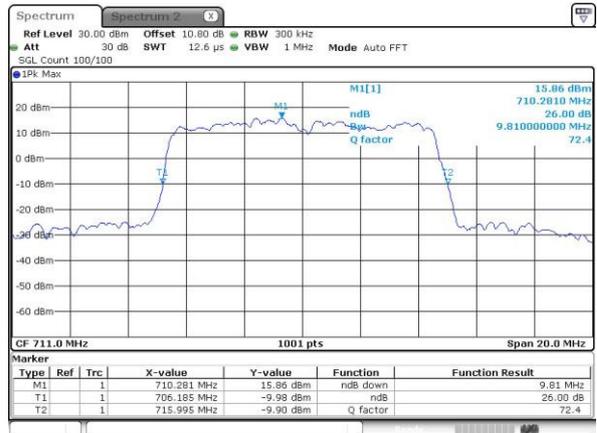
Date: 7.NOV.2016 21:51:04

Highest Channel / 10MHz / QPSK



Date: 7.NOV.2016 21:33:34

Highest Channel / 10MHz / 16QAM



Date: 7.NOV.2016 21:33:46



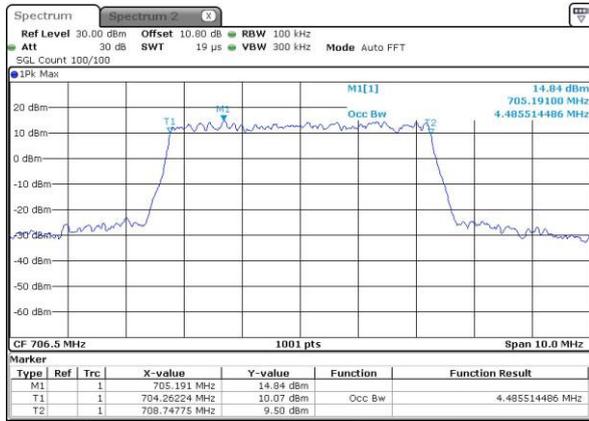
Occupied Bandwidth

Mode	LTE Band 17 : 99%OBW(MHz)											
	1.4MHz		3MHz		5MHz		10MHz		15MHz		20MHz	
BW	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Mod.	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Lowest CH	-	-	-	-	4.49	4.51	9.03	8.97	-	-	-	-
Middle CH	-	-	-	-	4.48	4.49	8.95	9.01	-	-	-	-
Highest CH	-	-	-	-	4.46	4.5	8.97	8.99	-	-	-	-



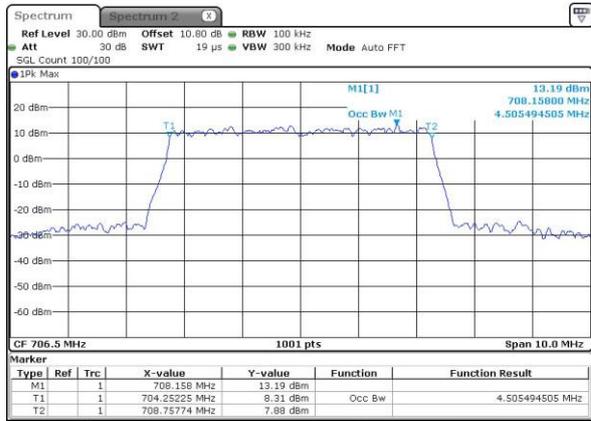
LTE Band 17

Lowest Channel / 5MHz / QPSK



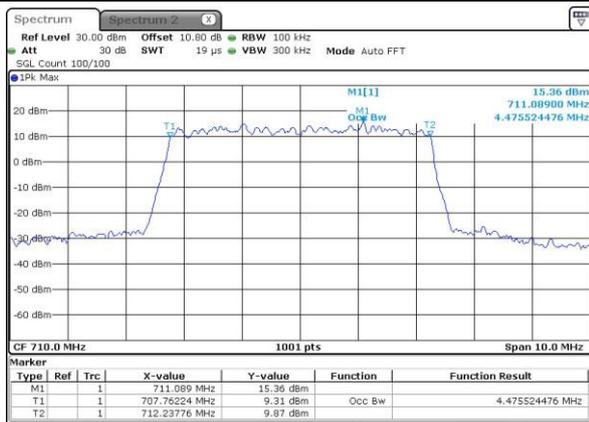
Date: 7,NOV,2016 21:05:47

Lowest Channel / 5MHz / 16QAM



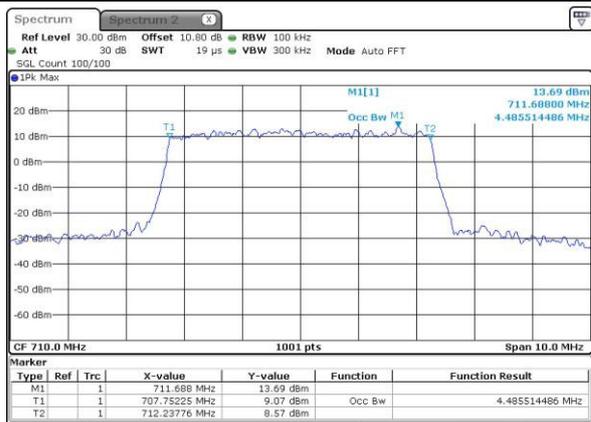
Date: 7,NOV,2016 21:06:01

Middle Channel / 5MHz / QPSK



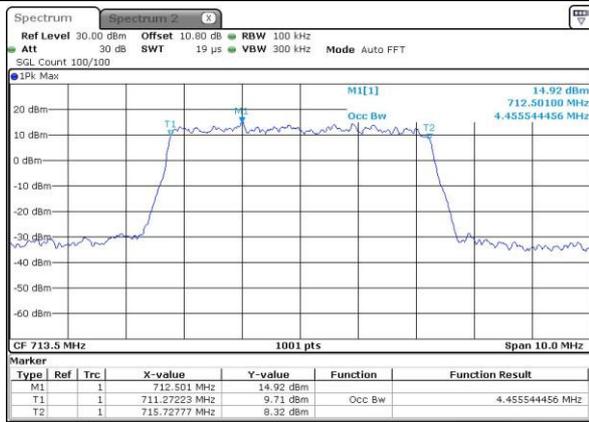
Date: 7,NOV,2016 21:13:09

Middle Channel / 5MHz / 16QAM



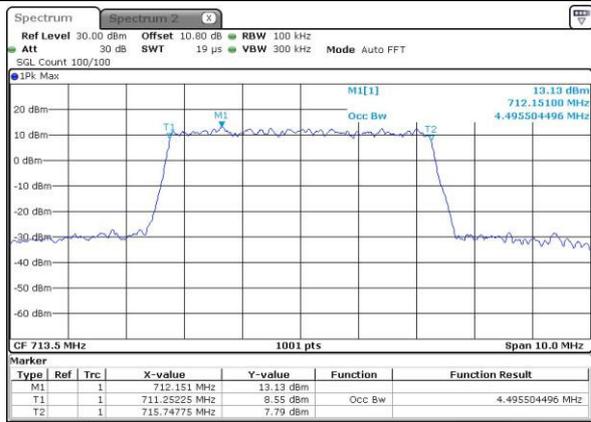
Date: 7,NOV,2016 21:13:21

Highest Channel / 5MHz / QPSK



Date: 7,NOV,2016 21:15:51

Highest Channel / 5MHz / 16QAM

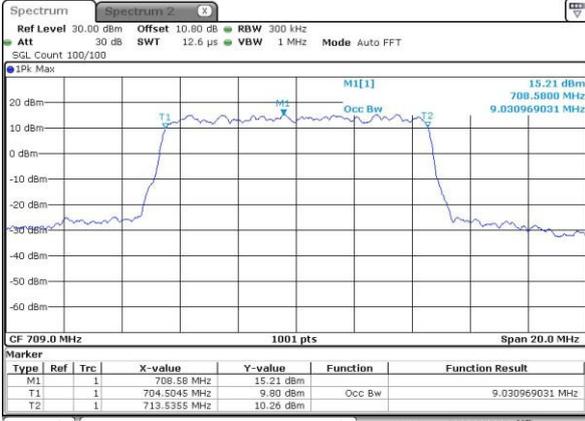


Date: 7,NOV,2016 21:16:03



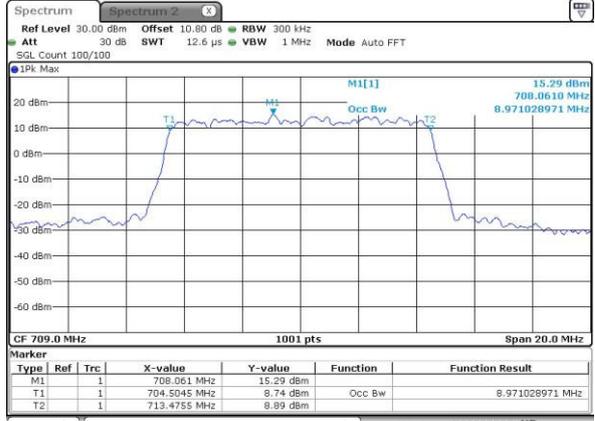
LTE Band 17

Lowest Channel / 10MHz / QPSK



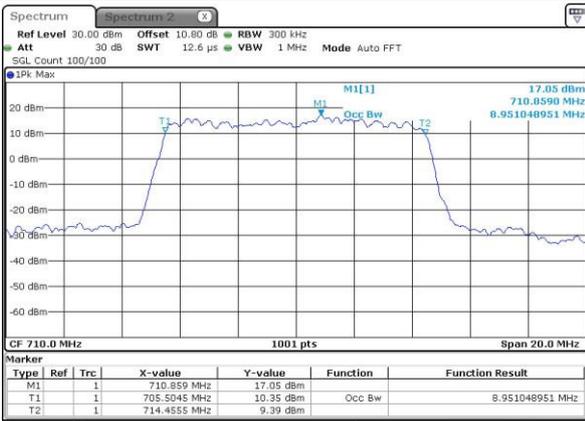
Date: 7,NOV,2016 21:23:11

Lowest Channel / 10MHz / 16QAM



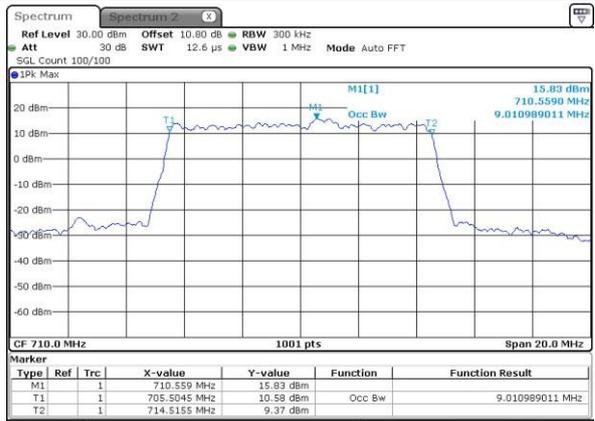
Date: 7,NOV,2016 21:23:23

Middle Channel / 10MHz / QPSK



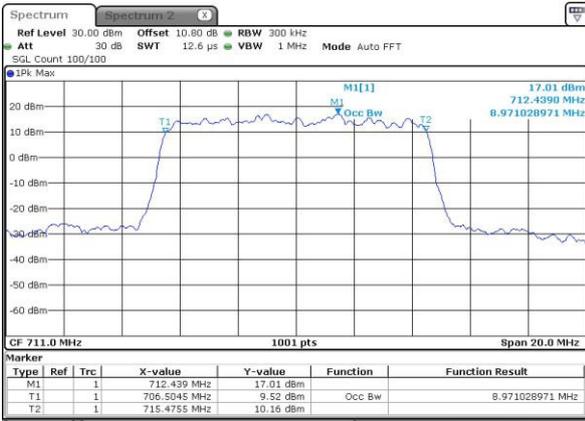
Date: 7,NOV,2016 21:30:30

Middle Channel / 10MHz / 16QAM



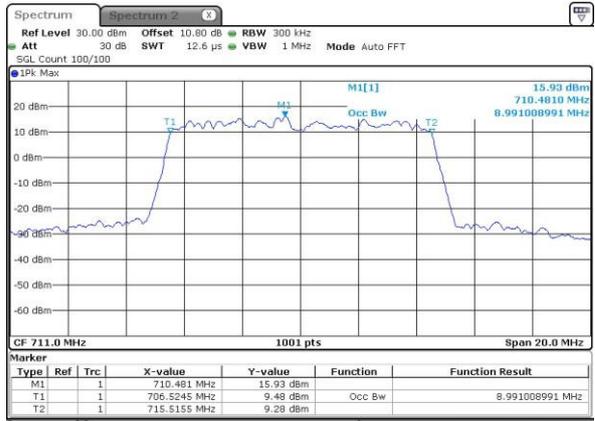
Date: 7,NOV,2016 21:30:41

Highest Channel / 10MHz / QPSK



Date: 7,NOV,2016 21:33:11

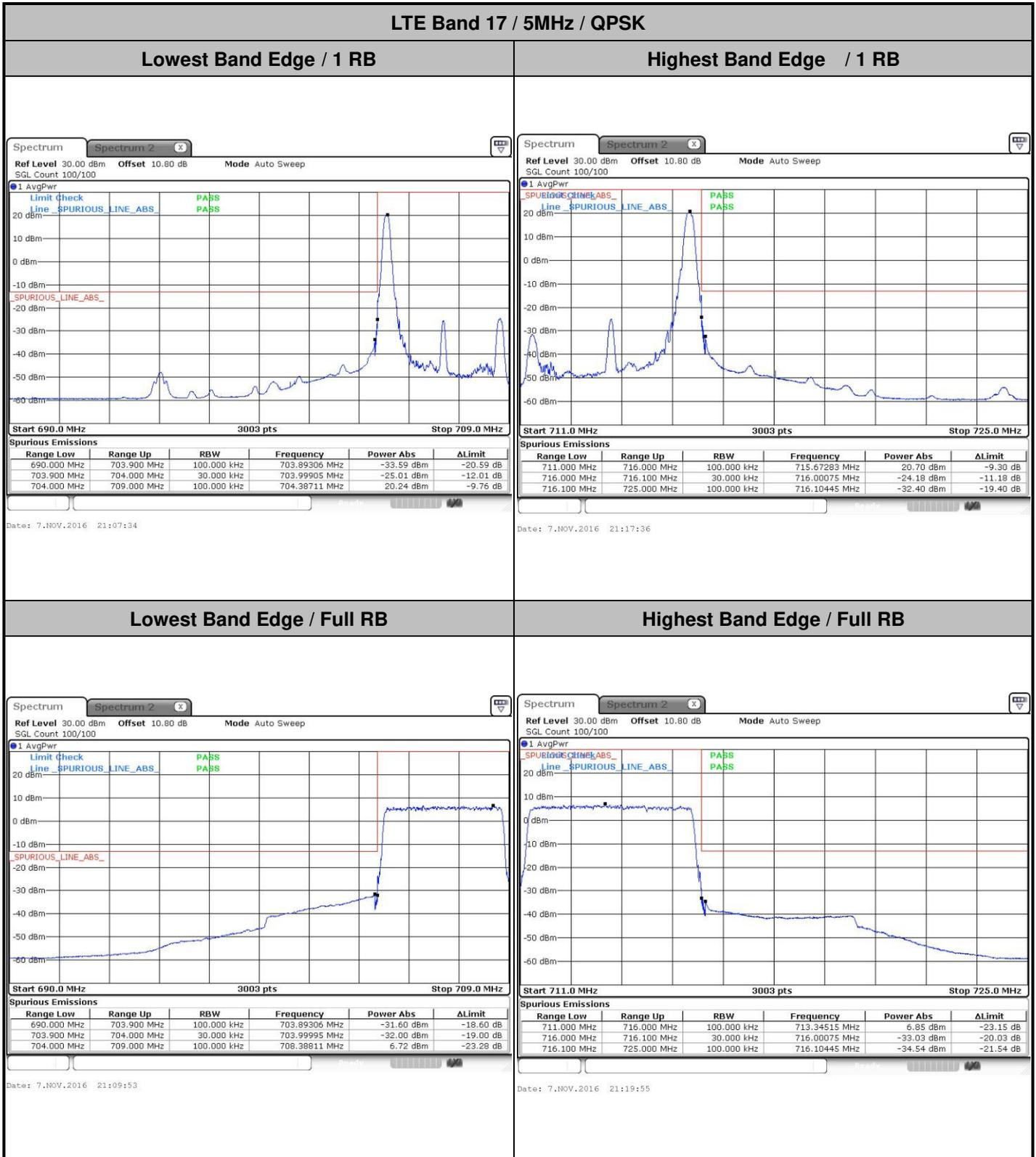
Highest Channel / 10MHz / 16QAM



Date: 7,NOV,2016 21:33:23



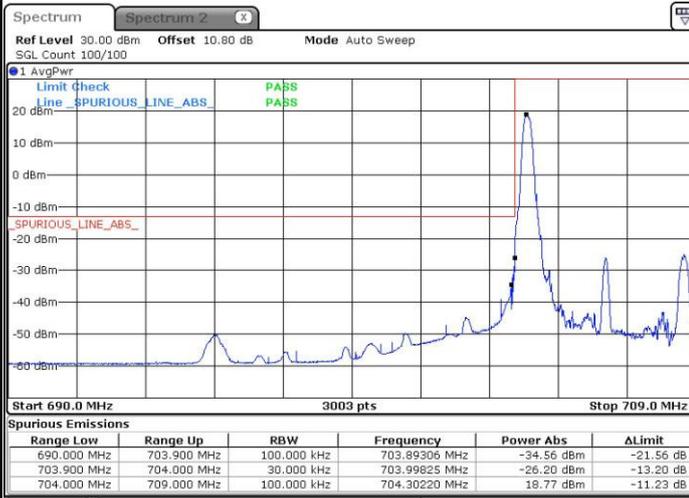
Conducted Band Edge





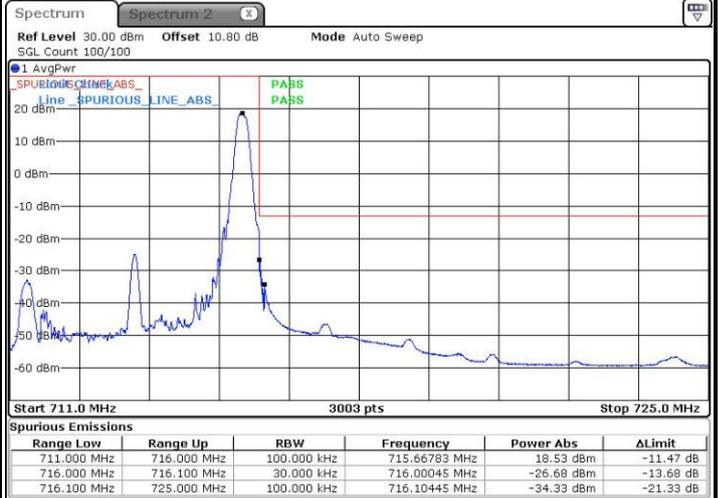
LTE Band 17 / 5MHz / 16QAM

Lowest Band Edge / 1 RB



Date: 7.NOV.2016 21:08:43

Highest Band Edge / 1 RB



Date: 7.NOV.2016 21:18:46

Lowest Band Edge / Full RB



Date: 7.NOV.2016 21:11:02

Highest Band Edge / Full RB

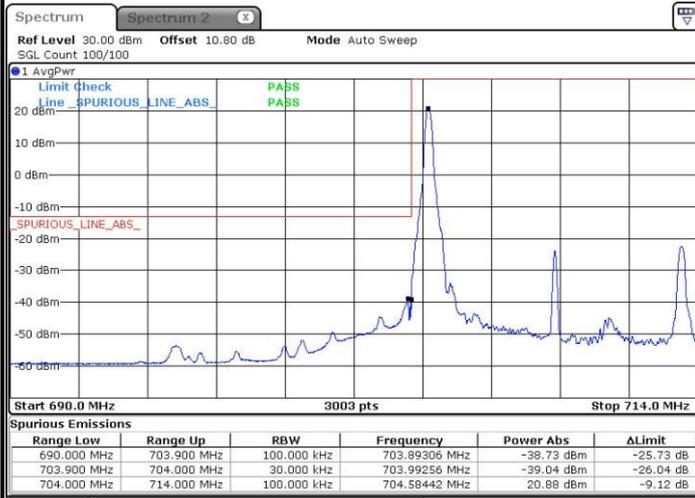


Date: 7.NOV.2016 21:21:05



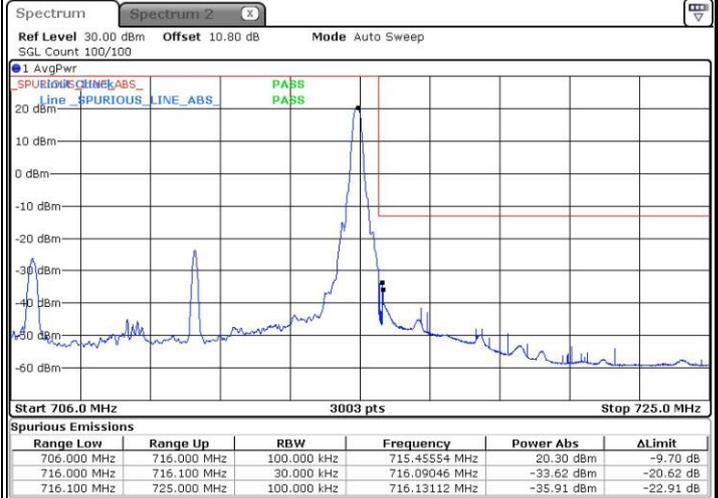
LTE Band 17 / 10MHz / QPSK

Lowest Band Edge / 1 RB



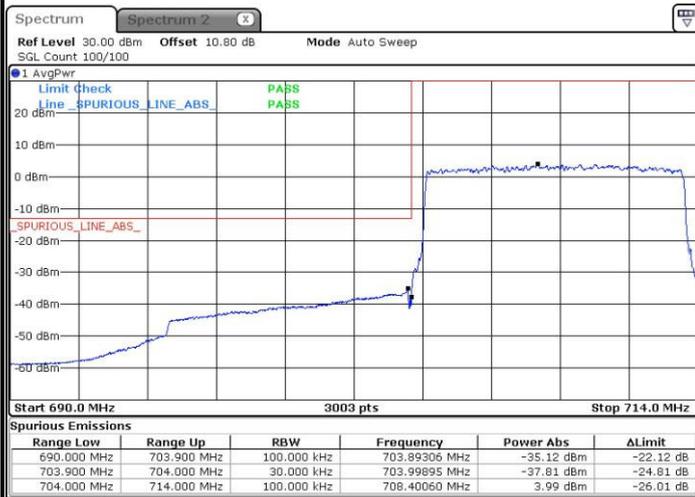
Date: 7.NOV.2016 21:24:55

Highest Band Edge / 1 RB



Date: 7.NOV.2016 21:13:55

Lowest Band Edge / Full RB



Date: 7.NOV.2016 21:27:14

Highest Band Edge / Full RB

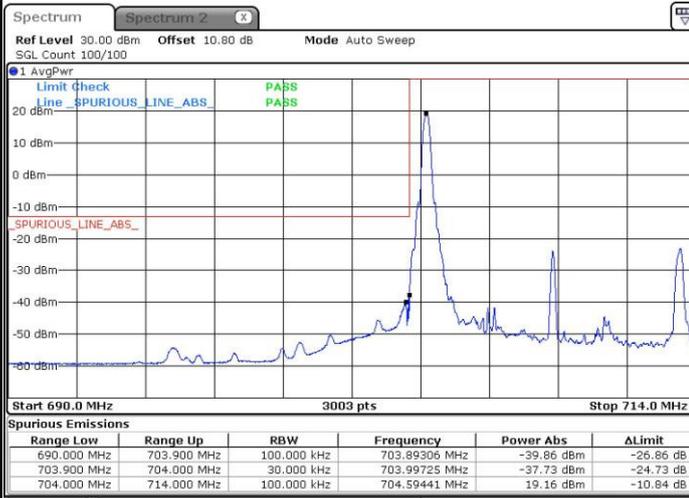


Date: 7.NOV.2016 21:13:14



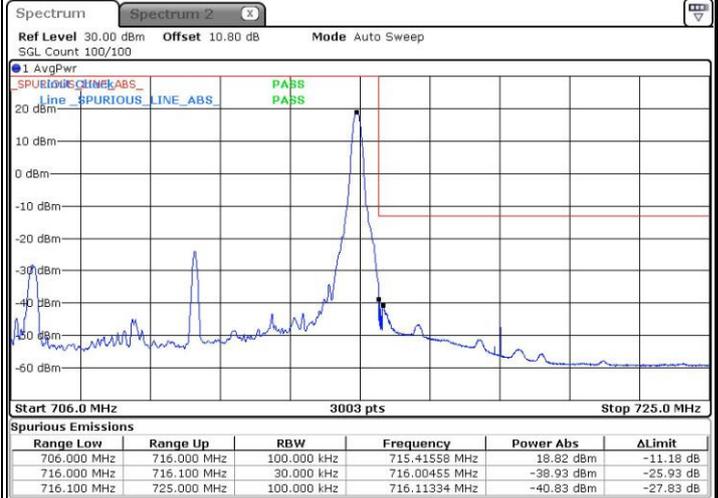
LTE Band 17 / 10MHz / 16QAM

Lowest Band Edge / 1 RB



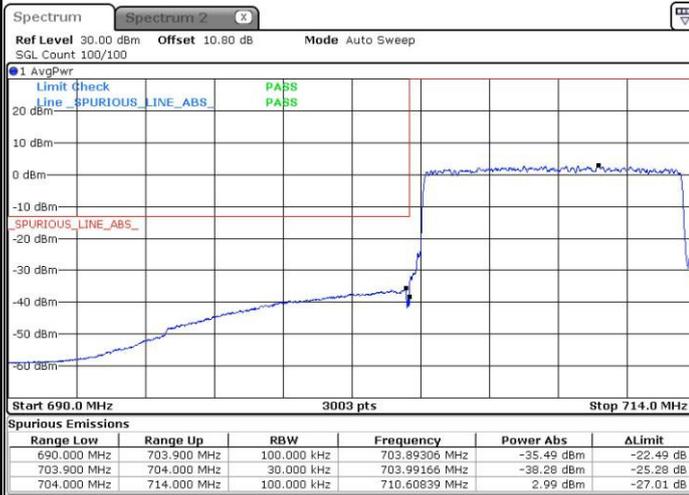
Date: 7.NOV.2016 21:26:05

Highest Band Edge / 1 RB



Date: 7.NOV.2016 21:36:05

Lowest Band Edge / Full RB



Date: 7.NOV.2016 21:28:23

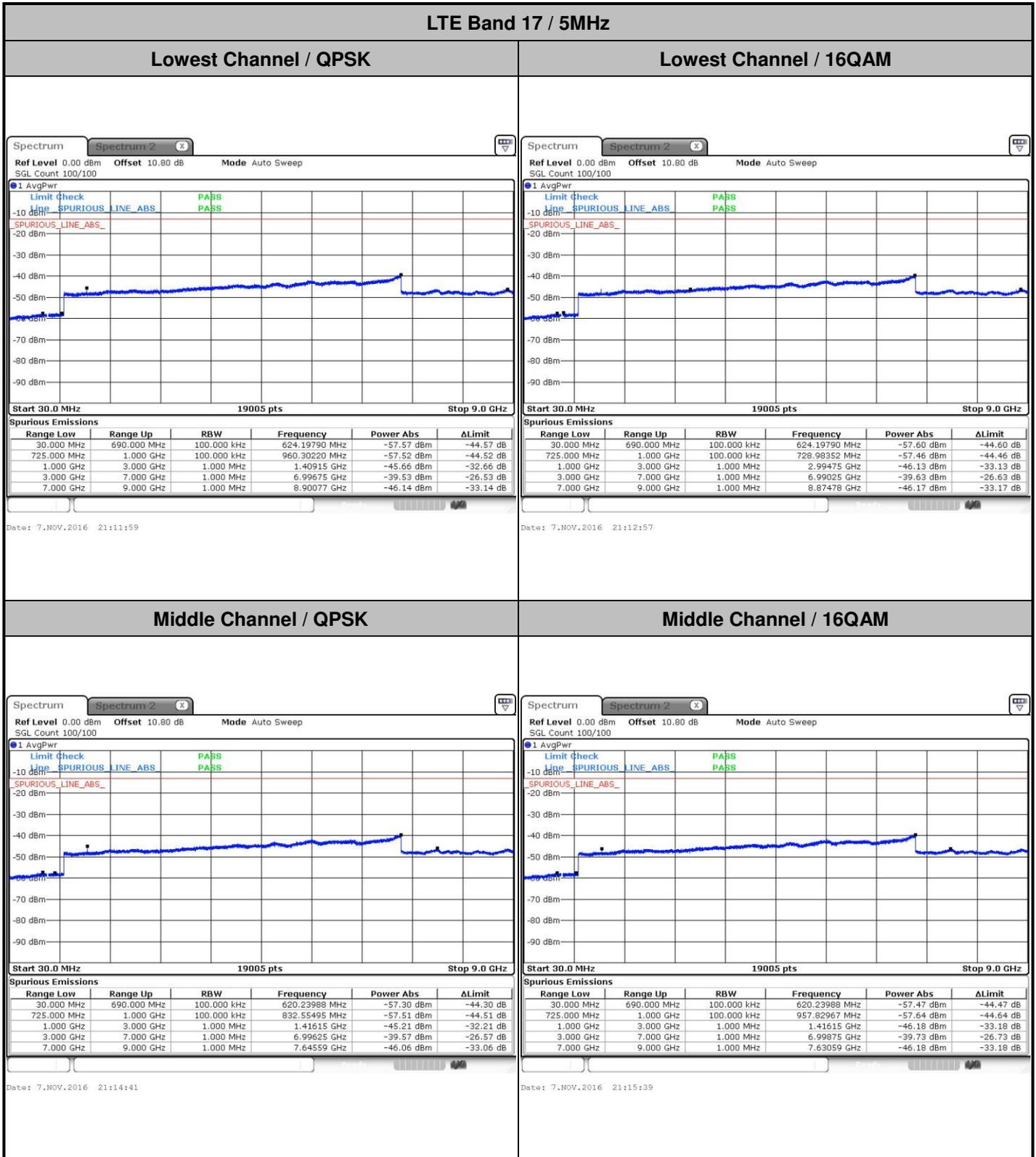
Highest Band Edge / Full RB



Date: 7.NOV.2016 21:38:23



Conducted Spurious Emission





LTE Band 17 / 5MHz

Highest Channel / QPSK



Date: 7.NOV.2016 21:22:01

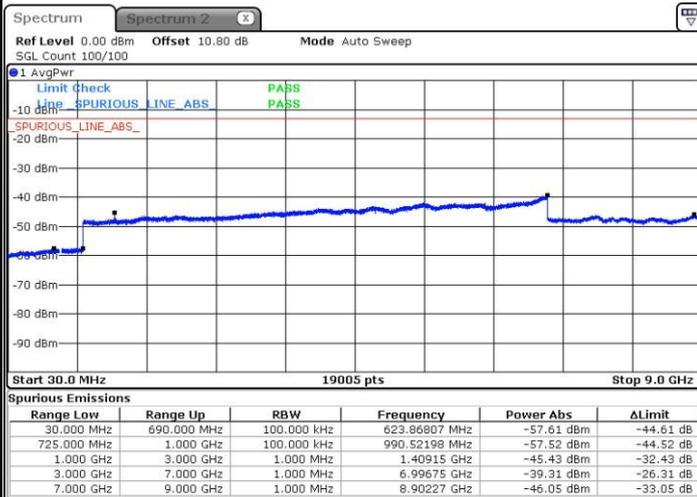
Highest Channel / 16QAM



Date: 7.NOV.2016 21:22:58

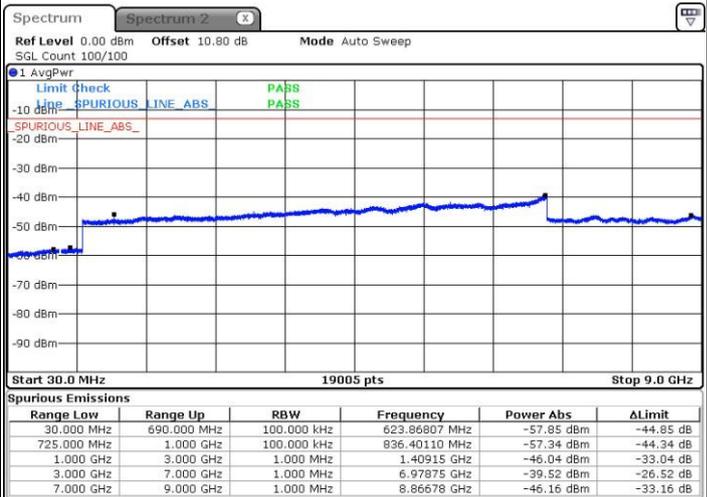
LTE Band 17 / 10MHz

Lowest Channel / QPSK



Date: 7.NOV.2016 21:29:20

Lowest Channel / 16QAM

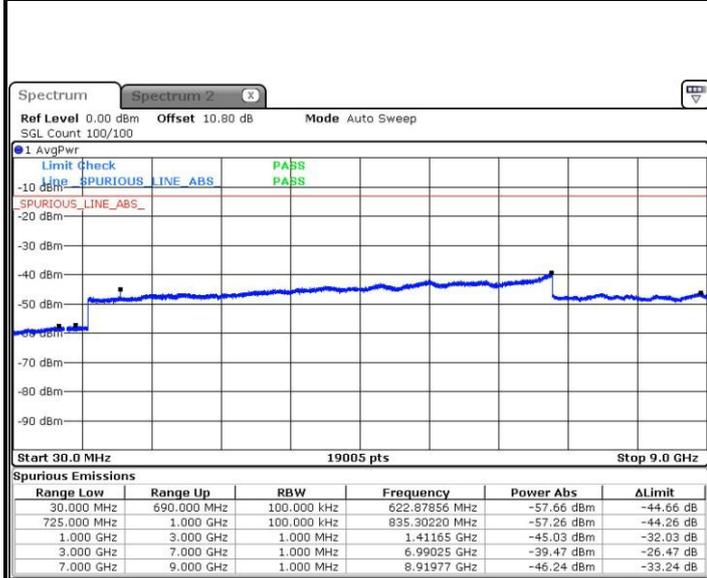


Date: 7.NOV.2016 21:30:17



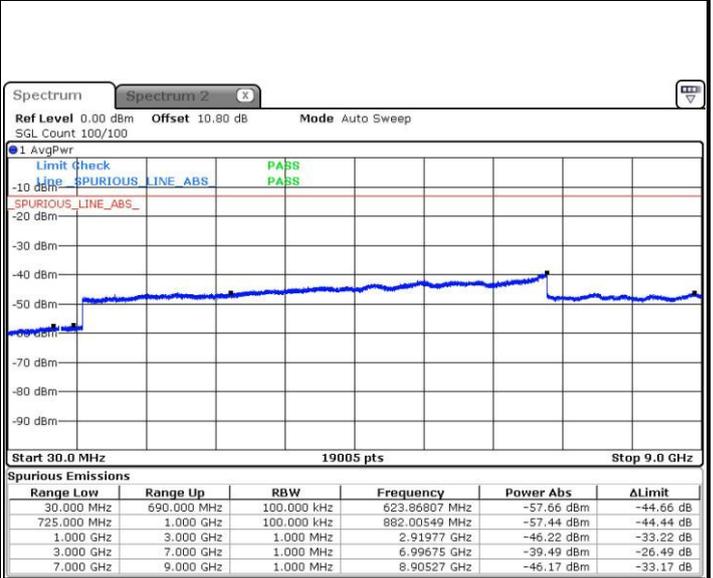
LTE Band 17 / 10MHz

Middle Channel / QPSK



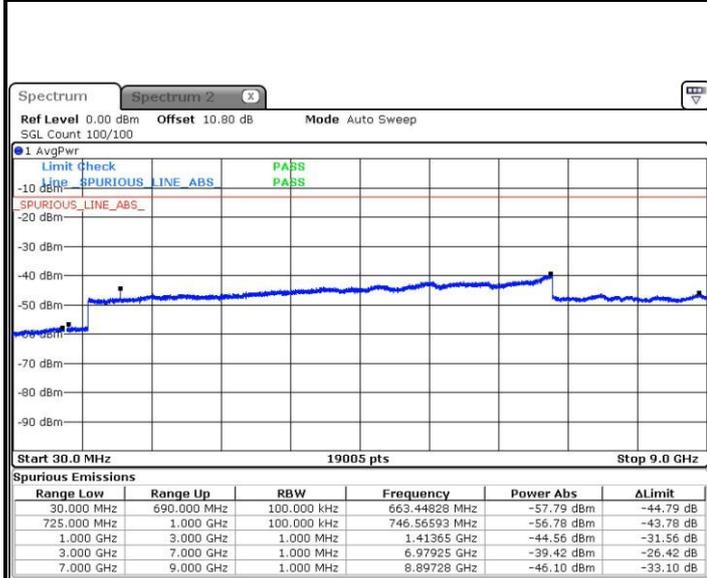
Date: 7.NOV.2016 21:32:01

Middle Channel / 16QAM



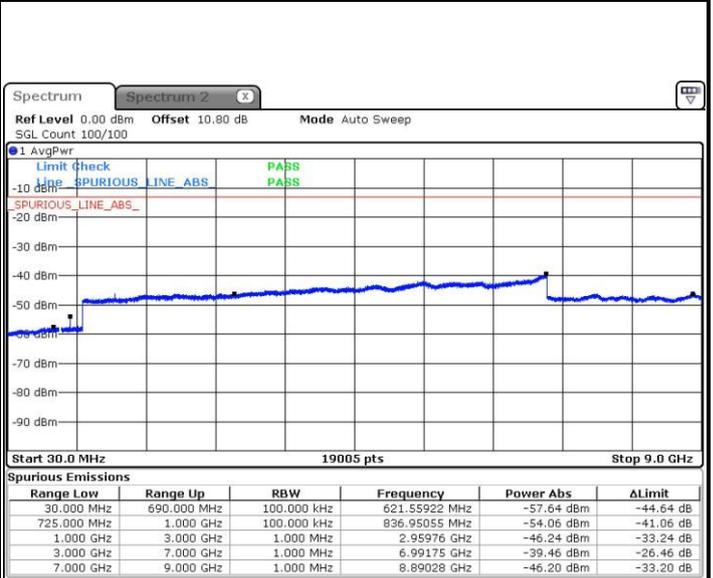
Date: 7.NOV.2016 21:32:59

Highest Channel / QPSK



Date: 7.NOV.2016 21:39:20

Highest Channel / 16QAM



Date: 7.NOV.2016 21:40:17



Frequency Stability

Test Conditions		LTE Band 17 (QPSK) / Middle Channel	Limit
Temperature (°C)	Voltage (Volt)	BW 10MHz	Note 2.
		Deviation (ppm)	Result
50	Normal Voltage	0.0034	PASS
40	Normal Voltage	0.0030	
30	Normal Voltage	0.0020	
20(Ref.)	Normal Voltage	0.0000	
10	Normal Voltage	0.0048	
0	Normal Voltage	0.0037	
-10	Normal Voltage	0.0039	
-20	Normal Voltage	0.0023	
-30	Normal Voltage	0.0034	
20	Maximum Voltage	0.0000	
20	Normal Voltage	0.0000	
20	Battery End Point	0.0013	

Note:

1. Normal Voltage =4.0 V. ; Battery End Point (BEP) =3.7 V. ; Maximum Voltage =4.0 V.
2. Note: The frequency fundamental emissions stay within the authorized frequency block.



Appendix B. Test Results of Radiated Test

ERP/EIRP

LTE Band 17 / 5MHz (Average)							
Channel	Mode	RB		Horizontal		Vertical	
		Size	Offset	ERP(dBm)	ERP(W)	ERP(dBm)	ERP(W)
Lowest	QPSK	1	0	-0.56	0.0009	11.94	0.0156
Middle		1	0	-0.18	0.0010	12.95	0.0197
Highest		1	0	0.13	0.0010	13.02	0.0200
Lowest	16QAM	1	12	-1.80	0.0007	12.02	0.0159
Middle		1	12	-1.56	0.0007	12.38	0.0173
Highest		1	12	-1.92	0.0006	12.47	0.0177
Limit	ERP < 3W			Result		PASS	

LTE Band 17 / 10MHz (Average)							
Channel	Mode	RB		Horizontal		Vertical	
		Size	Offset	ERP(dBm)	ERP(W)	ERP(dBm)	ERP(W)
Lowest	QPSK	1	0	-1.65	0.0007	11.87	0.0154
Middle		1	0	-0.96	0.0008	12.30	0.0170
Highest		1	0	-0.77	0.0008	12.63	0.0183
Lowest	16QAM	1	0	-2.39	0.0006	10.76	0.0119
Middle		1	0	-2.29	0.0006	11.28	0.0134
Highest		1	0	-1.51	0.0007	11.47	0.0140
Limit	ERP < 3W			Result		PASS	



Radiated Spurious Emission

LTE Band 17

LTE Band 17 / 5MHz / QPSK									
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)
Lowest	1408	-70.71	-13	-57.71	-56.23	-72.42	0.87	4.73	H
	2112	-68.00	-13	-55.00	-56.92	-68.92	1.17	4.24	H
	2816	-68.68	-13	-55.68	-60.59	-70.79	1.39	5.65	H
									H
									H
									H
	1408	-67.86	-13	-54.86	-53.62	-69.57	0.87	4.73	V
	2112	-68.13	-13	-55.13	-56.68	-69.05	1.17	4.24	V
	2816	-67.32	-13	-54.32	-59.18	-69.43	1.39	5.65	V
									V
Middle	1416	-69.95	-13	-56.95	-56.22	-71.70	0.87	4.78	H
	2120	-69.48	-13	-56.48	-58.43	-70.42	1.17	4.26	H
	2832	-67.27	-13	-54.27	-60.36	-69.39	1.39	5.67	H
									H
									H
									H
	1416	-68.79	-13	-55.79	-54.55	-70.54	0.87	4.78	V
	2120	-69.53	-13	-56.53	-58.18	-70.47	1.17	4.26	V
	2832	-68.19	-13	-55.19	-60.11	-70.31	1.39	5.67	V
									V
Highest	1424	-71.82	-13	-58.82	-57.44	-73.62	0.88	4.83	H
	2136	-69.73	-13	-56.73	-58.82	-70.71	1.18	4.31	H
	2848	-68.56	-13	-55.56	-60.59	-70.69	1.40	5.68	H
									H
									H
									H
	1424	-70.63	-13	-57.63	-56.54	-72.43	0.88	4.83	V
	2136	-70.12	-13	-57.12	-58.87	-71.10	1.18	4.31	V
	2848	-68.60	-13	-55.60	-60.58	-70.73	1.40	5.68	V
									V

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



LTE Band 17 / 10MHz / QPSK									
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)
Lowest	1408	-69.48	-13	-56.48	-55.00	-71.19	0.87	4.73	H
	2112	-49.53	-13	-36.53	-38.45	-50.45	1.17	4.24	H
	2816	-68.27	-13	-55.27	-60.18	-70.38	1.39	5.65	H
									H
									H
									H
									H
	1408	-67.34	-13	-54.34	-53.10	-69.05	0.87	4.73	V
	2112	-53.21	-13	-40.21	-41.76	-54.13	1.17	4.24	V
	2816	-66.79	-13	-53.79	-58.65	-68.90	1.39	5.65	V
									V
	Middle	1408	-69.46	-13	-56.46	-54.97	-71.17	0.87	4.73
2120		-57.16	-13	-44.16	-46.17	-58.10	1.17	4.26	H
2824		-68.83	-13	-55.83	-60.74	-70.95	1.39	5.66	H
									H
									H
									H
									H
1408		-67.73	-13	-54.73	-53.49	-69.44	0.87	4.73	V
2120		-62.89	-13	-49.89	-51.44	-63.83	1.17	4.26	V
2824		-67.53	-13	-54.53	-59.39	-69.65	1.39	5.66	V
									V
Highest		1416	-70.07	-13	-57.07	-55.59	-71.82	0.87	4.78
	2120	-68.73	-13	-55.73	-57.74	-69.67	1.17	4.26	H
	2824	-68.93	-13	-55.93	-60.84	-71.05	1.39	5.66	H
									H
									H
									H
									H
	1416	-67.71	-13	-54.71	-53.47	-69.46	0.87	4.78	V
	2120	-68.94	-13	-55.94	-57.59	-69.88	1.17	4.26	V
	2824	-67.88	-13	-54.88	-59.74	-70.00	1.39	5.66	V
									V

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