

FCC TEST REPORT (WWAN part, 4G) No. 150801628SHA-002

Applicant : Haier Telecom (Qingdao) Co., Ltd.
No1. Haier Road , Hi-tech Zone, Qingdao, 266101, China

Manufacturer : Haier Telecom (Qingdao) Co., Ltd.
No1. Haier Road , Hi-tech Zone, Qingdao, 266101, China

Product Name : Mobile Phone

Type/Model : L51

Classification : PCS Licensed Transmitter Held to Ear (PCE)

TEST RESULT : PASS

SUMMARY

The equipment complies with the requirements according to the following standard(s):

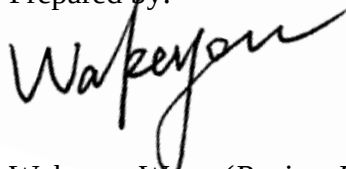
FCC 47CFR Part 22 PUBLIC MOBILE SERVICES (Subpart H)

FCC 47CFR Part 24 PERSONAL COMMUNICATIONS SERVICES (Subpart E)

FCC 47CFR Part 27 MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES

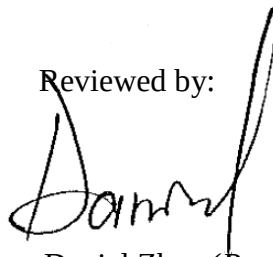
Date of issue: Aug 24, 2015

Prepared by:



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Description of Test Facility

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1. General Information

1.1 Applicant Information

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Manufacturer : Haier Telecom (Qingdao) Co., Ltd.
No1. Haier Road , Hi-tech Zone, Qingdao, 266101, China

1.2 Identification of the EUT

Product Name : Mobile Phone

Type/model : L51

Hardware version : MP

Software version : HL-L51-H01-S01

IMEI : 867747020003024

FCC ID : SG71507L51

Sample received date : June 20, 2015

Date of test : June 20, 2015 ~ Aug 10, 2015

1.3 Technical specification

Tested	Mode	Intervals / Bandwidth (MHz)	TX & RX frequency (MHz)
☐	GSM/GPRS/EDGE 850	Intervals 0.2	Tx: 824.20 - 848.80 Rx: 869.20 - 893.80
☐	GSM/GPRS/EDGE 1900	Intervals 0.2	Tx: 1850.20 - 1909.80 Rx: 1930.20 - 1989.80
☐	WCDMA/HSDPA/HSUPA/ HSPA+ (Downlink Only) 850	Intervals 0.2	Tx: 826.40 - 846.60MHz Rx: 871.40 - 891.60MHz
☐	WCDMA/HSDPA/HSUPA/ HSPA+ (Downlink Only) 1900	Intervals 0.2	Tx: 1852.40 - 1907.60MHz Rx: 1932.40 - 1987.60MHz
☒	LTE 2	Bandwidth 1.4/3/5/10/15/20	Tx: 1850.7 MHz - 1909.3 Rx:1930.7 MHz - 1989.3
☒	LTE 4	Bandwidth 1.4/3/5/10/15/20	Tx: 1710.7 MHz - 1754.3 Rx:2110.7 MHz - 2154.3
☒	LTE 7	Bandwidth 5/10/15/20	Tx: 2502.5 MHz -2567.5 Rx:2622.5MHz - 2687.5
☒	LTE 17	Bandwidth 5/10	Tx: 706.5 MHz - 713.5 Rx:736.5 MHz - 743.5
☐	WLAN 802.11b / g /n20	/	/
☐	Bluetooth V4.0 LE / EDR	/	/

Antenna : Internal, un-detachable
main, 1.82dBi max;
Diversity, 1.62dBi max;
Wi-Fi & Bluetooth, 1.85dBi max;
aGPS, 1.51dBi max;

Rating : Normal voltage, 4.2V;
Extreme low voltage, 3.7V;
Extreme high voltage, 5V;
AC/DC adapter, 100-240V, 50/60Hz input, 5V DC output

1.4 Technical Specification for Mode tested in this report

Multislot Class	:	/
Maximum Output Power to Antenna	:	LTE band 2: 22.47dBm LTE band4: 22.75dBm LTE band 7: 23.61dBm LTE band 17: 23.19dBm
Type of Modulation	:	QPSK/16QAM

System	Bandwidth	Modulation	Emission Designator	Freq Tolerance (ppm)	Maximum ERP/EIRP (dBm)	Maximum ERP/EIRP (W)
LTE band 2	1.4	QPSK	1M09G7D	-	21.80	0.151
LTE band 2	1.4	16QAM	1M11W7D	-	21.70	0.148
LTE band 2	3	QPSK	2M69G7D	-	-	-
LTE band 2	3	16QAM	2M69W7D	-	-	-
LTE band 2	5	QPSK	4M50G7D	-	-	-
LTE band 2	5	16QAM	4M52W7D	-	-	-
LTE band 2	10	QPSK	8M99G7D	0.0042	-	-
LTE band 2	10	16QAM	8M99W7D	-	-	-
LTE band 2	15	QPSK	13M6G7D	-	-	-
LTE band 2	15	16QAM	13M6W7D	-	-	-
LTE band 2	20	QPSK	17M9G7D	-	22.10	0.162
LTE band 2	20	16QAM	17M9W7D	-	22.00	0.158
LTE band 4	1.4	QPSK	1M09G7D	-	22.30	0.170
LTE band 4	1.4	16QAM	1M11W7D	-	22.80	0.191
LTE band 4	3	QPSK	2M69G7D	-	-	-
LTE band 4	3	16QAM	2M95W7D	-	-	-
LTE band 4	5	QPSK	4M52G7D	-	-	-
LTE band 4	5	16QAM	4M52W7D	-	-	-
LTE band 4	10	QPSK	8M99G7D	0.0099	-	-
LTE band 4	10	16QAM	9M04W7D	-	-	-
LTE band 4	15	QPSK	13M5G7D	-	-	-
LTE band 4	15	16QAM	13M6W7D	-	-	-
LTE band 4	20	QPSK	18M0G7D	-	22.50	0.178
LTE band 4	20	16QAM	18M0W7D	-	22.90	0.195
LTE band 7	5	QPSK	4M47G7D	-	19.30	0.085
LTE band 7	5	16QAM	4M50W7D	-	19.40	0.087
LTE band 7	10	QPSK	8M99G7D	0.0028	-	-
LTE band 7	10	16QAM	9M00W7D	-	-	-
LTE band 7	15	QPSK	13M4G7D	-	-	-
LTE band 7	15	16QAM	13M4W7D	-	-	-
LTE band 7	20	QPSK	18M0G7D	-	19.60	0.091
LTE band 7	20	16QAM	18M0W7D	-	19.70	0.093
LTE band 17	5	QPSK	4M52G7D	0.0103	14.80	0.030
LTE band 17	5	16QAM	4M50 W7D	-	14.40	0.028

LTE band 17	10	QPSK	8M99G7D	-	14.60	0.029
LTE band 17	10	16QAM	8M94W7D	-	14.40	0.028

Note: 1RB, 50%RB and 100% RB allocation offset to the upper edge, middle and lower edge were assessed for each mode. The worst test data is listed in this report (RB allocation = 1; RB offset = 0)

2. Test Specification

2.1 Standards or specification

FCC 47CFR Part 22 H
FCC 47CFR Part 24 E
FCC 47CFR Part 27
TIA-603 Version D
971168 D01 Power Meas License Digital Systems v02r02

2.2 Mode of operation during the test

While testing transmitting mode of EUT, the internal modulation and continuously transmission was applied.

2.3 Test software list

Test Items	Software	Manufacturer	Version
Conducted emission	ESxS-K1	R&S	V2.1.0
Radiated emission	ES-K1	R&S	V1.71

2.4 Test peripherals list

Item No.	Name	Band and Model	Description
1	PC	HP ProBook 6450b	/

2.5 Instrument list

Equipment	Type	Manu.	Internal no.	Cal. Date	Due date
Test Receiver	ESCS 30	R&S	EC 2107	2014-10-21	2015-10-20
Test Receiver	ESIB 26	R&S	EC 3045	2014-10-20	2015-10-19
Test Receiver	ESCI 7	R&S	EC4501	2014-12-25	2015-12-24
Semi-anechoic chamber	-	Albatross project	EC 3048	2015-5-11	2016-5-10
High Pass Filter	WHKX 1.0/15G-10SS	Wainwright	EC4297-1	2015-1-8	2016-1-7
High Pass Filter	WHKX 2.8/18G-12SS	Wainwright	EC4297-2	2015-1-8	2016-1-7
High Pass Filter	WHKX 7.0/1.8G-8SS	Wainwright	EC4297-3	2015-1-8	2016-1-7
Band Reject Filter	WRCGV 2400/2483-2390/2493-35/10SS	Wainwright	EC4297-4	2015-1-8	2016-1-7
RF cable	SUCOFLEX 104	HUBER+SUHNER	/	2015-2-13	2016-2-12
Bilog Antenna	CBL 6112D	TESEQ	EC 4206	2015-4-27	2016-4-26
Horn antenna	HF 906	R&S	EC 3049	2015-4-27	2016-4-26
Pre-amplifier	Pre-amp 18	R&S	EC 3222	2015-4-20	2016-4-19
Spectrum analyzer	E7402A	Agilent	EC2254	2014-08-16	2015-08-15
Climate Chamber	SETH-Z-102U	ESPEC	EC4315	2015-4-9	2016-4-8
PXA Signal Analyzer	N9030A	Agilent	EC5338	2015-5-15	2016-4-14
Handset Tester	CMW500	R&S	/	2015-5-15	2016-4-14

2.6 Test Summary

This report applies to tested sample only. This report shall not be reproduced in part without written approval of Intertek Testing Service Shanghai Limited.

Test Items	FCC Section	Results	Details see section
RF Output Power	2.1046	Pass	3.1
ERP / EIRP	22.913 24.232 27.50	Pass	3.2
Occupied Bandwidth	2.1049	Pass	3.3
Conducted Out of Band Emissions	2.1051 2.1057 22.917 24.238 27.53	Pass	3.4
Radiated Spurious Emission	2.1053 2.1057 22.917 24.238 27.53	Pass	3.5
Band Edge Emission	22.917 24.238 27.53	Pass	3.6
Peak-to-Average Ratio	24.232 27.50	Pass	3.7
Frequency Stability	2.1055 22.355 24.235 27.54	Pass	3.8

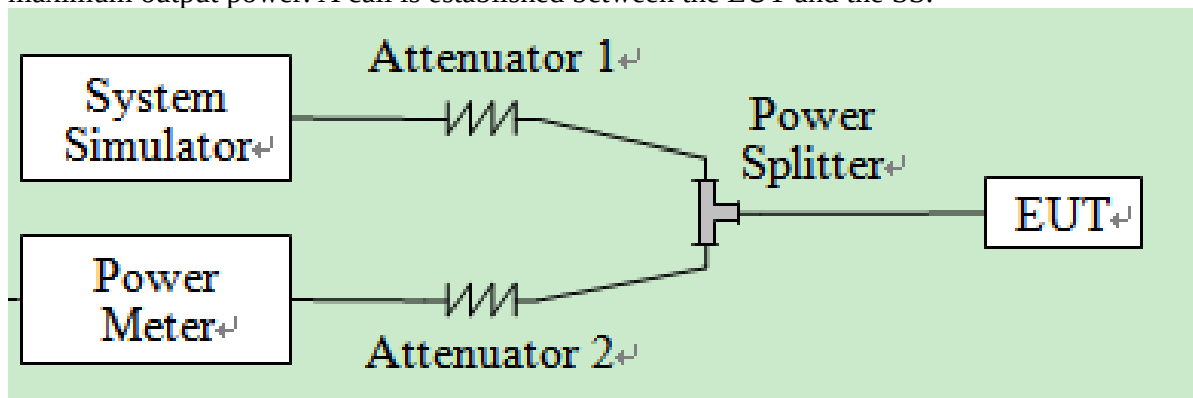
3. Test Result

3.1 RF Power Output (FCC Part 2.1046) { tc \l 2 "4.2 RF Power Output (FCC Part 2.1046, 22.913 & 24.232)" }

According to FCC section 2.1046(a), for transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in FCC section 2.1033(c)(8).

Test Procedures:

The EUT is coupled to the Power Meter and the System Simulator (SS) with Attenuators through the Power Splitter; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading. The EUT is commanded by the SS to operate at the maximum output power. A call is established between the EUT and the SS.



Test results:

Band	Bandwidth (MHz)	Modulation	Channel (MHz)	Result (dBm)
2	1.4	QPSK	1850.7	22.35
			1880	22.47
			1909.3	22.29
	1.4	16QAM	1850.7	21.51
			1880	21.31
			1909.3	21.42
	3	QPSK	1851.5	22.03
			1880	22.13
			1908.5	21.96
	3	16QAM	1851.5	21.20
			1880	21.66
			1908.5	21.30
	5	QPSK	1852.5	22.10
			1880	22.07
			1907.5	21.84
	5	16QAM	1852.5	20.80
			1880	20.94
			1907.5	21.16
	10	QPSK	1855	22.25
			1880	22.40
			1905	22.17
	10	16QAM	1855	21.47
			1880	21.52
			1905	21.29
	15	QPSK	1857.5	22.30
			1880	22.34
			1902.5	22.06
	15	16QAM	1857.5	21.86
			1880	21.58
			1902.5	21.52
	20	QPSK	1860	22.45
			1880	22.36
			1900	22.39
	20	16QAM	1860	21.85
			1880	21.49
			1900	21.13

Band	Bandwidth (MHz)	Modulation	Channel (MHz)	Result (dBm)
4	1.4	QPSK	1710.7	22.60
			1732.5	22.53
			1754.3	22.51
	1.4	16QAM	1710.7	21.77
			1732.5	21.72
			1754.3	21.57
	3	QPSK	1711.5	22.36
			1732.5	22.42
			1753.5	22.35
	3	16QAM	1711.5	21.65
			1732.5	21.48
			1753.5	21.67
	5	QPSK	1712.5	22.28
			1732.5	22.21
			1752.5	22.28
	5	16QAM	1712.5	21.17
			1732.5	21.40
			1752.5	21.44
	10	QPSK	1715	22.75
			1732.5	22.50
			1750	22.49
	10	16QAM	1715	21.68
			1732.5	21.54
			1750	21.63
	15	QPSK	1717.5	22.64
			1732.5	22.57
			1747.5	22.61
	15	16QAM	1717.5	21.77
			1732.5	21.79
			1747.5	21.78
	20	QPSK	1720	22.69
			1732.5	22.54
			1745	22.73
	20	16QAM	1720	21.82
			1732.5	21.81
			1745	22.03

Band	Bandwidth (MHz)	Modulation	Channel (MHz)	Result (dBm)
7	5	QPSK	2502.5	22.99
			2535	23.19
			2567.5	22.96
	5	16QAM	2502.5	22.19
			2535	22.22
			2567.5	22.07
	10	QPSK	2505	23.16
			2535	23.38
			2565	23.27
	10	16QAM	2505	22.50
			2535	23.22
			2565	22.58
	15	QPSK	2507.5	23.52
			2535	23.43
			2562.5	23.29
	15	16QAM	2507.5	23.36
			2535	23.29
			2562.5	22.89
	20	QPSK	2510	23.40
			2535	23.56
			2560	23.61
	20	16QAM	2510	22.80
			2535	22.94
			2560	22.62

Band	Bandwidth (MHz)	Modulation	Channel (MHz)	Result (dBm)
17	5	QPSK	706.5	22.54
			710	22.86
			713.5	23.04
	5	16QAM	706.5	21.47
			710	21.52
			713.5	21.73
	10	QPSK	709	23.19
			710	22.90
			711	22.14
	10	16QAM	709	22.11
			710	22.37
			711	22.37

Note: 1RB, 50%RB and 100% RB allocation offset to the upper edge, middle and lower edge were assessed for each mode. The worst test data is listed in this report (RB allocation = 1; RB offset = 0)

3.2 ERP / EIRP (FCC Part 22.913 & 24.232 & 27.50) { tc \l 2 "4.2 RF Power Output (FCC Part 2.1046, 22.913 & 24.232)" }

The limit is as follows:

Part 22.913 (for 850MHz band):

- ☐ $\leq 500\text{W ERP (57dBm)}$ for base stations and cellular repeaters
- ☐ $\leq 7\text{W ERP (38.5dBm)}$ for mobile and auxiliary test transmitters

Part 24.232 (for 1900MHz band):

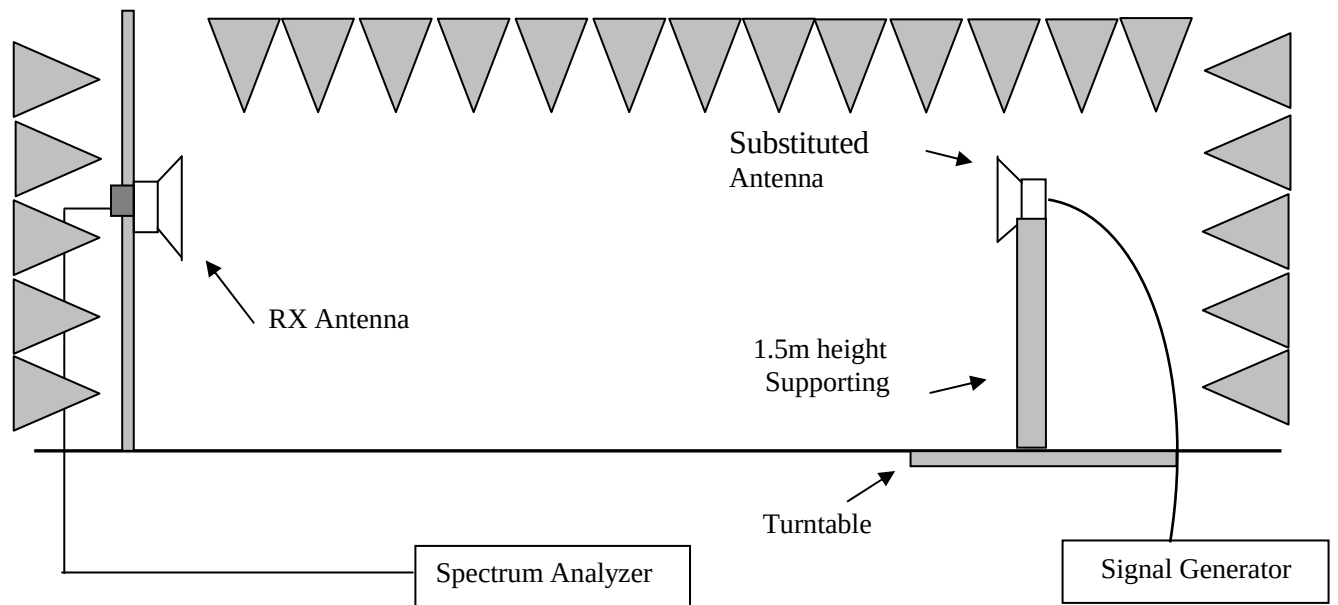
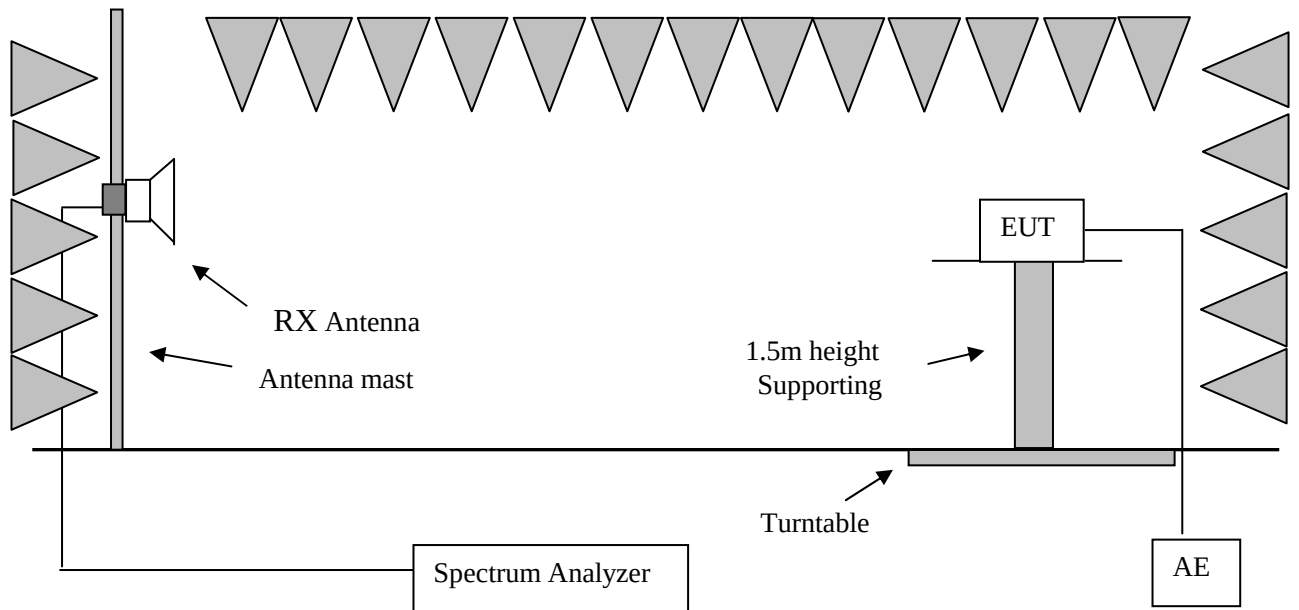
- ☐ $\leq 1640\text{W e.i.r.p. (62.1dBm)}$ for base stations up to 300m HAAT;
- ☒ $\leq 2\text{W e.i.r.p. (33dBm)}$ peak output power for portable mobile

Part 27.50

- ☒ LTE Band 4, $\leq 1\text{W e.i.r.p. (30dBm)}$ peak output power for portable mobile
- ☒ LTE Band 7, $\leq 1\text{W e.i.r.p. (30dBm)}$ peak output power for portable mobile
- ☒ LTE Band 17, $\leq 3\text{W e.i.r.p. (34.8dBm)}$ peak output power for portable mobile

Test Procedures:

1. The EUT was placed on a turntable with 1.5 meter height in a fully anechoic chamber.
2. The EUT was set at 3 meters from the receiving antenna, which was mounted on the antenna tower.
3. The radiated emission at the fundamental frequency was measured at 3 m with a test antenna and a spectrum analyzer which used a channel power option across EUT's signal bandwidth.
4. The table was rotated 360 degrees to determine the position of the highest radiated power.
5. The height of the receiving antenna is adjusted to look for the maximum ERP/EIRP.
6. Taking the record of maximum ERP/EIRP.
7. A substituted antenna was substituted in place of the EUT and was driven by a signal generator.
8. The conducted power at the terminal of the dipole antenna is measured.
9. Repeat step 3 to step 5 to get the maximum ERP/EIRP of the substitution antenna.
10. $\text{ERP/EIRP} = P_s + E_t - E_s + G_s = P_s + R_t - R_s + G_s$
 P_s (dBm): Input power to substitution antenna.
 G_s (dBi or dBd): Substitution antenna Gain.
 $E_t = R_t + \text{AF}$
 $E_s = R_s + \text{AF}$
 AF (dB/m) : Receive antenna factor
 R_t : The highest received signal in spectrum analyzer for EUT.
 R_s : The highest received signal in spectrum analyzer for substitution antenna.



Test results:

Band	Bandwidth (MHz)	Modulation	Frequency (MHz)	ERP/EIRP (dBm)	Limit (dBm)	H/V
2	1.4	QPSK	1850.7	21.80	33	V
	1.4	QPSK	1880	21.50	33	V
	1.4	QPSK	1909.3	21.60	33	V
	1.4	16QAM	1850.7	21.70	33	H
	1.4	16QAM	1880	21.40	33	V
	1.4	16QAM	1909.3	21.40	33	V
	20	QPSK	1860	22.10	33	V
	20	QPSK	1880	21.90	33	V
	20	QPSK	1900	22.10	33	H
	20	16QAM	1860	21.90	33	V
	20	16QAM	1880	21.70	33	V
	20	16QAM	1900	22.00	33	V

Band	Bandwidth (MHz)	Modulation	Frequency (MHz)	ERP/EIRP (dBm)	Limit (dBm)	H/V
4	1.4	QPSK	1710.7	22.30	30	H
	1.4	QPSK	1732.5	21.90	30	V
	1.4	QPSK	1754.3	22.20	30	V
	1.4	16QAM	1710.7	22.70	30	V
	1.4	16QAM	1732.5	22.20	30	V
	1.4	16QAM	1754.3	22.80	30	V
	20	QPSK	1720	22.50	30	V

	20	QPSK	1732.5	22.10	30	V
	20	QPSK	1745	22.50	30	V
	20	16QAM	1720	22.90	30	H
	20	16QAM	1732.5	22.70	30	V
	20	16QAM	1745	22.60	30	V

Band	Bandwidth (MHz)	Modulation	Frequency (MHz)	ERP/EIRP (dBm)	Limit (dBm)	H/V
7	5	QPSK	2502.5	19.30	30	V
	5	QPSK	2535	19.10	30	V
	5	QPSK	2567.5	19.10	30	V
	5	16QAM	2502.5	19.40	30	V
	5	16QAM	2535	19.30	30	V
	5	16QAM	2567.5	19.00	30	V
	20	QPSK	2510	19.50	30	V
	20	QPSK	2535	19.60	30	V
	20	QPSK	2560	19.30	30	V
	20	16QAM	2510	19.50	30	V
	20	16QAM	2535	19.70	30	V
	20	16QAM	2560	19.70	30	V

Band	Bandwidth (MHz)	Modulation	Frequency (MHz)	ERP/EIRP (dBm)	Limit (dBm)	H/V
17	5	QPSK	706.5	14.60	34.8	V
	5	QPSK	710	14.40	34.8	H

	5	QPSK	713.5	14.80	34.8	H
	5	16QAM	706.5	14.30	34.8	V
	5	16QAM	710	14.10	34.8	V
	5	16QAM	713.5	14.40	34.8	V
	10	QPSK	709	14.30	34.8	V
	10	QPSK	710	14.60	34.8	V
	10	QPSK	711	14.50	34.8	V
	10	16QAM	709	14.40	34.8	V
	10	16QAM	710	14.30	34.8	V
	10	16QAM	711	14.00	34.8	V

Note: the worst test data is listed here.

Example: At frequency of 711MHz, Ps = 10dBm, Rt = 3.3dBm, Rs = -22.8dBm, Gs = 0.8dBi;
ERP = Ps + Rt – Rs + Gs = 10dBm + 3.3dBm + 22.8dBm + 0.8Bi - 2.15 = 34.8dBm

3.3 Occupied Bandwidth (FCC Part 2.1049) { tc \l 2 "4.3 Occupied Bandwidth (FCC Part 2.1049)" }

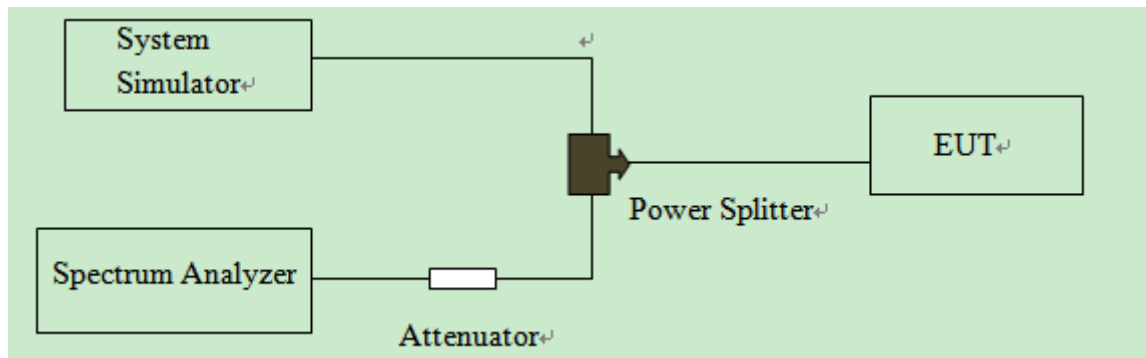
The limit is as follows:

From 2.1049, occupied bandwidth is defined as the measured spectral width of an emission. The measurement determines occupied bandwidth as the difference between upper and lower frequencies where 0.5% of the emission power is above the upper frequency and 0.5% of the emission power is below the lower frequency.

The 26dB bandwidth is the emission bandwidth is defined as the width of the signal between two points, located at the 2 sides of the carrier frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

Test Procedures:

1. The EUT was connected to Spectrum Analyzer and Base Station via power divider.
2. 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.
3. The 99% occupied bandwidth and 26 dB bandwidth of the middle channel for the highest RF powers were measured.



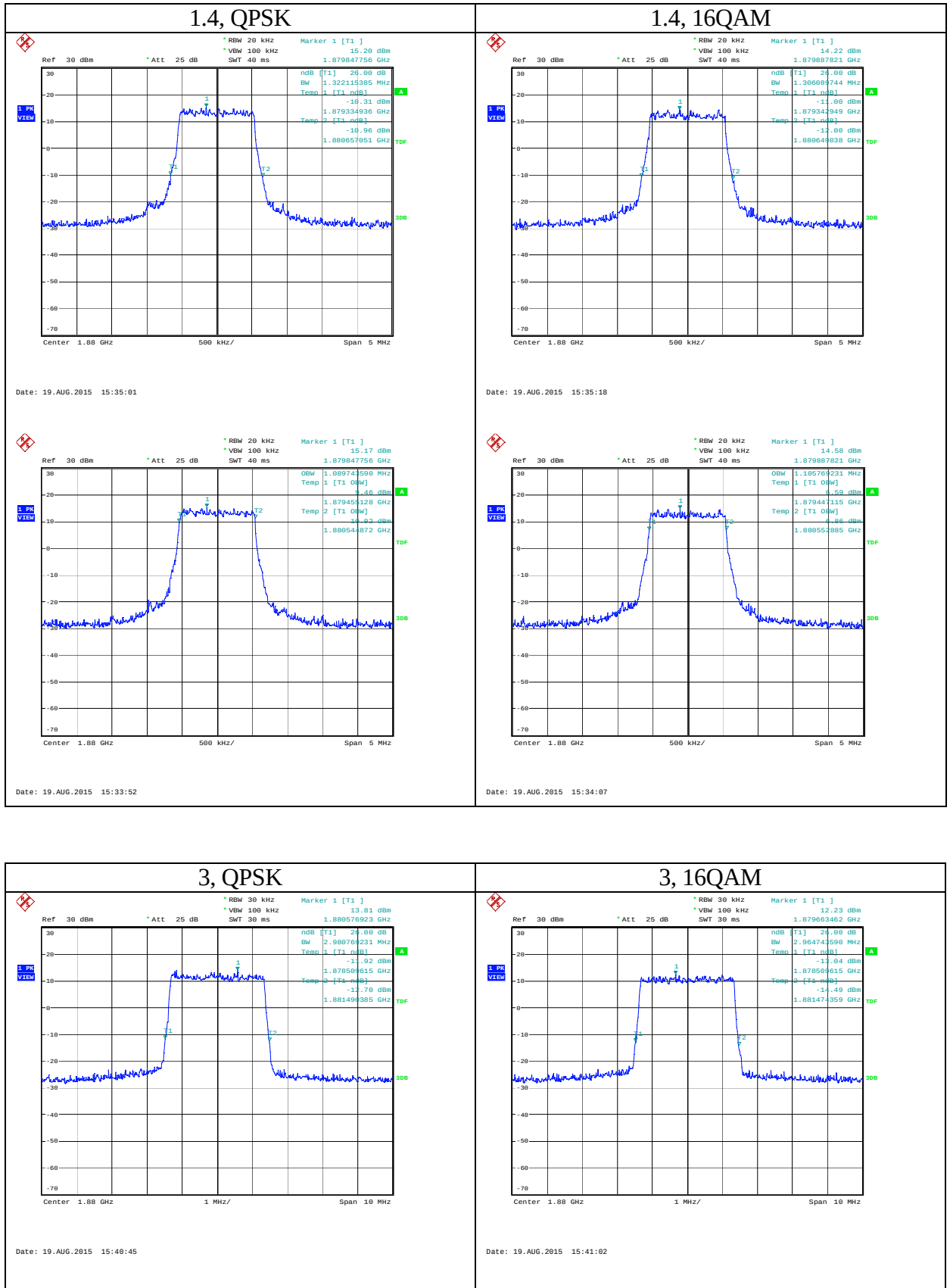
Test results:

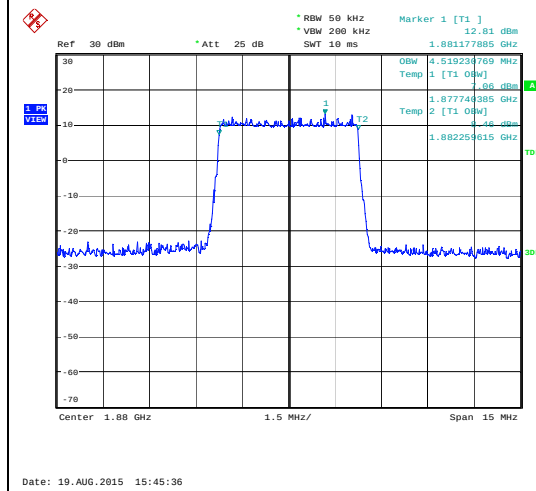
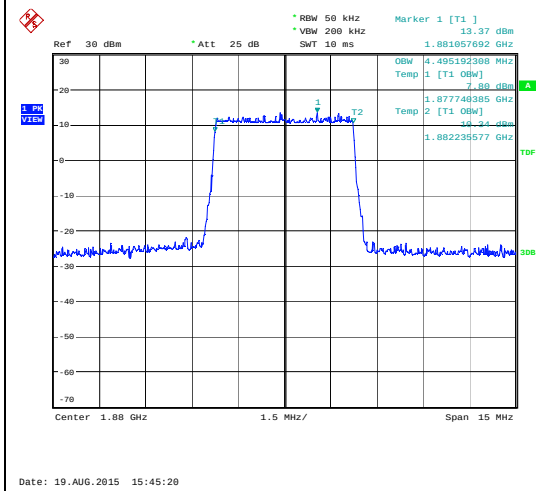
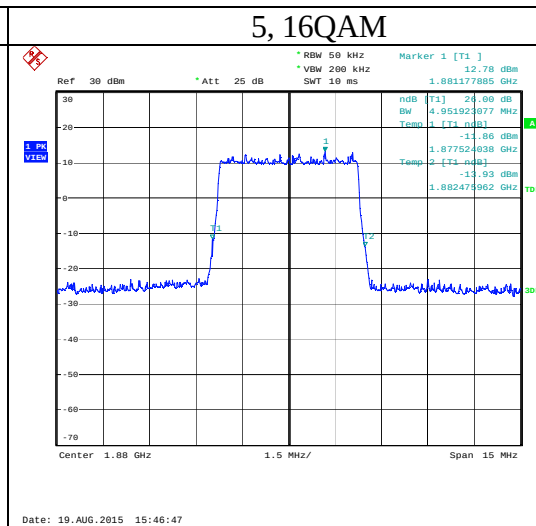
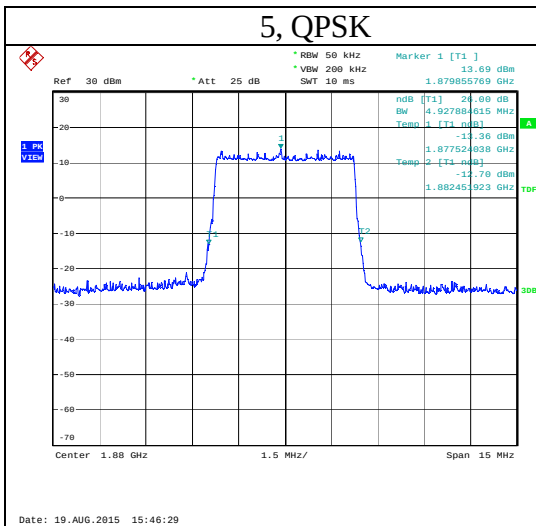
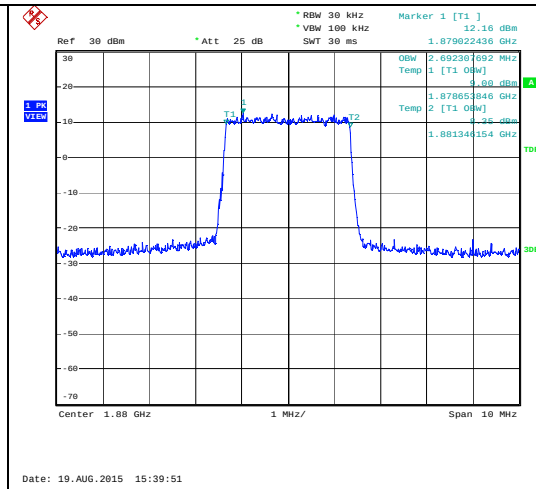
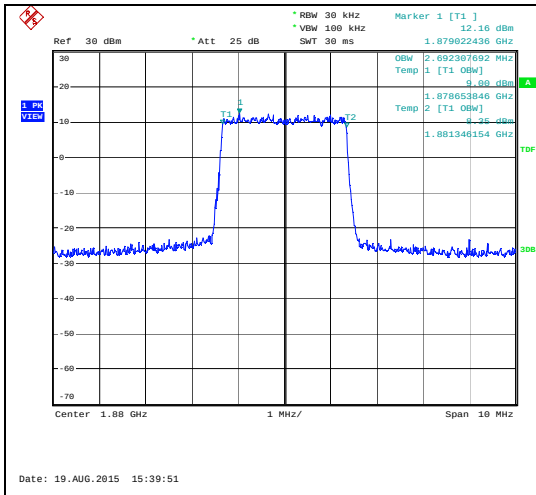
Band	Bandwidth (MHz)	Modulation	99% Bandwidth (MHz)	26dB Bandwidth (MHz)
2	1.4	QPSK	1.09	1.32
	1.4	16QAM	1.11	1.31
	3	QPSK	2.69	2.98
	3	16QAM	2.69	2.96
	5	QPSK	4.50	4.93
	5	16QAM	4.52	4.95
	10	QPSK	8.99	9.81
	10	16QAM	8.99	9.76
	15	QPSK	13.56	14.71
	15	16QAM	13.56	14.64
	20	QPSK	17.88	19.33
	20	16QAM	17.88	19.33

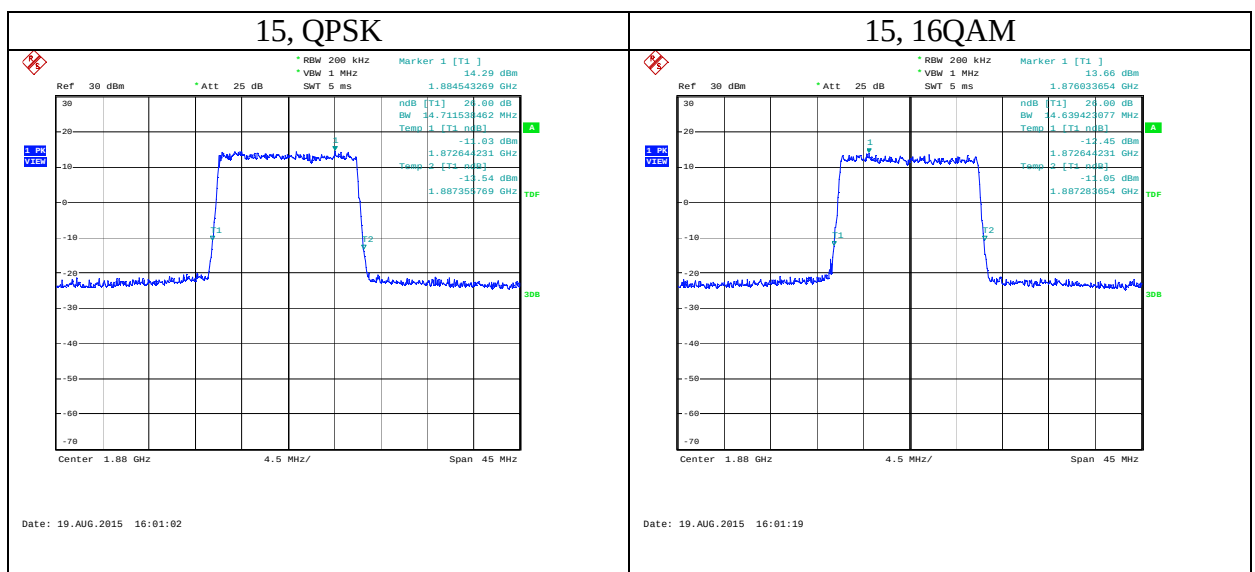
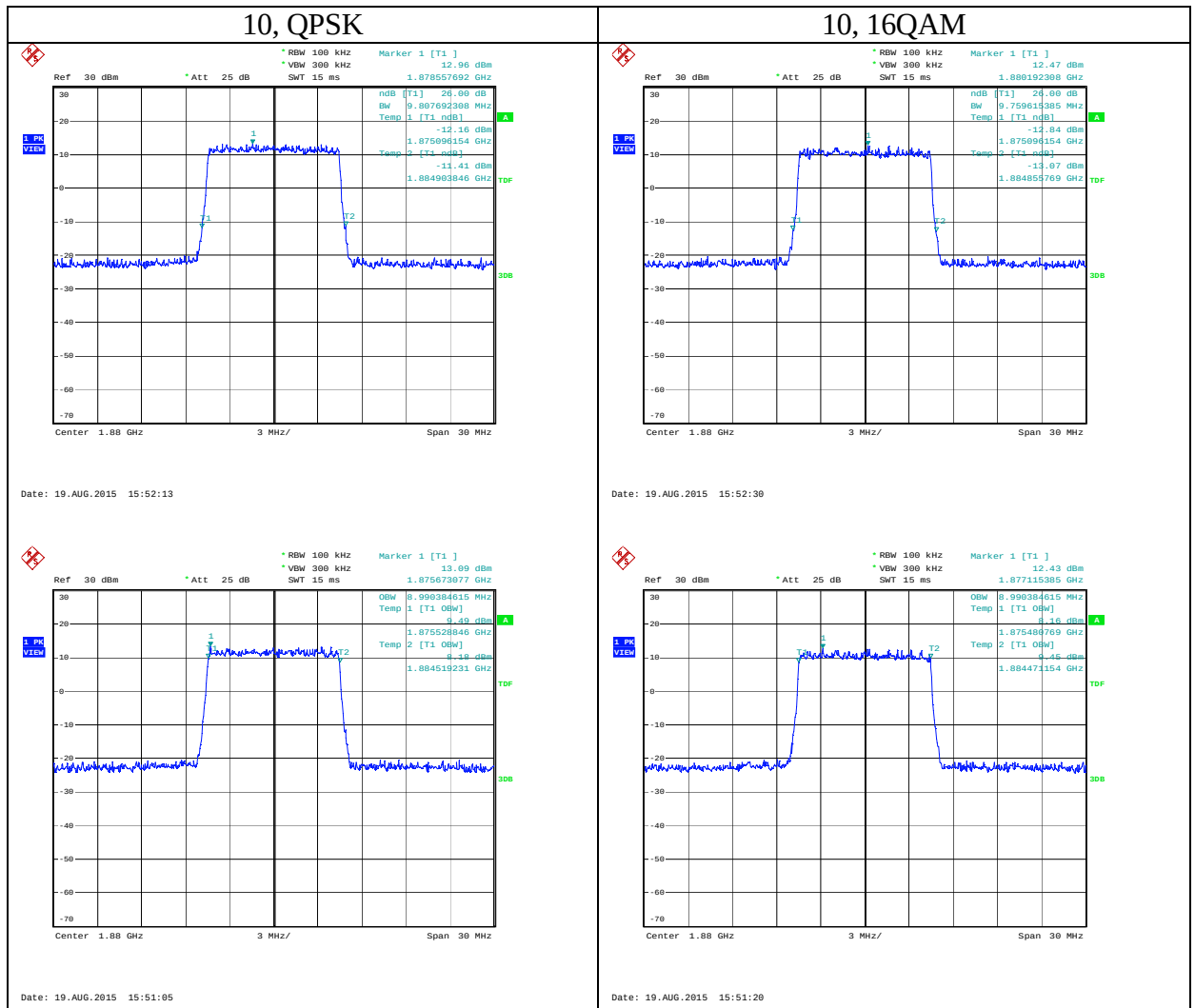
Band	Bandwidth (MHz)	Modulation	99% Bandwidth (MHz)	26dB Bandwidth (MHz)
4	1.4	QPSK	1.09	1.30
	1.4	16QAM	1.11	1.31
	3	QPSK	2.69	2.95
	3	16QAM	2.95	2.98
	5	QPSK	4.52	4.90
	5	16QAM	4.52	4.95
	10	QPSK	8.99	9.86
	10	16QAM	9.04	9.76
	15	QPSK	13.49	14.64
	15	16QAM	13.56	14.71
	20	QPSK	17.98	19.42
	20	16QAM	17.98	19.33

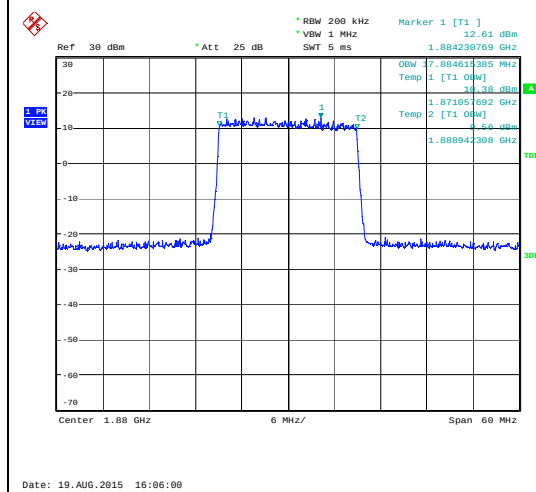
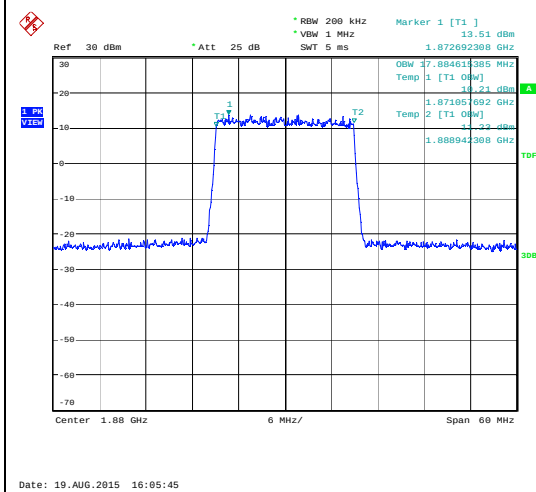
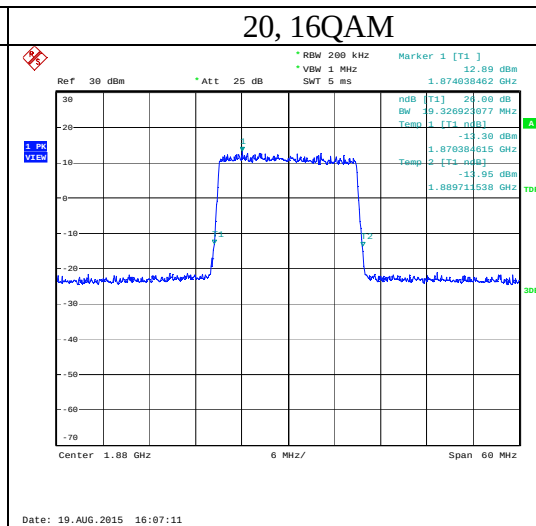
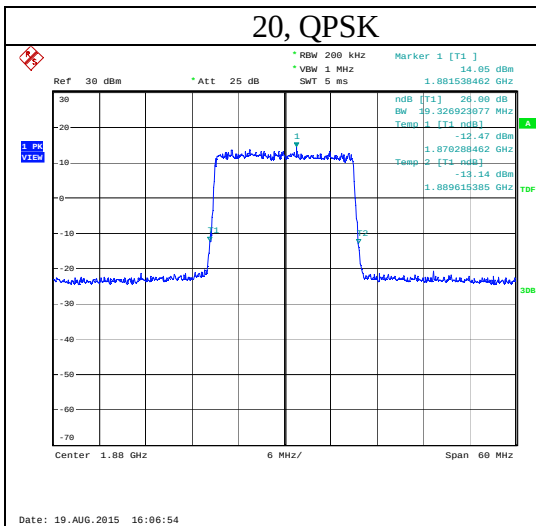
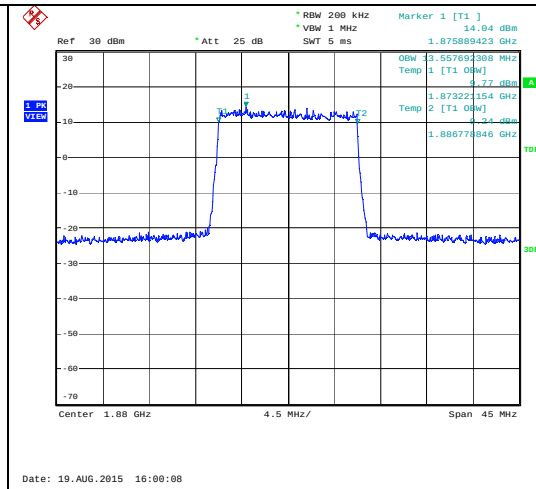
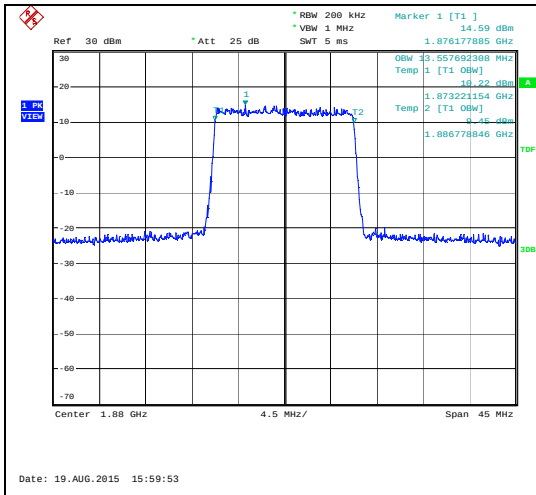
Band	Bandwidth (MHz)	Modulation	99% Bandwidth (MHz)	26dB Bandwidth (MHz)
7	5	QPSK	4.47	4.95
	5	16QAM	4.50	4.98
	10	QPSK	8.99	9.86
	10	16QAM	9.00	9.86
	15	QPSK	13.41	14.71
	15	16QAM	13.41	14.78
	20	QPSK	17.98	19.23
	20	16QAM	17.98	19.23

Band	Bandwidth (MHz)	Modulation	99% Bandwidth (MHz)	26dB Bandwidth (MHz)
17	5	QPSK	4.52	4.93
	5	16QAM	4.50	4.95
	10	QPSK	8.99	9.76
	10	16QAM	8.94	9.81

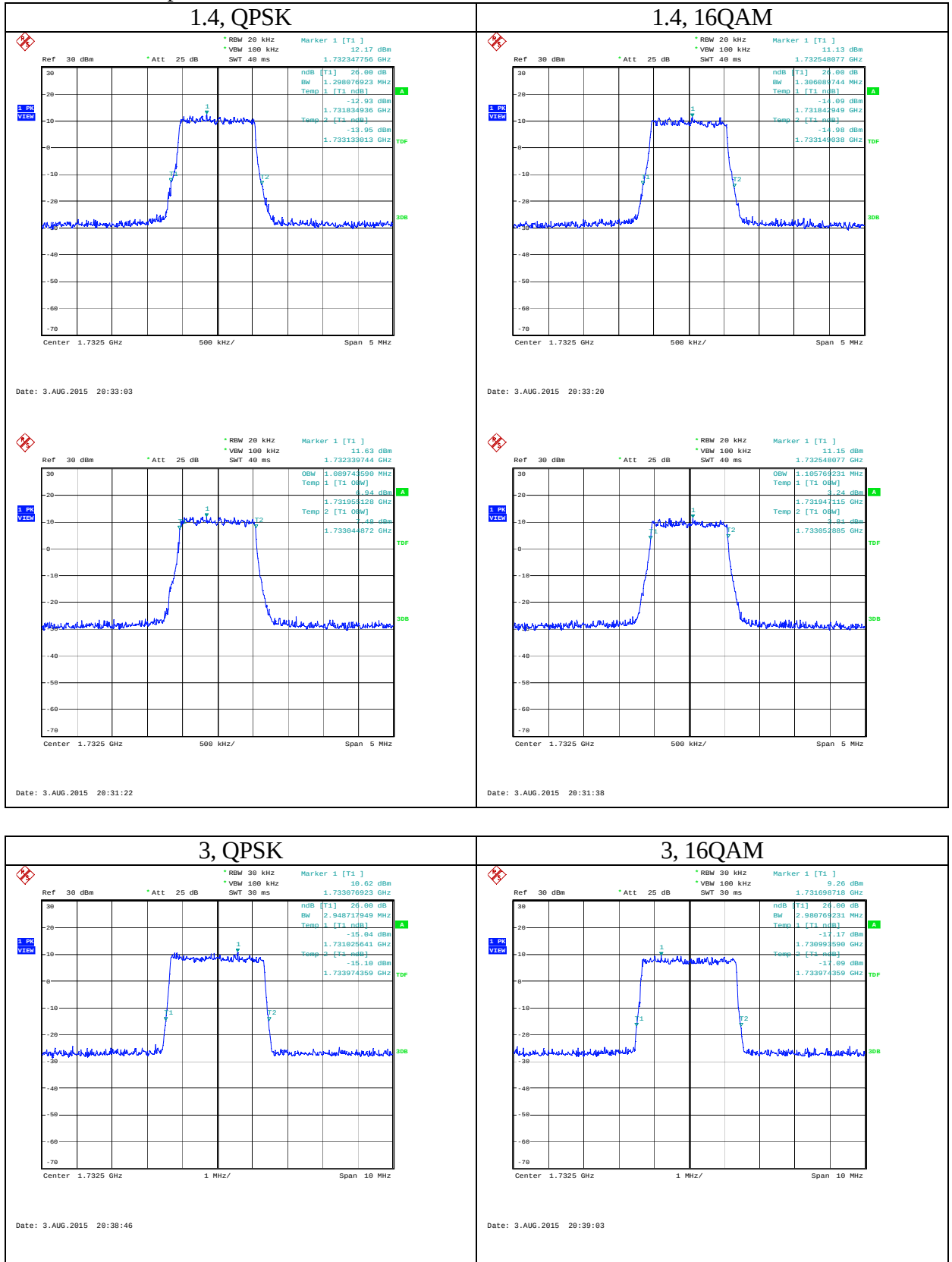




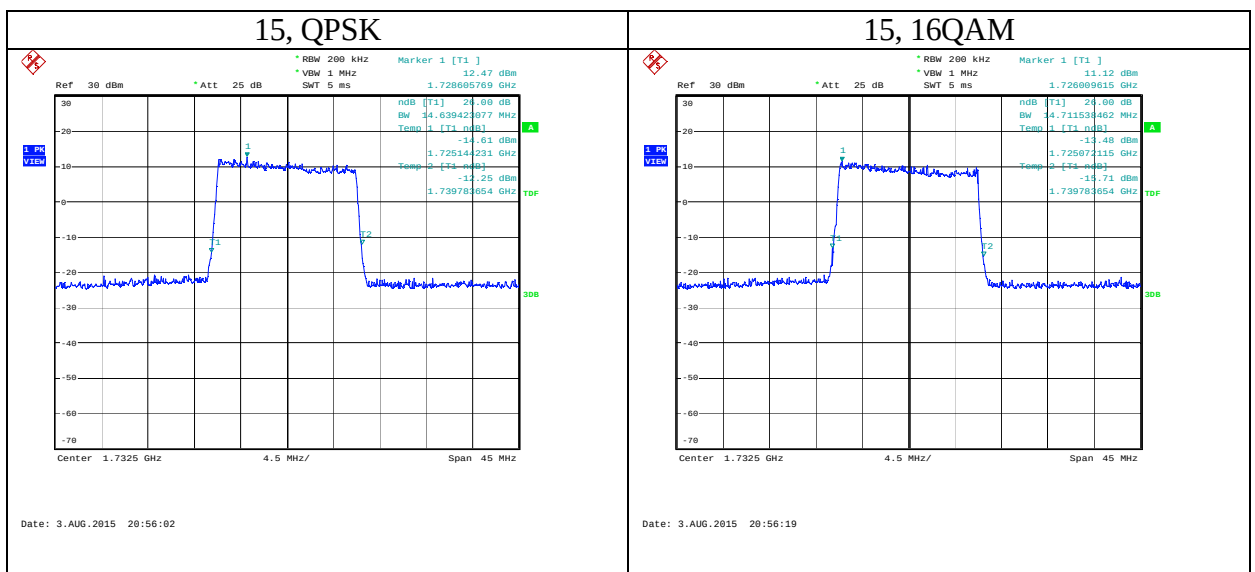
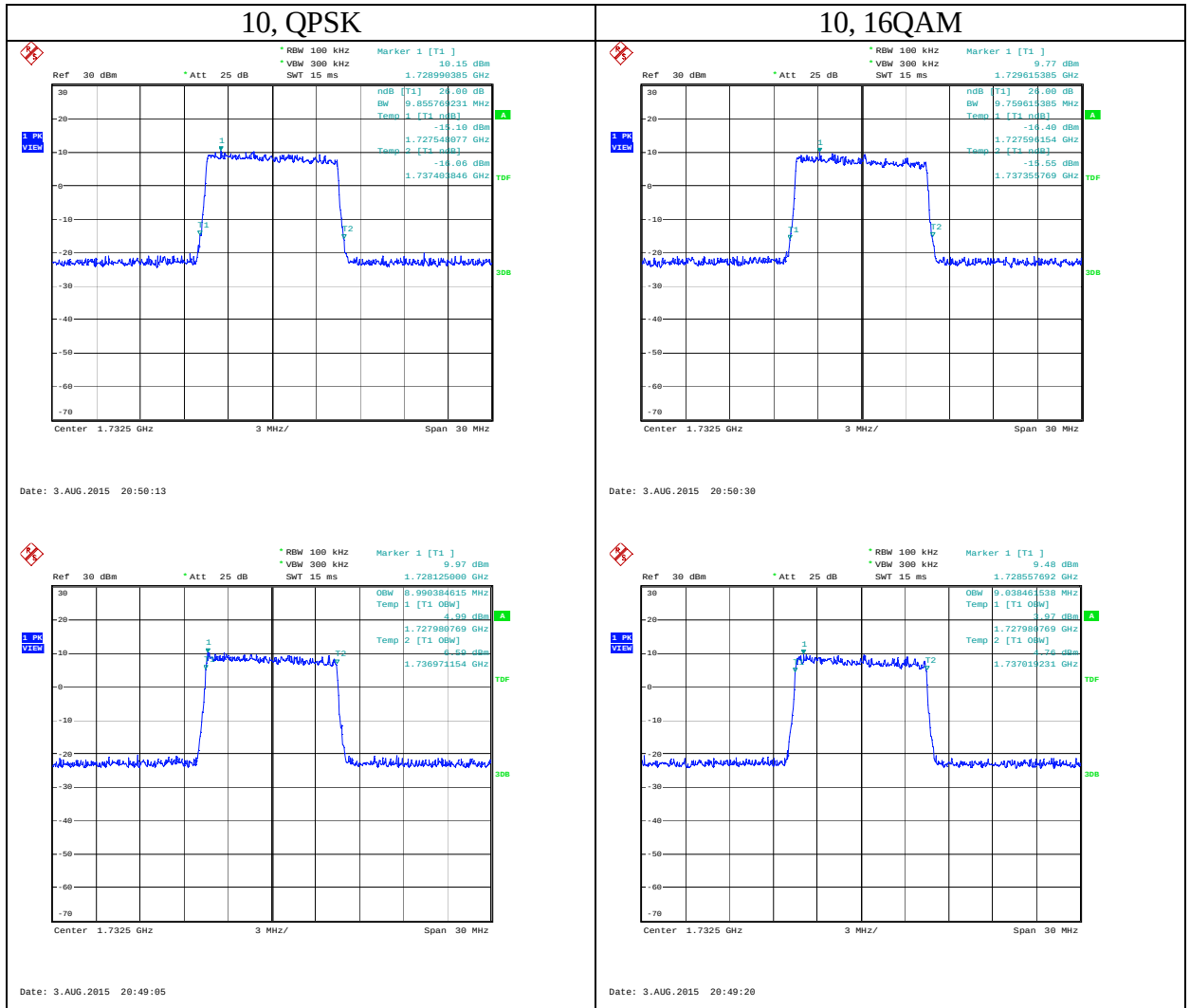


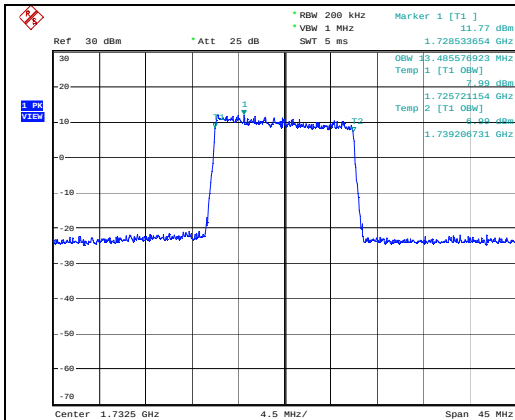


Band 4 test Graph

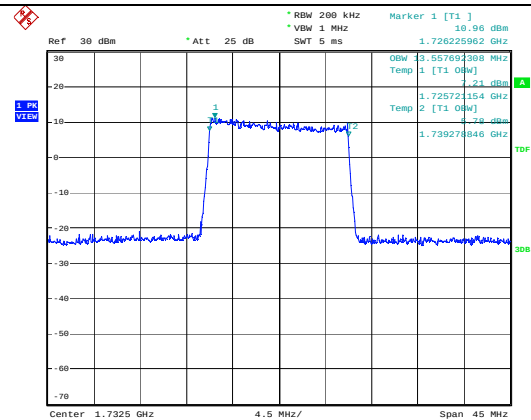






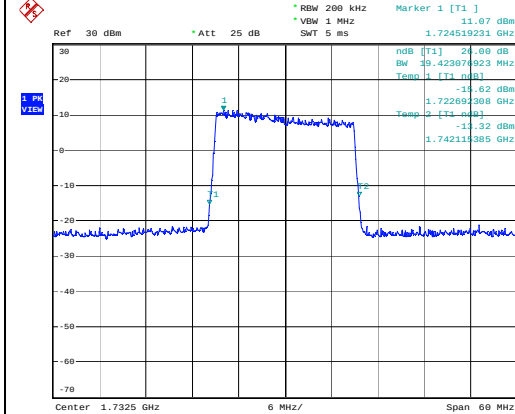


Date: 3.AUG.2015 20:54:53



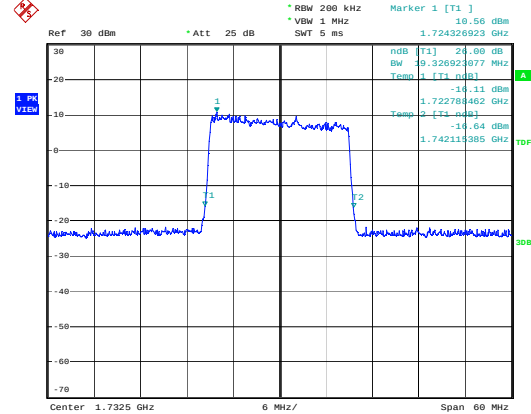
Date: 3.AUG.2015 20:55:08

20, QPSK

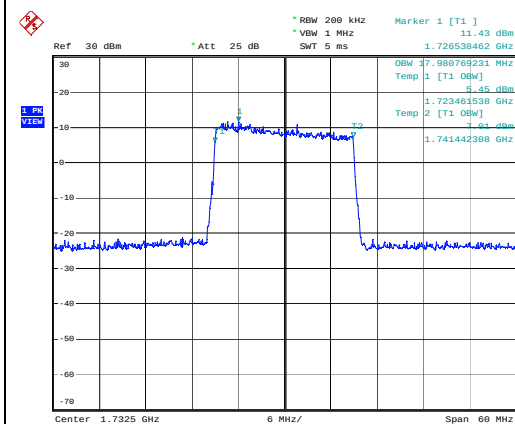


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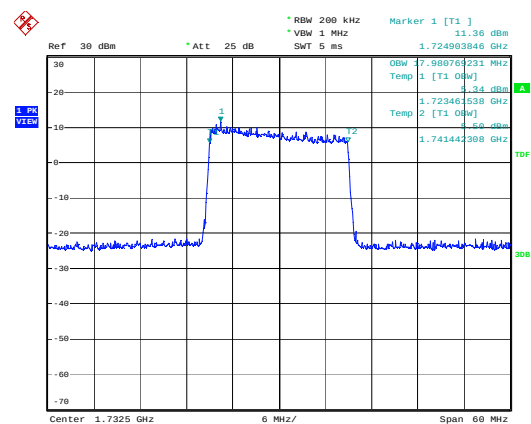
20, 16QAM



Date: 3.AUG.2015 21:02:11

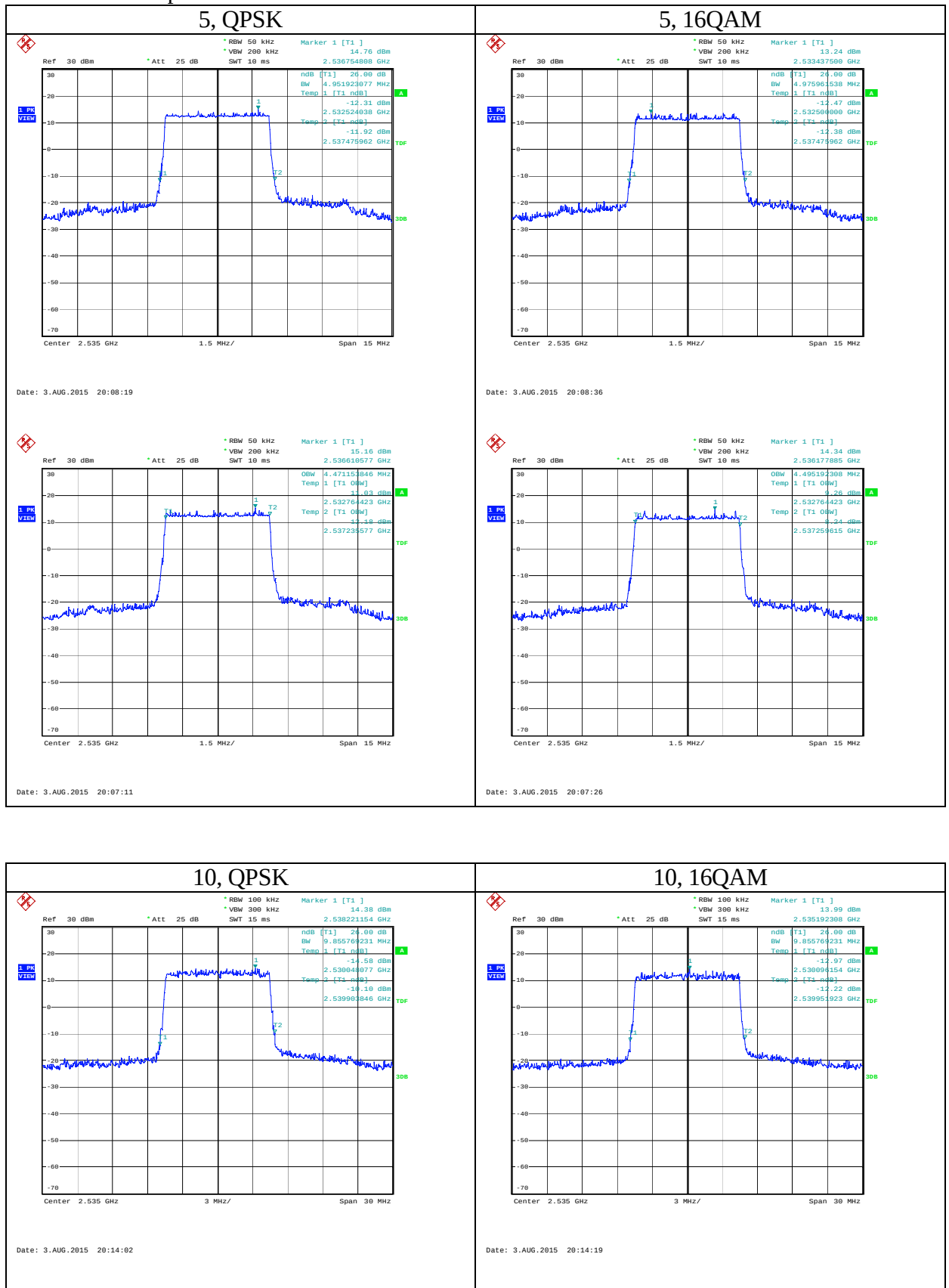


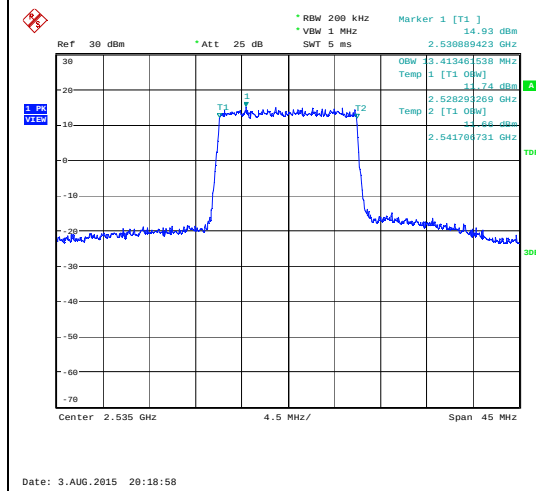
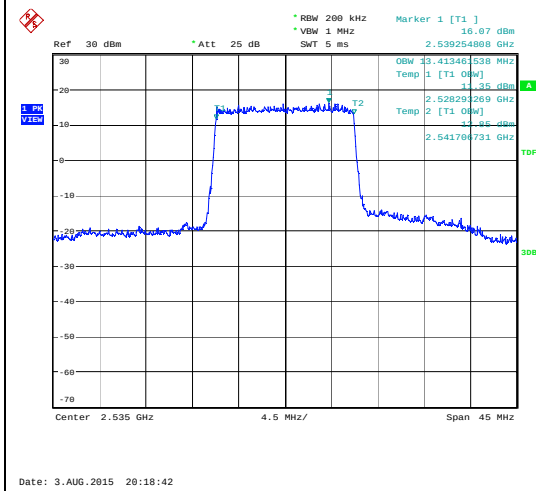
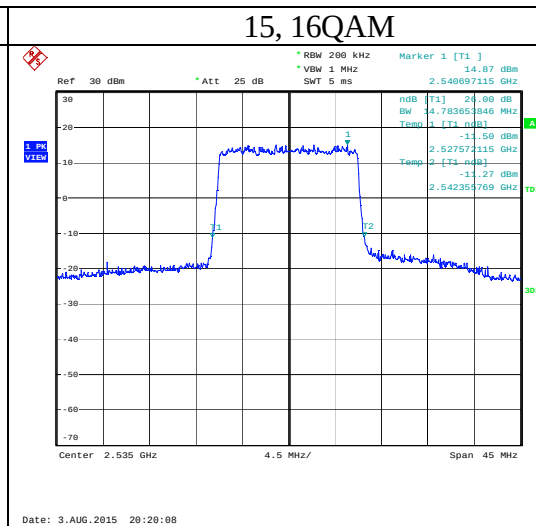
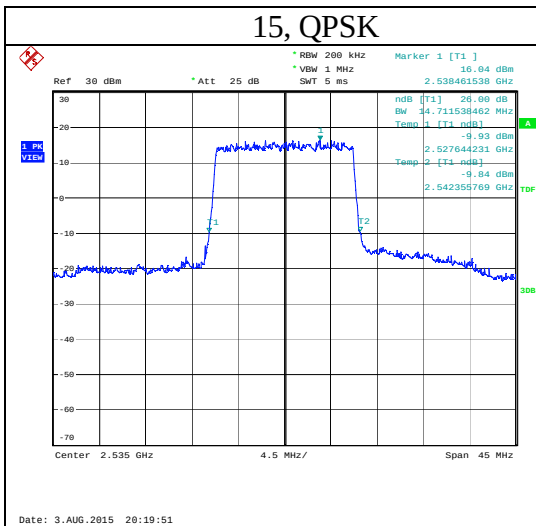
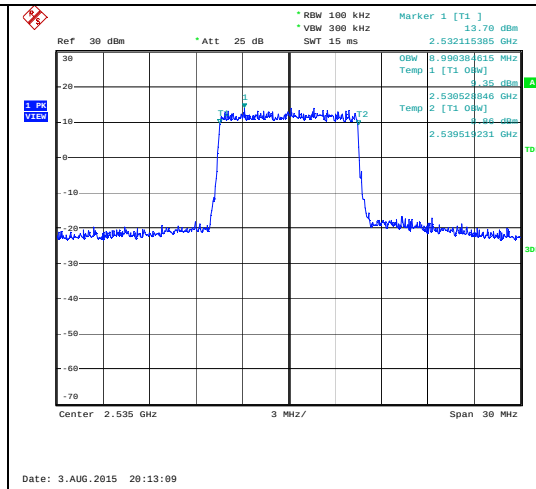
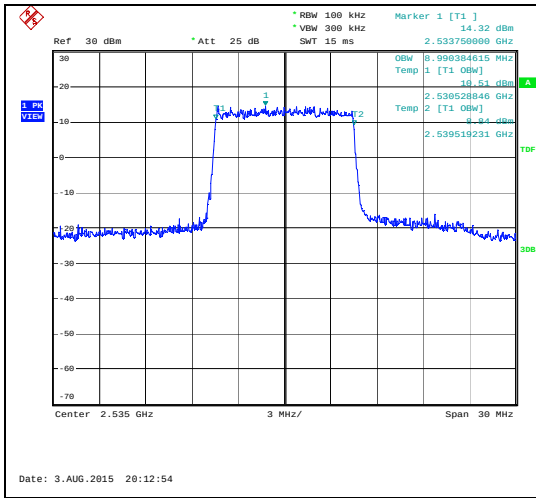
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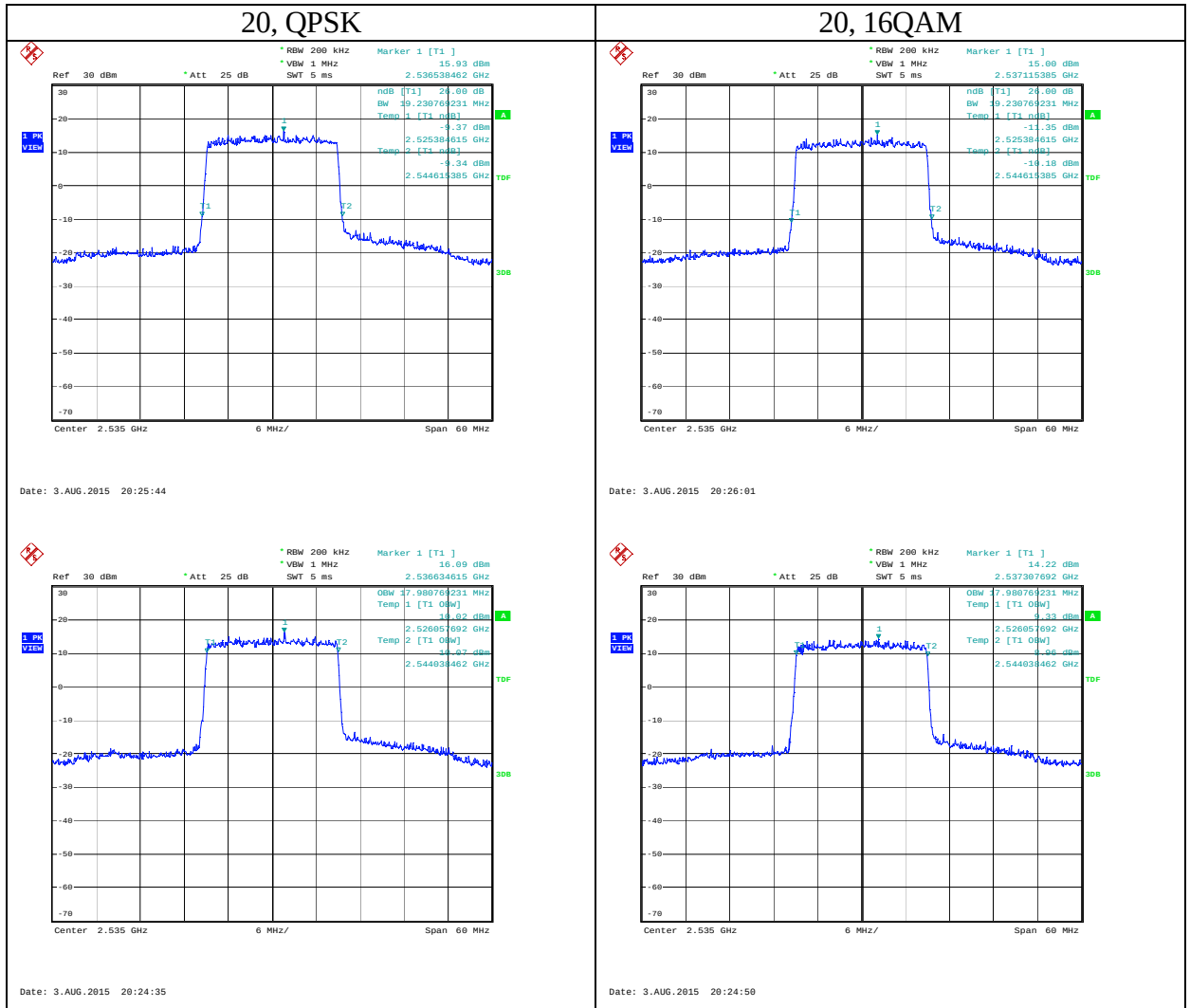


Date: 3.AUG.2015 21:01:01

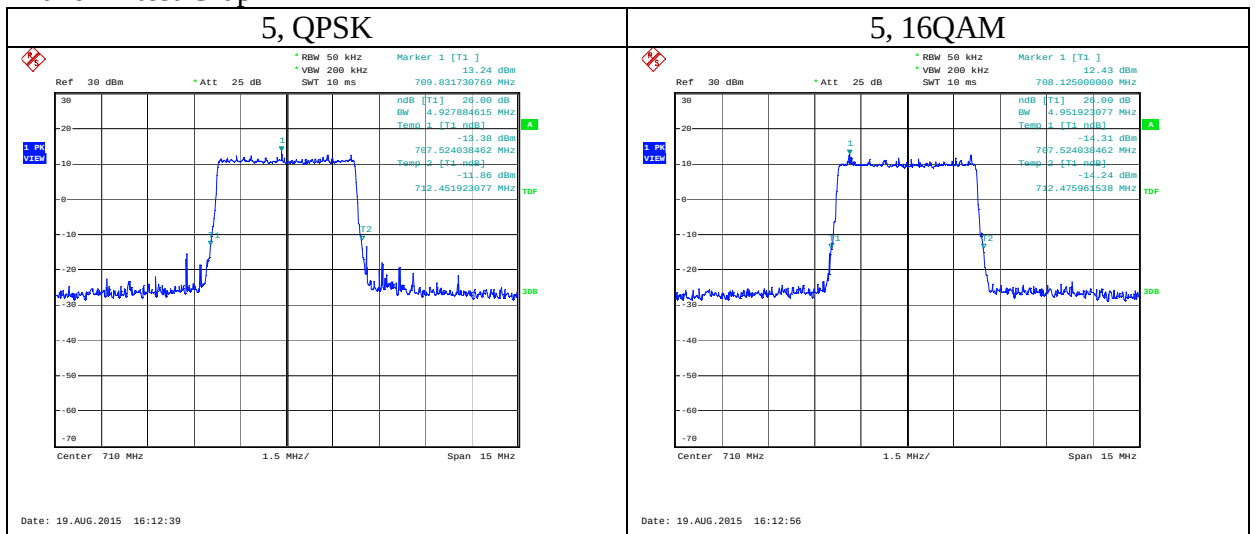
Band 7 test Graph

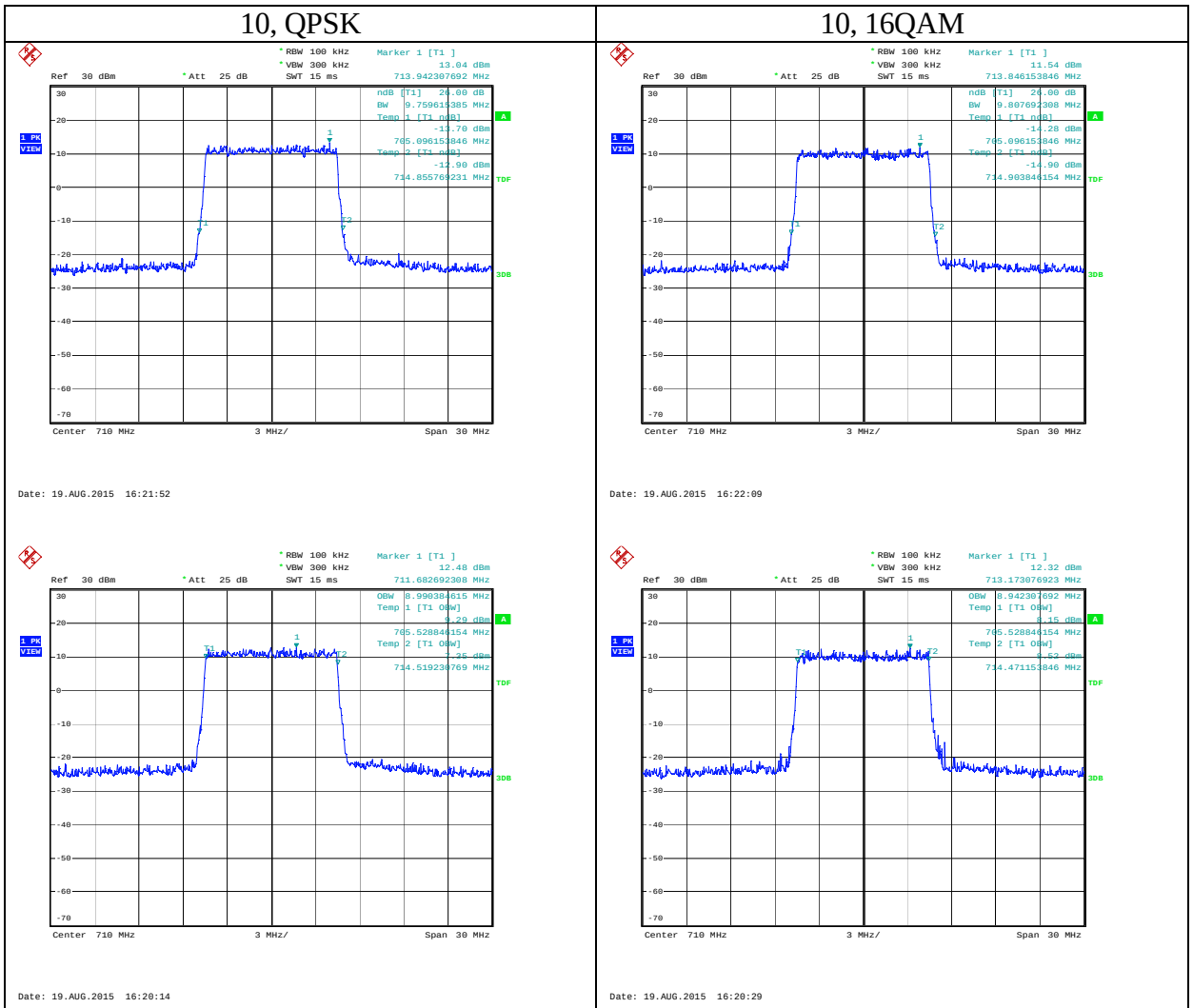
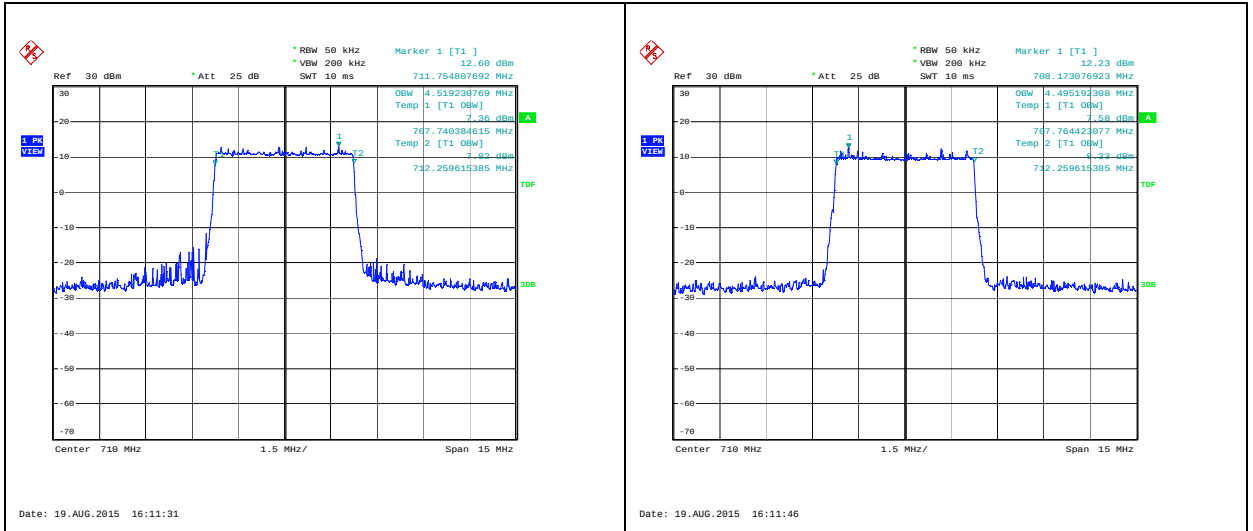






Band 17 test Graph





3.4 Conducted Spurious Emission (FCC Part 22.1051, 2.1057, 22.917, 24.238, 27.53){ tc \\ 2 "4.4 Spurious Emissions at Antenna Terminals (FCC Part 2.1051, 2.1057, 22.917, 24.238)" }

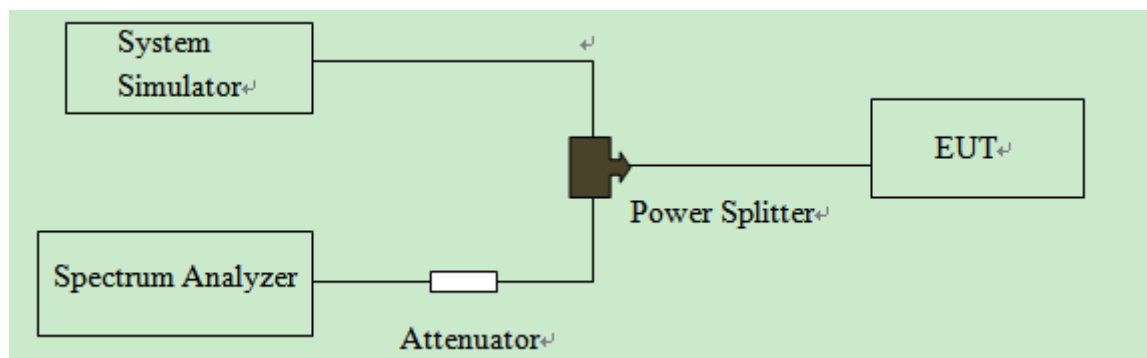
The limit is as follows:

The conducted spurious emissions are measured from 9kHz up to the 10th harmonic of fundamental emission.

According to 22.917, 24.238 and 27.53, 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, i.e. at or below -13dBm.

Test Procedures:

1. The EUT was connected to spectrum analyzer and base station via power divider.
2. 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.
3. The middle channel for the highest RF power within the transmitting frequency was measured.
4. The conducted spurious emission for the whole frequency range was taken.
5. The RF fundamental frequency should be excluded against the limit line in the Operating frequency band.
6. The limit line is derived from $43 + 10\log(P)$ dB below the transmitter power P(Watts)
 $= P(W) - [43 + 10\log(P)] \text{ (dB)}$
 $= [30 + 10\log(P)] \text{ (dBm)} - [43 + 10\log(P)] \text{ (dB)}$
 $= -13\text{dBm}.$



Test results:

Band	Bandwidth (MHz)	Modulation	Channel (MHz)	Result
2	1.4	QPSK	1850.7	Pass
			1880	Pass
			1909.3	Pass
	1.4	16QAM	1850.7	Pass
			1880	Pass
			1909.3	Pass
	3	QPSK	1851.5	Pass
			1880	Pass
			1908.5	Pass
	3	16QAM	1851.5	Pass
			1880	Pass
			1908.5	Pass
	5	QPSK	1852.5	Pass
			1880	Pass
			1907.5	Pass
	5	16QAM	1852.5	Pass
			1880	Pass
			1907.5	Pass
	10	QPSK	1855	Pass
			1880	Pass
			1905	Pass
	10	16QAM	1855	Pass
			1880	Pass
			1905	Pass
	15	QPSK	1857.5	Pass
			1880	Pass
			1902.5	Pass
	15	16QAM	1857.5	Pass
			1880	Pass
			1902.5	Pass
	20	QPSK	1860	Pass
			1880	Pass
			1900	Pass
	20	16QAM	1860	Pass
			1880	Pass
			1900	Pass

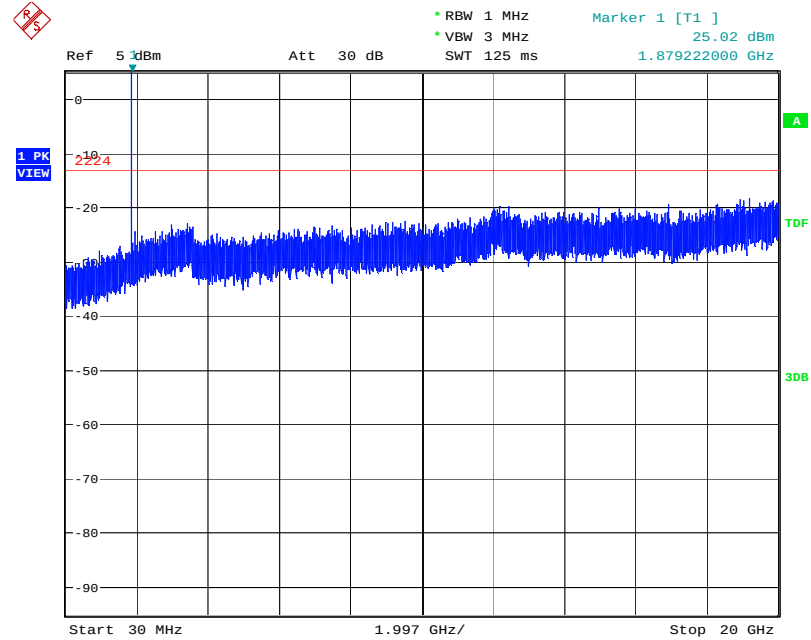
Band	Bandwidth (MHz)	Modulation	Channel (MHz)	Result
4	1.4	QPSK	1710.7	Pass
			1732.5	Pass
			1754.3	Pass
	1.4	16QAM	1710.7	Pass
			1732.5	Pass
			1754.3	Pass
	3	QPSK	1711.5	Pass
			1732.5	Pass
			1753.5	Pass
	3	16QAM	1711.5	Pass
			1732.5	Pass
			1753.5	Pass
	5	QPSK	1712.5	Pass
			1732.5	Pass
			1752.5	Pass
	5	16QAM	1712.5	Pass
			1732.5	Pass
			1752.5	Pass
	10	QPSK	1715	Pass
			1732.5	Pass
			1750	Pass
	10	16QAM	1715	Pass
			1732.5	Pass
			1750	Pass
	15	QPSK	1717.5	Pass
			1732.5	Pass
			1747.5	Pass
	15	16QAM	1717.5	Pass
			1732.5	Pass
			1747.5	Pass
	20	QPSK	1720	Pass
			1732.5	Pass
			1745	Pass
	20	16QAM	1720	Pass
			1732.5	Pass
			1745	Pass

Band	Bandwidth (MHz)	Modulation	Channel (MHz)	Result
7	5	QPSK	2502.5	Pass
			2535	Pass
			2567.5	Pass
	5	16QAM	2502.5	Pass
			2535	Pass
			2567.5	Pass
	10	QPSK	2505	Pass
			2535	Pass
			2565	Pass
	10	16QAM	2505	Pass
			2535	Pass
			2565	Pass
	15	QPSK	2507.5	Pass
			2535	Pass
			2562.5	Pass
	15	16QAM	2507.5	Pass
			2535	Pass
			2562.5	Pass
	20	QPSK	2510	Pass
			2535	Pass
			2560	Pass
	20	16QAM	2510	Pass
			2535	Pass
			2560	Pass

Band	Bandwidth (MHz)	Modulation	Channel (MHz)	Result
17	5	QPSK	706.5	Pass
			710	Pass
			713.5	Pass
	5	16QAM	706.5	Pass
			710	Pass
			713.5	Pass
	10	QPSK	709	Pass
			710	Pass
			711	Pass
	10	16QAM	709	Pass
			710	Pass
			711	Pass

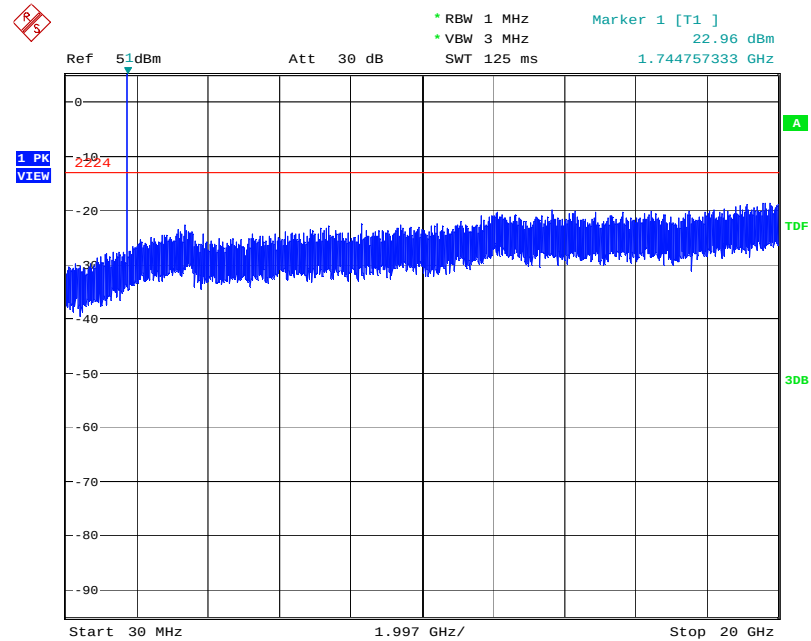
Worst test graph below:

Band 2



Date: 19.AUG.2015 18:33:53

Band 4

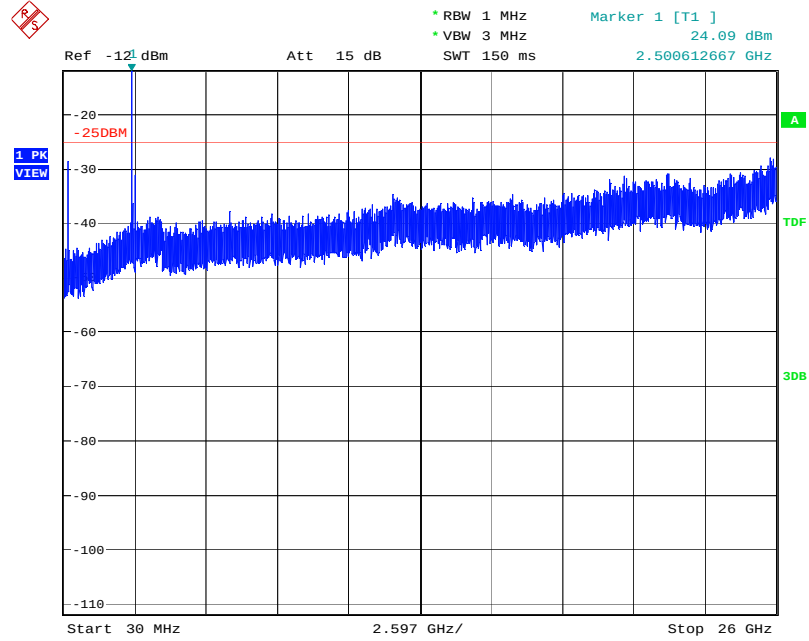


Date: 5.AUG.2015 17:35:06

FCC ID: SG71507L51

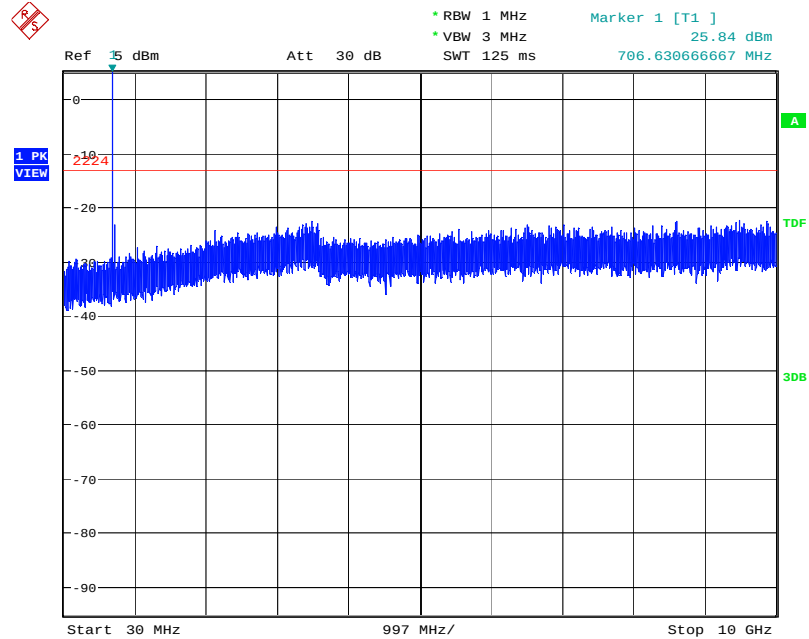
TTRF_FCC_WWAN_V1

Band 7



Date: 5.AUG.2015 17:11:35

Band 17



Date: 19.AUG.2015 17:59:21

3.5 Radiated Spurious Emissions (FCC Part 2.1053, 2.1057, 22.917, 24.238, 27.53){ tc \l 2 "4.5 Power of Spurious Emissions (FCC Part 2.1053, 2.1057, 22.917, 24.238)" }

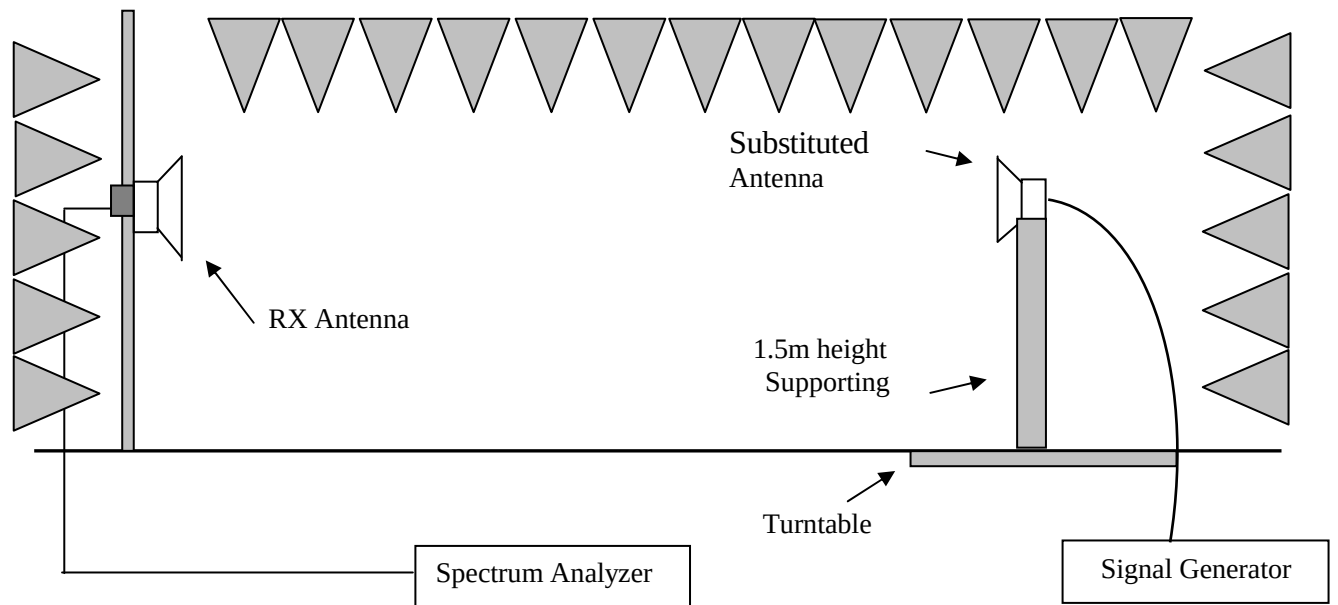
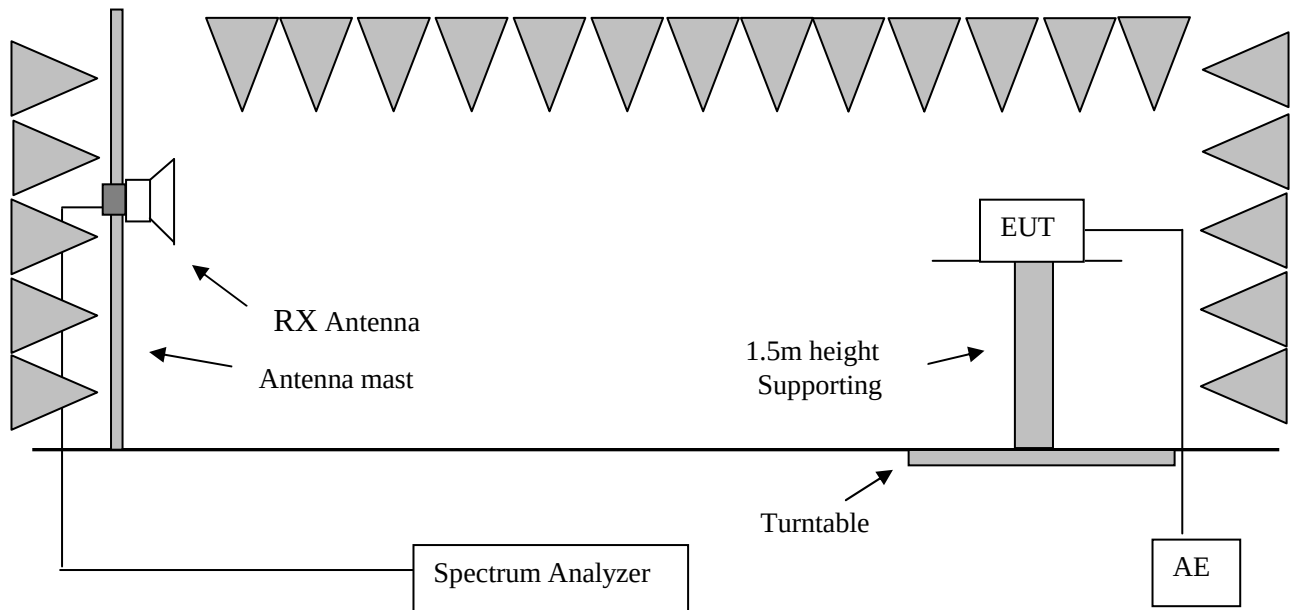
The limit is as follows:

The radiated spurious emissions are tested per TIA/EIA-603 using the Substitution Method and measured from 9kHz up to the 10th harmonic of fundamental emission. The simultaneous transmission has been considered when perform spurious radiation test.

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, i.e. at or below -13dBm. The RBW: 100kHz and VBW: 300KHz were used at the 850 band; The RBW: 1MHz and VBW: 3MHz were used at the 1900 band;

Test Procedures:

1. The EUT was placed on a rotatable wooden table with 0.8 meter above ground.
2. The EUT was set 3 meters from the receiving antenna, which was mounted on the antenna tower.
3. The table was rotated 360 degrees to determine the position of the highest spurious emission.
4. 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.
5. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, taking the record of maximum spurious emission.
6. A horn antenna was substituted in place of the EUT and was driven by a signal generator.
7. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission.
8. Taking the record of output power at antenna port.
9. Repeat step 7 to step 8 for another polarization.
10. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
11. The limit line is derived from $43 + 10\log(P)$ dB below the transmitter power P(Watts)
 $= P(W) - [43 + 10\log(P)] \text{ (dB)}$
 $= [30 + 10\log(P)] \text{ (dBm)} - [43 + 10\log(P)] \text{ (dB)}$
 $= -13\text{dBm}.$
12. $\text{EIRP (dBm)} = \text{S.G. Power} - \text{Tx Cable Loss} + \text{Tx Antenna Gain}$
13. $\text{ERP (dBm)} = \text{EIRP} - 2.15$



Worst Test results:

Band 2, 1880.0MHz

Polarization	Frequency (MHz)	Measured ERP (dBm)	Limit ERP (dBm)	Margin (dB)
V	3758.80	-34.93	-13	21.93

Band 4, 1732.5MHz

Polarization	Frequency (MHz)	Measured ERP (dBm)	Limit ERP (dBm)	Margin (dB)
V	3464.00	-29.29	-13	16.29

LTE band 7, 2535.0MHz

Polarization	Frequency (MHz)	Measured ERP (dBm)	Limit EIRP (dBm)	Margin (dB)
V	7598.40	-36.85	-13	23.85

LTE band 17, 710.0MHz

Polarization	Frequency (MHz)	*Calculated EIRP (dBm)	Limit EIRP (dBm)	Margin (dB)
V	2123.08	-26.88	-13	13.88

Note: 1. the worst test data is listed here.

2. *EIRP = ERP + 2.15dB

3.6 Band Edge Emission (FCC Part 22.917, 24.238, 27.53) { tc \l 2 "4.6 Blocked at Antenna Terminals (FCC Part 22.917, 24.238)" }

The limit is as follows:

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 is employed. The 26dB emission bandwidth taken in section 4.4 is used for calculating the resolution bandwidth.

The power of any emission at the blocked edge must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB, i.e. at or below -13dBm when using 1% emissions bandwidth.

According to the FCC KDB with Publication Number: 890810, measurements using narrower resolution bandwidths are acceptable and must sum the power from all contiguous reduced resolution bandwidths within the 1% resolution specified, an alternative is to add an additional correction factor of $10 \log(RBW1 / RBW2)$ to the $43 + 10 \log(P)$ limit. RBW1 is the narrower measurement resolution bandwidth and RBW2 is the 1% emissions bandwidth.

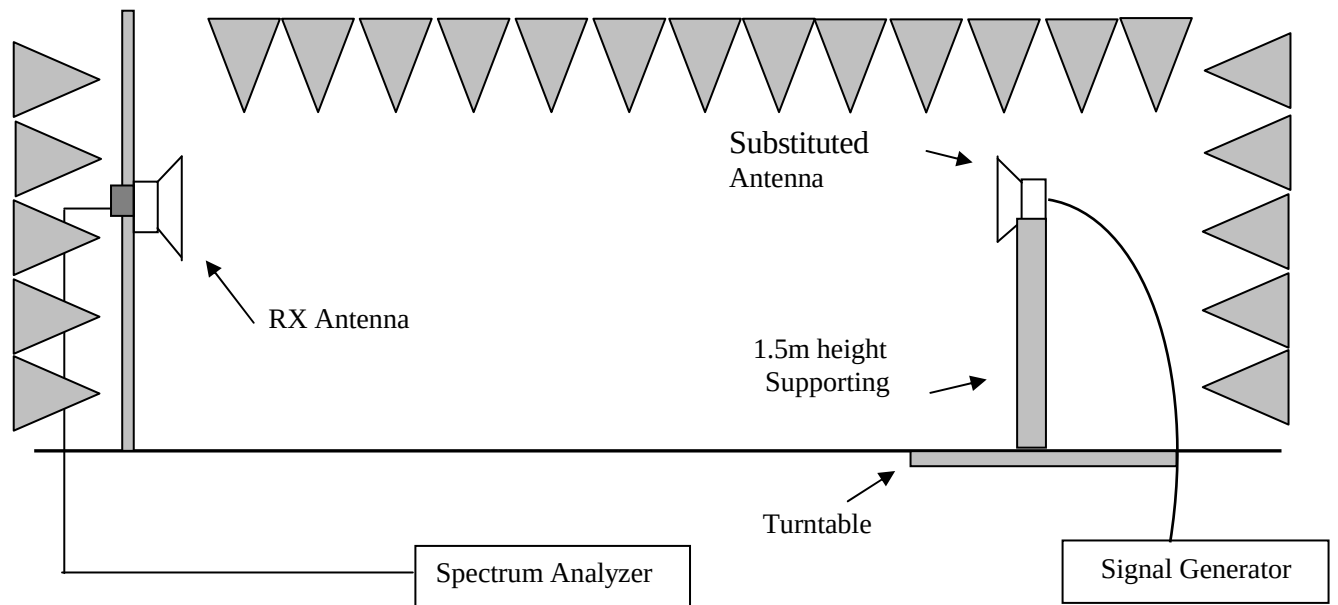
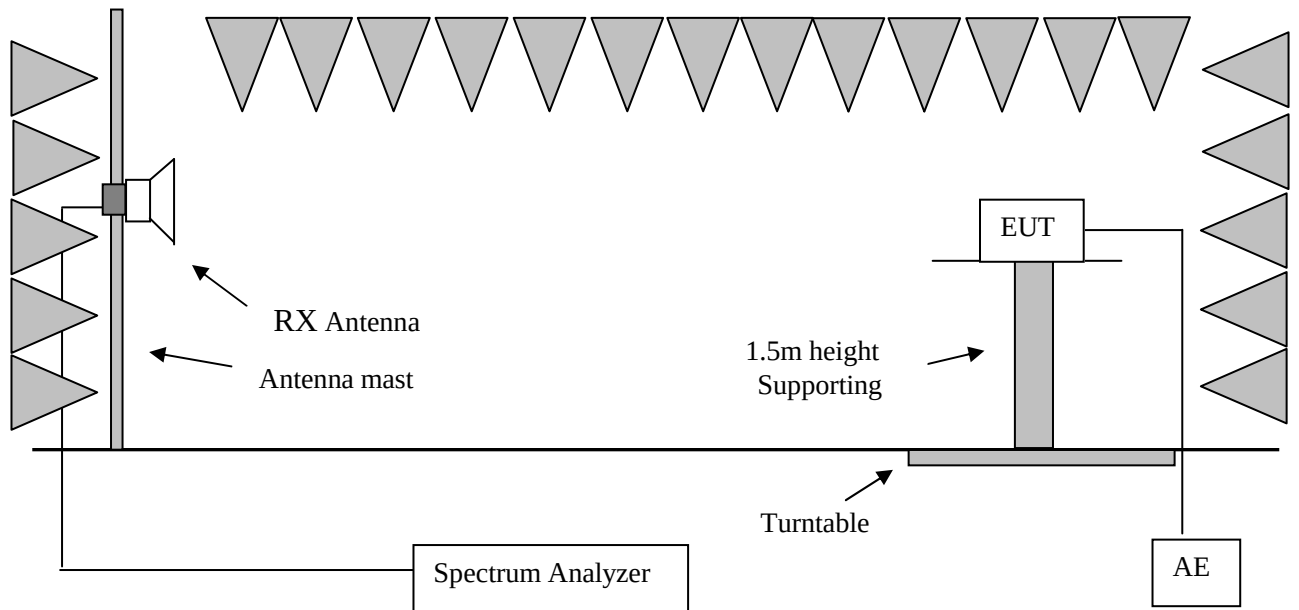
Test Procedures:

1. The EUT was connected to Spectrum Analyzer and Base Station via power divider.
2. 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.
3. The band edges of low and high channels for the highest RF powers were measured.
4. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
5. The limit line is derived from $43 + 10 \log(P)$ dB below the transmitter power P(Watts)

$$= P(W) - [43 + 10 \log(P)] \text{ (dB)}$$

$$= [30 + 10 \log(P)] \text{ (dBm)} - [43 + 10 \log(P)] \text{ (dB)}$$

$$= -13 \text{ dBm.}$$



Test results:

Band	Bandwidth (MHz)	Modulation	Channel (MHz)	Result
2	1.4	QPSK	1850.7	Pass
			1880	Pass
			1909.3	Pass
	1.4	16QAM	1850.7	Pass
			1880	Pass
			1909.3	Pass
	3	QPSK	1851.5	Pass
			1880	Pass
			1908.5	Pass
	3	16QAM	1851.5	Pass
			1880	Pass
			1908.5	Pass
	5	QPSK	1852.5	Pass
			1880	Pass
			1907.5	Pass
	5	16QAM	1852.5	Pass
			1880	Pass
			1907.5	Pass
	10	QPSK	1855	Pass
			1880	Pass
			1905	Pass
	10	16QAM	1855	Pass
			1880	Pass
			1905	Pass
	15	QPSK	1857.5	Pass
			1880	Pass
			1902.5	Pass
	15	16QAM	1857.5	Pass
			1880	Pass
			1902.5	Pass
	20	QPSK	1860	Pass
			1880	Pass
			1900	Pass
	20	16QAM	1860	Pass
			1880	Pass
			1900	Pass

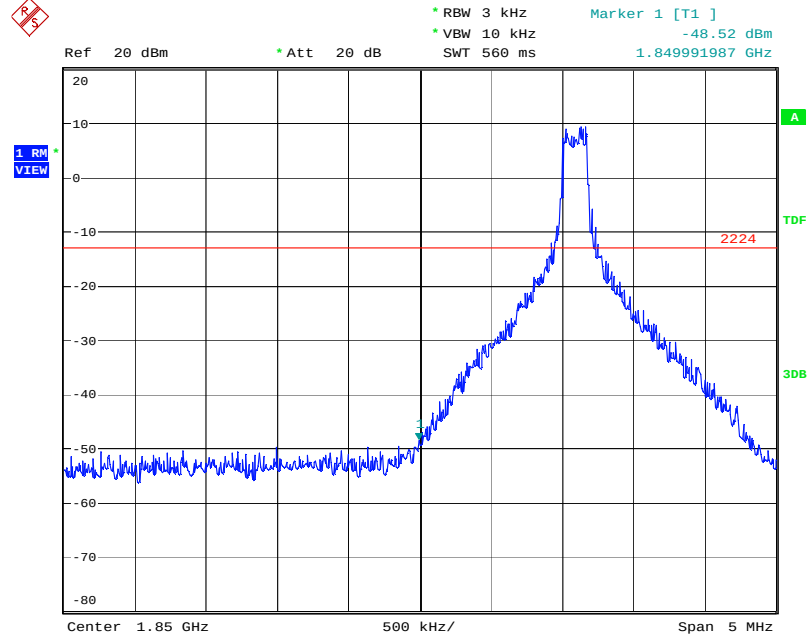
Band	Bandwidth (MHz)	Modulation	Channel (MHz)	Result
4	1.4	QPSK	1710.7	Pass
			1732.5	Pass
			1754.3	Pass
	1.4	16QAM	1710.7	Pass
			1732.5	Pass
			1754.3	Pass
	3	QPSK	1711.5	Pass
			1732.5	Pass
			1753.5	Pass
	3	16QAM	1711.5	Pass
			1732.5	Pass
			1753.5	Pass
	5	QPSK	1712.5	Pass
			1732.5	Pass
			1752.5	Pass
	5	16QAM	1712.5	Pass
			1732.5	Pass
			1752.5	Pass
	10	QPSK	1715	Pass
			1732.5	Pass
			1750	Pass
	10	16QAM	1715	Pass
			1732.5	Pass
			1750	Pass
	15	QPSK	1717.5	Pass
			1732.5	Pass
			1747.5	Pass
	15	16QAM	1717.5	Pass
			1732.5	Pass
			1747.5	Pass
	20	QPSK	1720	Pass
			1732.5	Pass
			1745	Pass
	20	16QAM	1720	Pass
			1732.5	Pass
			1745	Pass

Band	Bandwidth (MHz)	Modulation	Channel (MHz)	Result
7	5	QPSK	2502.5	Pass
			2535	Pass
			2567.5	Pass
	5	16QAM	2502.5	Pass
			2535	Pass
			2567.5	Pass
	10	QPSK	2505	Pass
			2535	Pass
			2565	Pass
	10	16QAM	2505	Pass
			2535	Pass
			2565	Pass
	15	QPSK	2507.5	Pass
			2535	Pass
			2562.5	Pass
	15	16QAM	2507.5	Pass
			2535	Pass
			2562.5	Pass
	20	QPSK	2510	Pass
			2535	Pass
			2560	Pass
	20	16QAM	2510	Pass
			2535	Pass
			2560	Pass

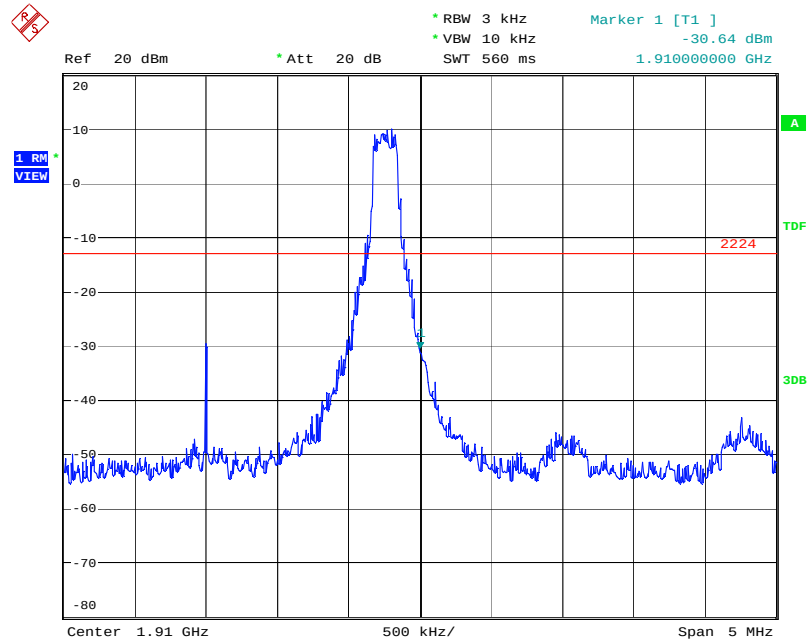
Band	Bandwidth (MHz)	Modulation	Channel (MHz)	Result
17	5	QPSK	706.5	Pass
			710	Pass
			713.5	Pass
	5	16QAM	706.5	Pass
			710	Pass
			713.5	Pass
	10	QPSK	709	Pass
			710	Pass
			711	Pass
	10	16QAM	709	Pass
			710	Pass
			711	Pass

Worst test graph below:

Band 2, 1RB



Date: 19.AUG.2015 19:09:00

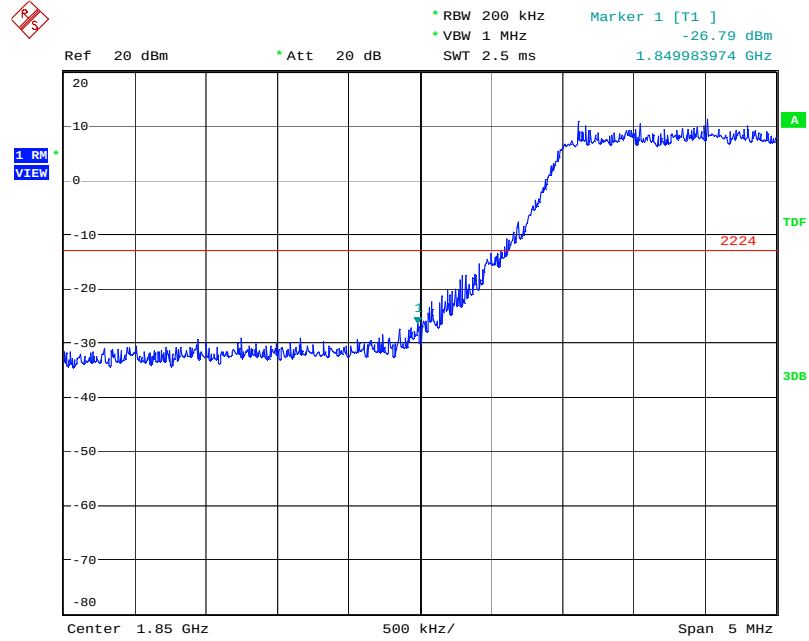


Date: 19.AUG.2015 19:06:34

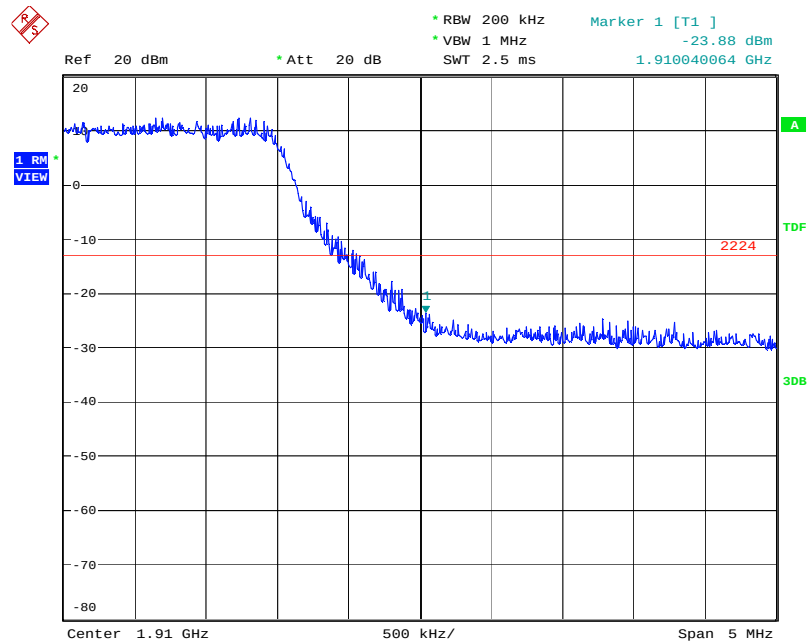
FCC ID: SG71507L51

TTRF_FCC_WWAN_V1

Band 2, 100%RB

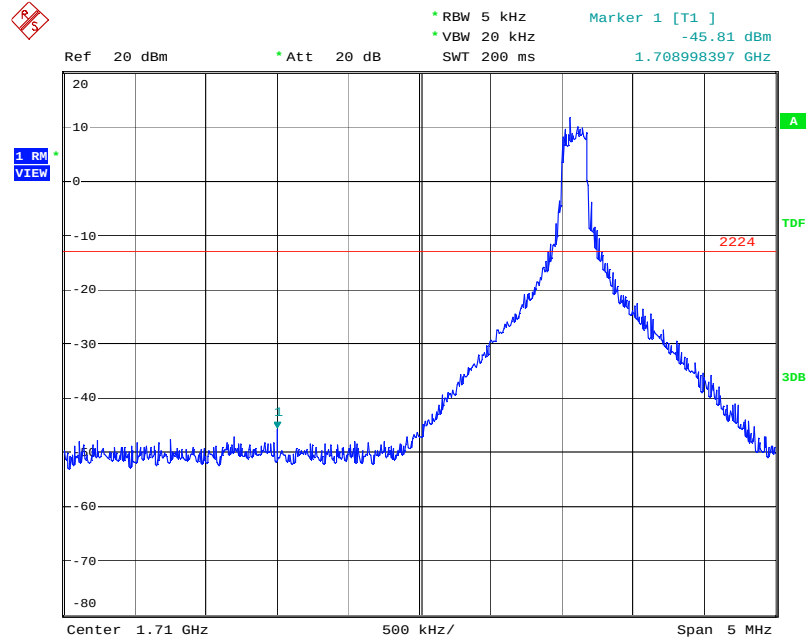


Date: 19.AUG.2015 17:19:29

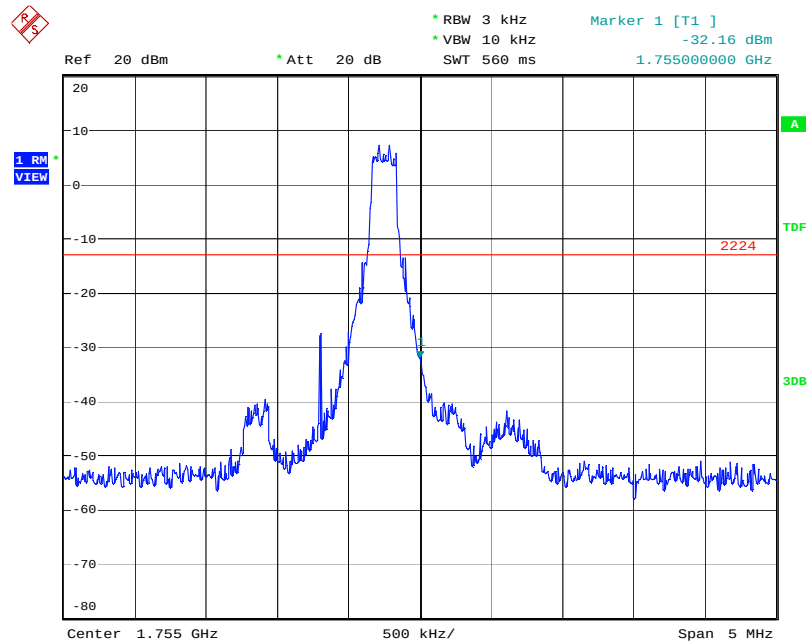


Date: 19.AUG.2015 17:20:17

Band 4, 1RB

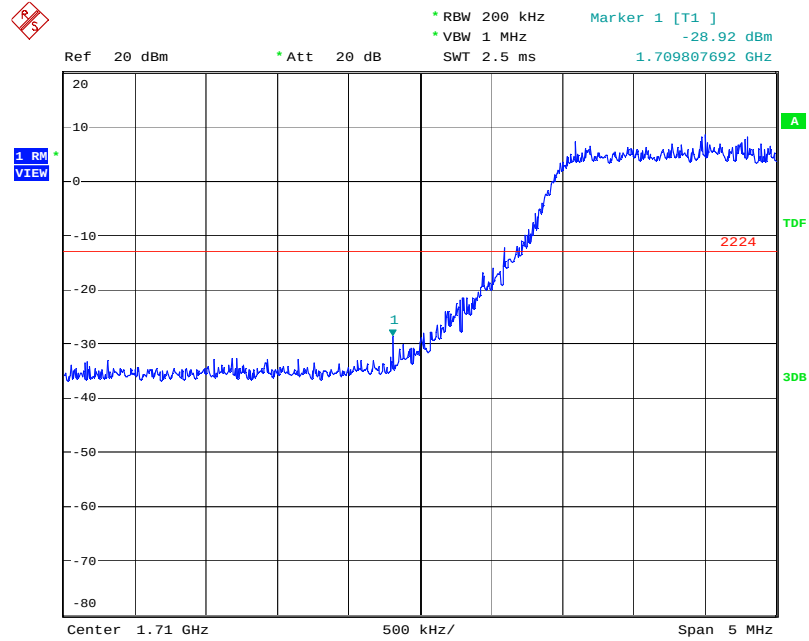


Date: 5.AUG.2015 17:27:22

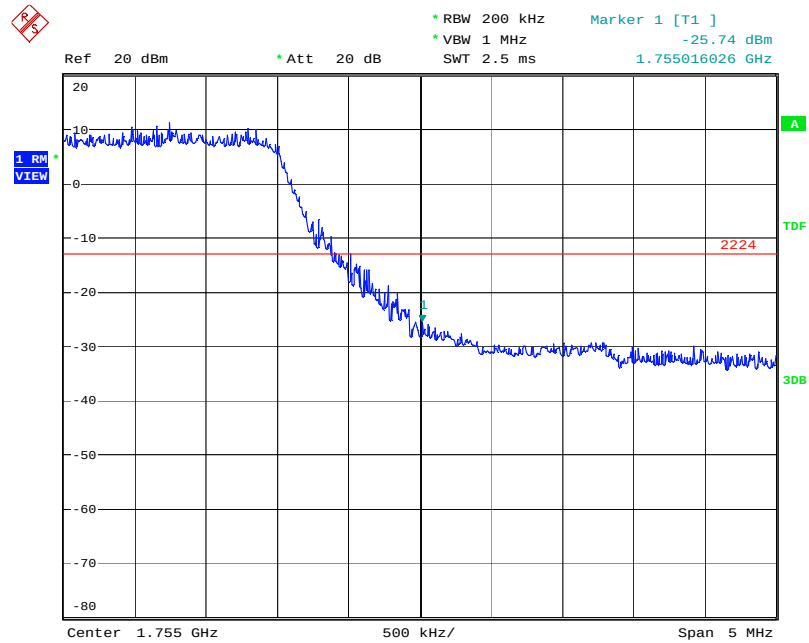


Date: 5.AUG.2015 17:21:06

Band 4, 100%RB

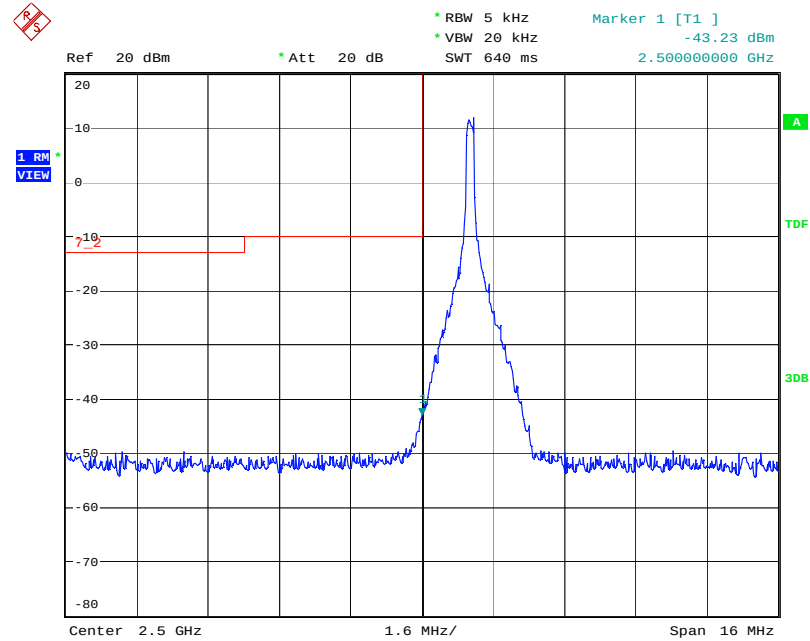


Date: 5.AUG.2015 17:31:40

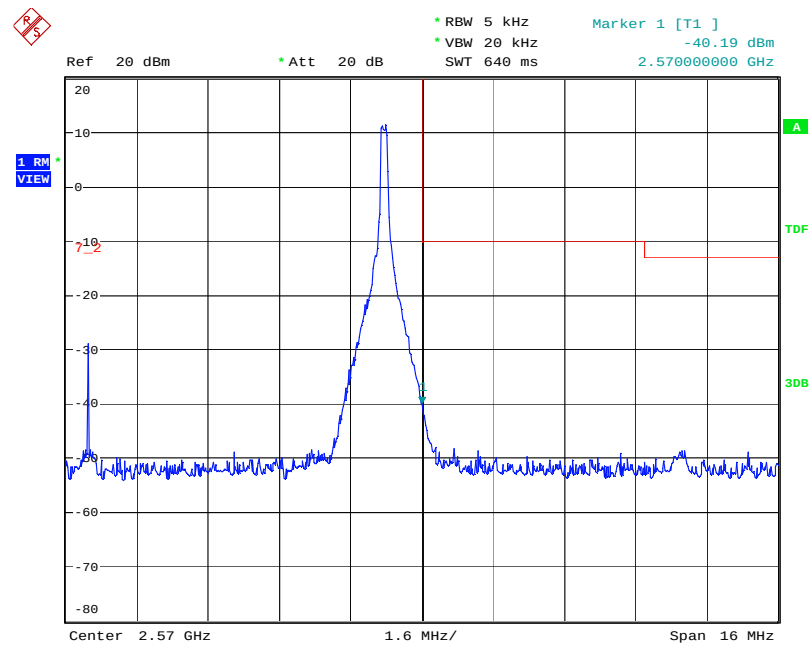


Date: 5.AUG.2015 17:32:29

Band 7, 1RB

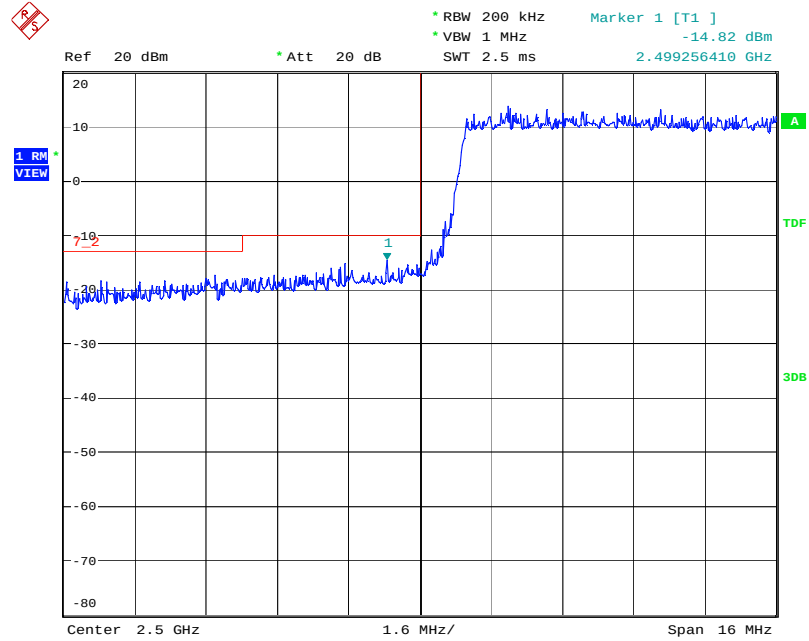


Date: 5.AUG.2015 17:10:41

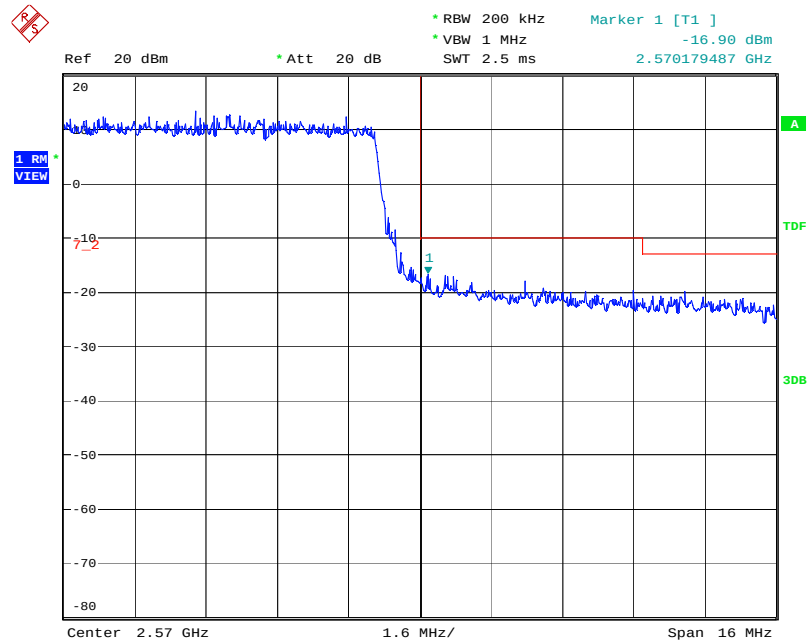


Date: 5.AUG.2015 17:03:45

Band 7, 100%RB

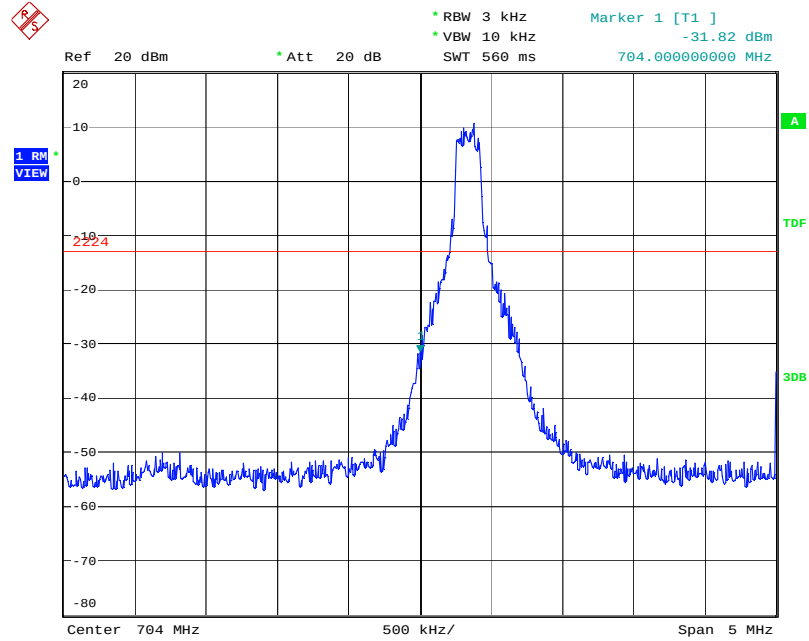


Date: 5.AUG.2015 17:14:06

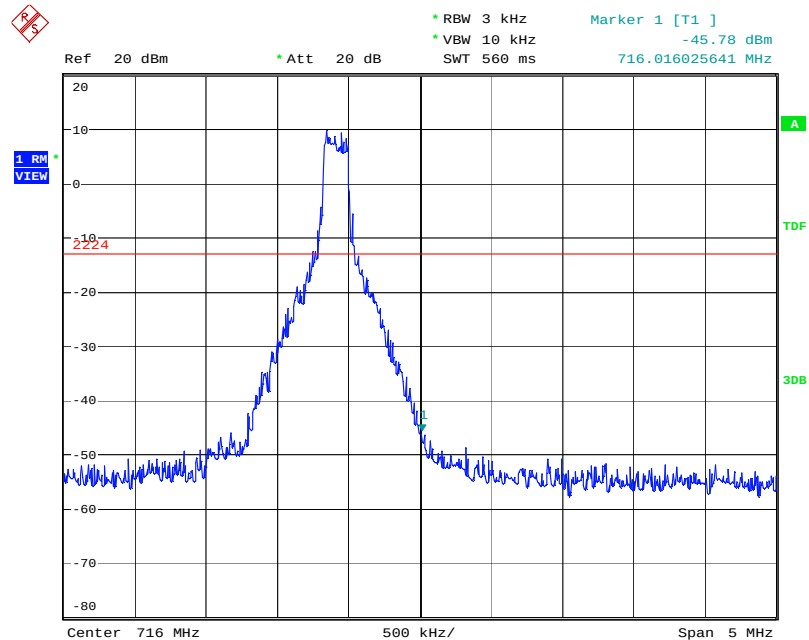


Date: 5.AUG.2015 17:14:54

Band 17, 1RB

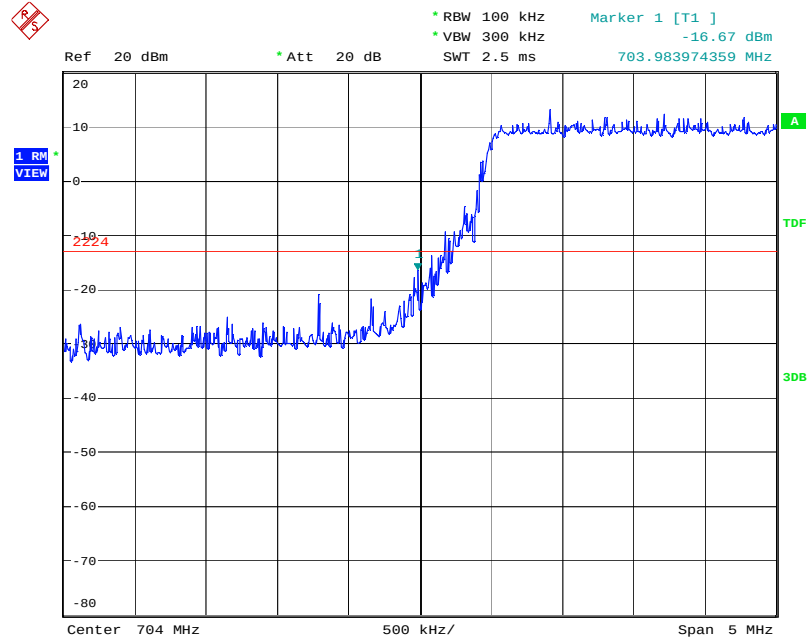


Date: 19.AUG.2015 19:10:59

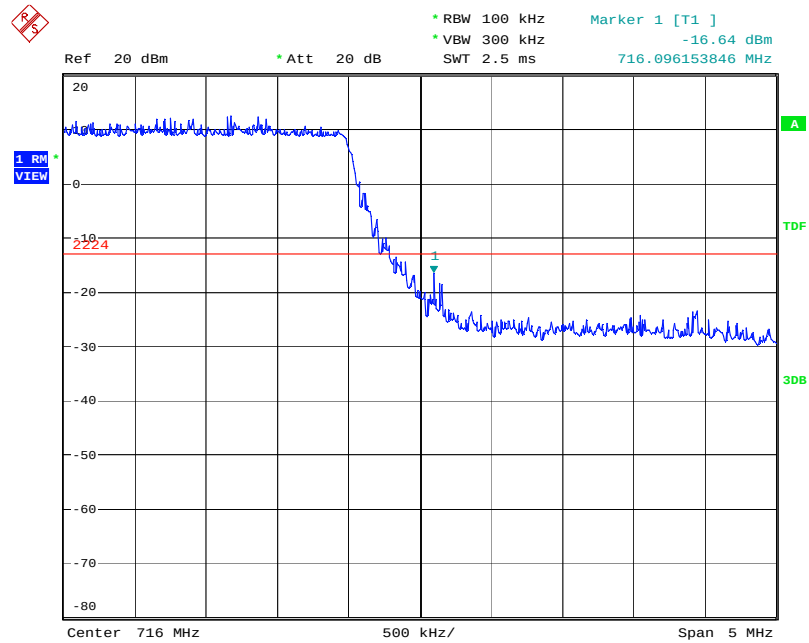


Date: 19.AUG.2015 19:38:33

Band 17, 100% RB



Date: 19.AUG.2015 17:40:25



Date: 19.AUG.2015 17:41:44

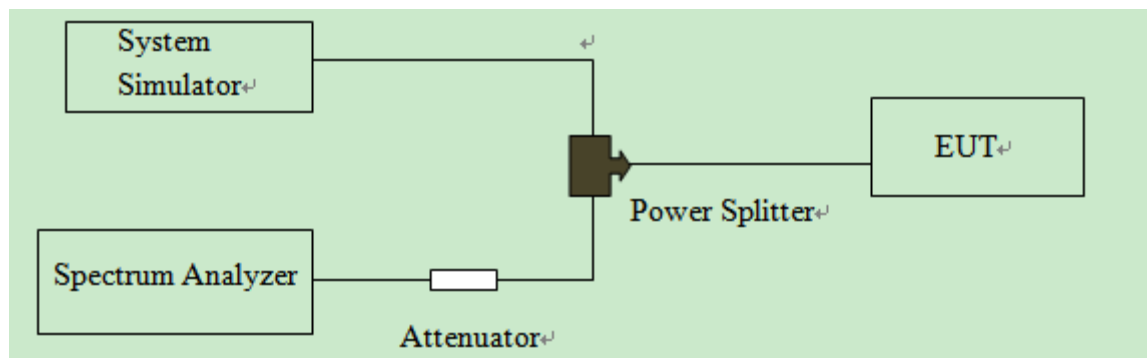
3.7 Peak-to-Average Ratio (FCC Part 24.232, 27.50)

The limit is as follows:

The peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

Test Procedures:

1. The EUT was connected to Spectrum Analyzer and Base Station via power divider.
2. 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.
3. For GSM/GPRS/EDGE operating modes:
 - a. Set the RBW = 1MHz, VBW = 1MHz, Peak detector in spectrum analyzer.
 - b. Set EUT in maximum power output, and triggered the burst signal.
 - c. Measured respectively the Peak level and Mean level, and the deviation was recorded as Peak to Average Ratio.
4. For UMTS operating modes:
 - a. Set the CCDF (Complementary Cumulative Distribution Function) option in spectrum analyzer.
 - b. The highest RF powers were measured and recorded the maximum PAPR level associated with a probability of 0.1 %.



Test Results:

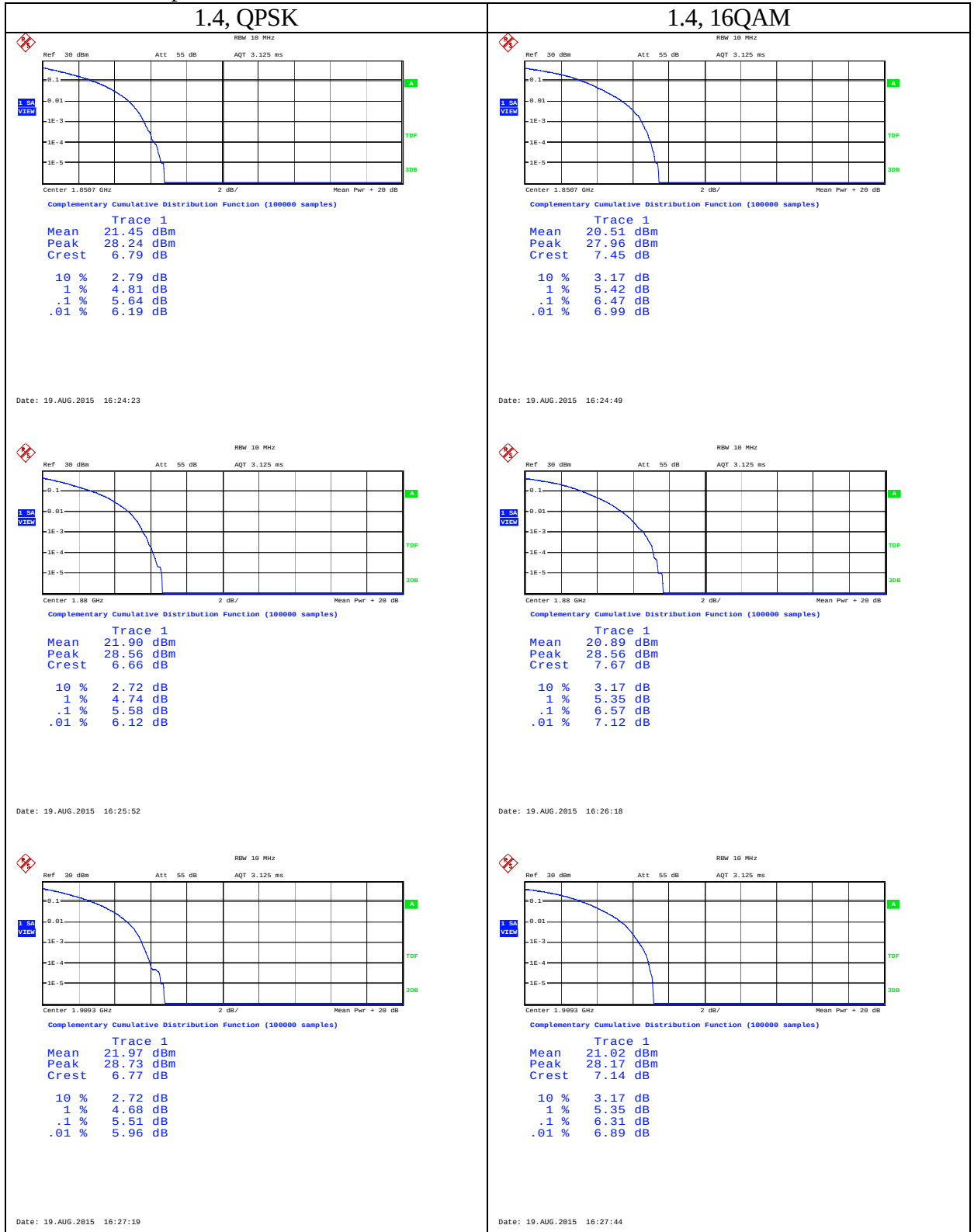
Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Channel		
					L	M	H
2	1.4	QPSK	1	0	6.19	6.12	5.96
	1.4	16QAM	1	0	6.99	7.12	6.89
	3	QPSK	1	0	6.31	6.15	6.15
	3	16QAM	1	0	7.18	7.05	6.99
	5	QPSK	1	0	6.31	6.28	6.28
	5	16QAM	1	0	7.08	7.02	6.99
	10	QPSK	1	0	6.44	6.09	6.38
	10	16QAM	1	0	7.05	7.24	7.34
	15	QPSK	1	0	6.99	6.73	7.02
	15	16QAM	1	0	7.66	7.79	7.98
	20	QPSK	1	0	7.40	7.37	7.37
	20	16QAM	1	0	8.21	8.27	8.46

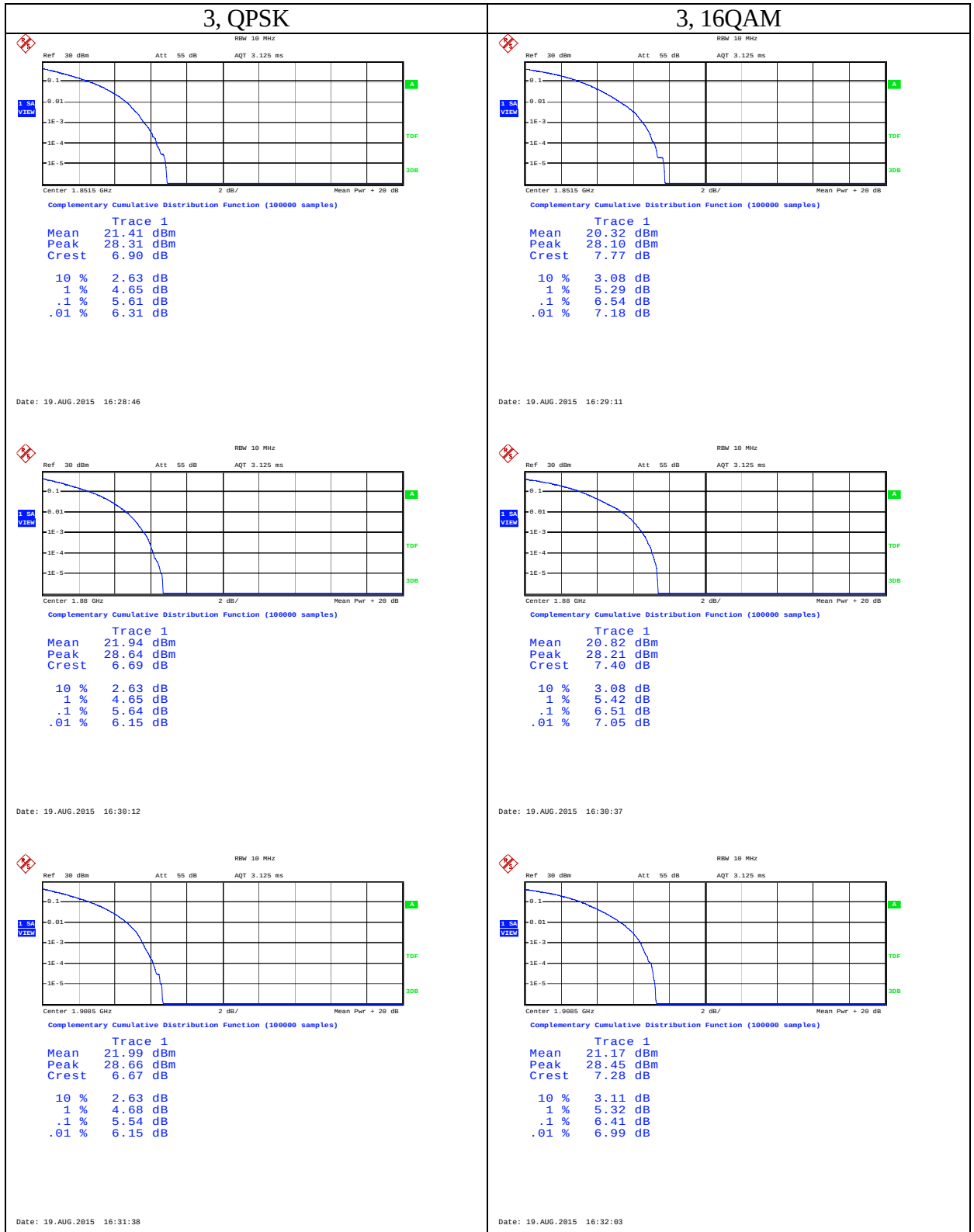
Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Channel		
					L	M	H
4	1.4	QPSK	1	0	5.90	6.06	5.96
	1.4	16QAM	1	0	7.31	7.08	6.73
	3	QPSK	1	0	6.41	6.09	5.80
	3	16QAM	1	0	7.18	7.08	6.76
	5	QPSK	1	0	6.28	6.31	6.09
	5	16QAM	1	0	7.21	6.96	6.79
	10	QPSK	1	0	6.41	6.38	6.41
	10	16QAM	1	0	7.37	7.21	7.21
	15	QPSK	1	0	7.05	6.99	7.24
	15	16QAM	1	0	7.69	8.14	8.01
	20	QPSK	1	0	7.72	7.60	7.76
	20	16QAM	1	0	8.21	8.43	8.33

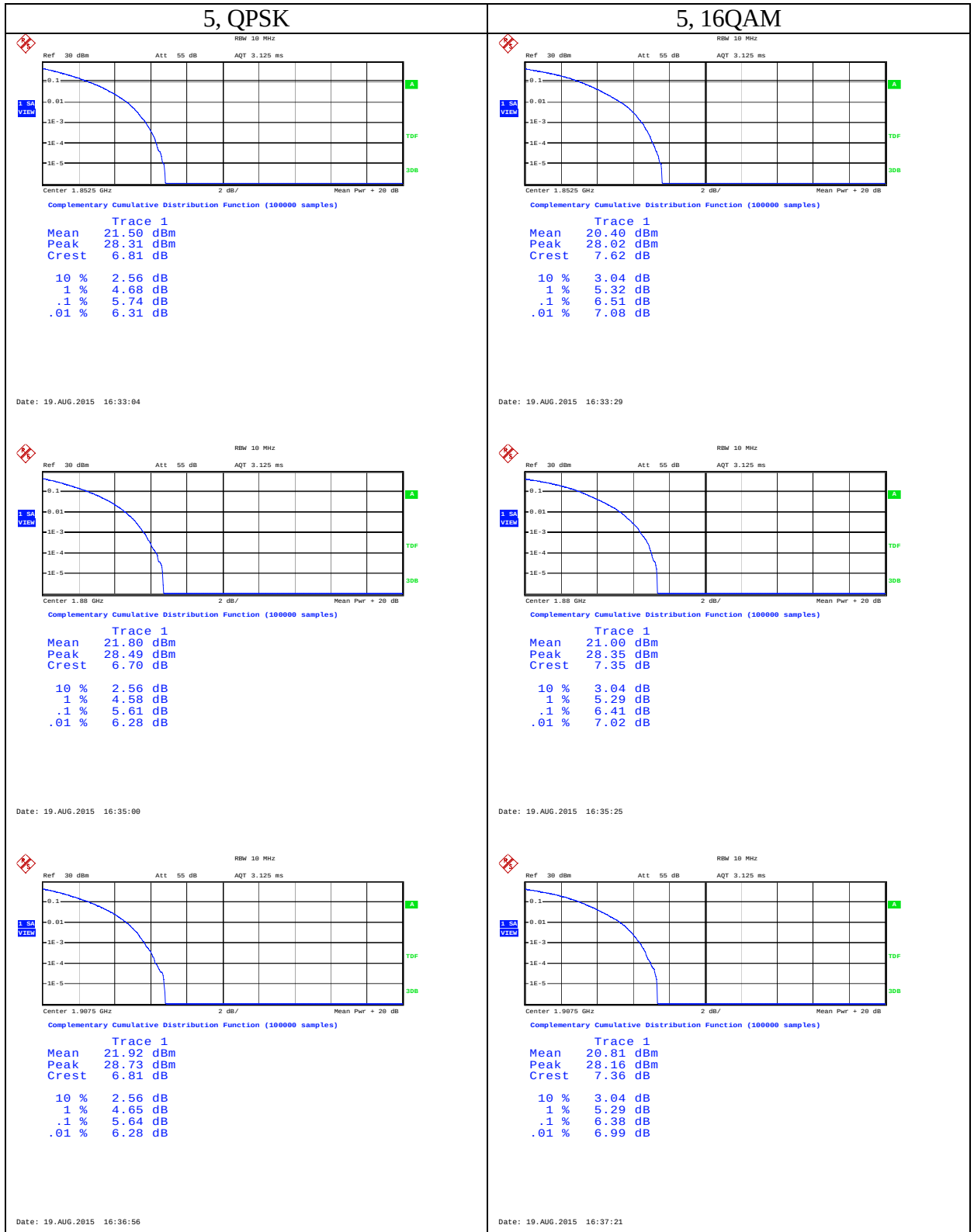
Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Channel		
					L	M	H
7	5	QPSK	1	0	5.45	5.35	5.16
	5	16QAM	1	0	6.31	6.12	6.06
	10	QPSK	1	0	5.93	5.93	5.90
	10	16QAM	1	0	6.67	6.79	6.67
	15	QPSK	1	0	6.83	6.96	6.86
	15	16QAM	1	0	7.63	7.66	7.66
	20	QPSK	1	0	7.37	7.37	7.50
	20	16QAM	1	0	8.40	8.27	8.08

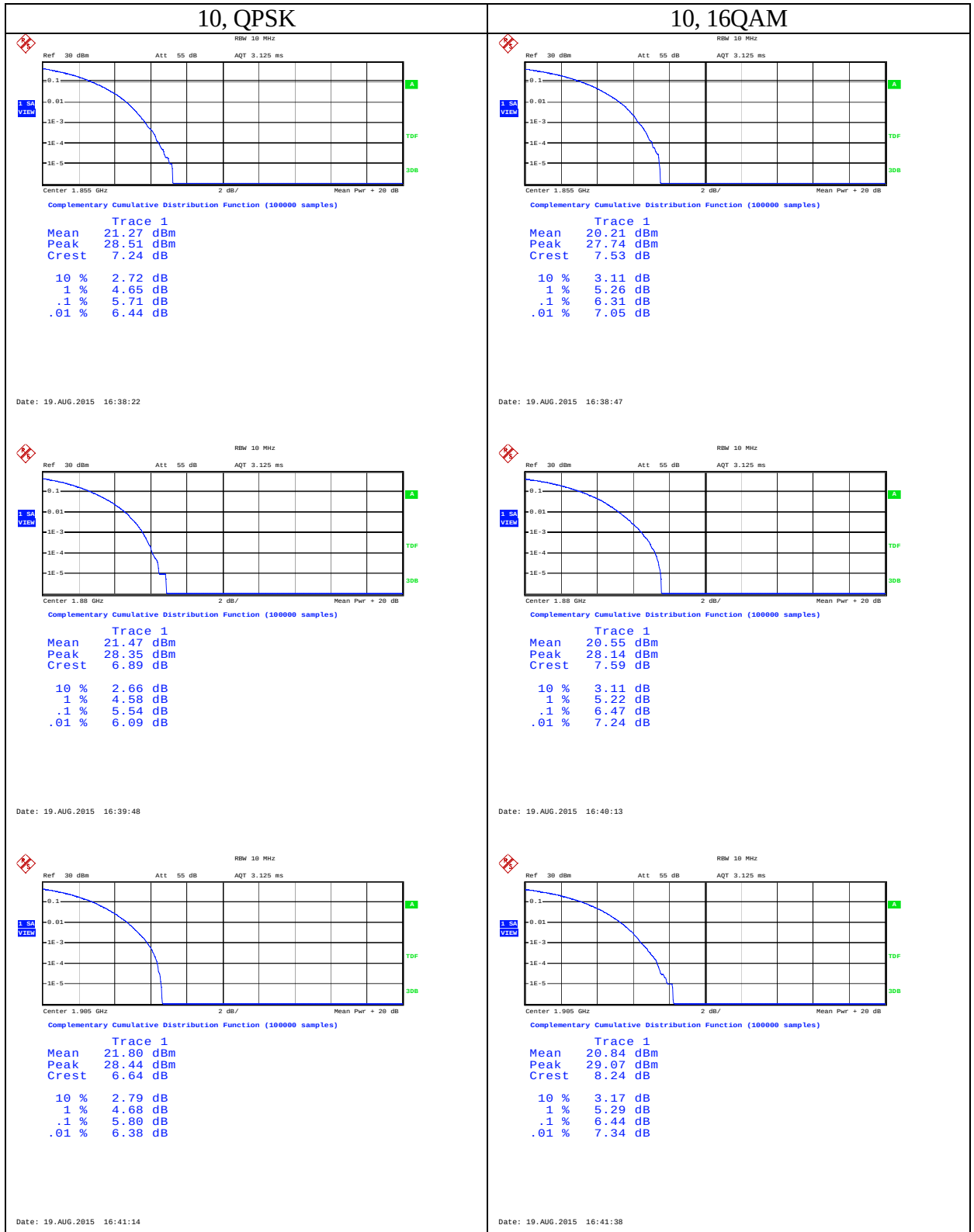
Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Channel		
					L	M	H
17	5	QPSK	1	0	5.96	5.58	5.61
	5	16QAM	1	0	6.70	6.38	6.47
	10	QPSK	1	0	5.96	5.58	6.47
	10	16QAM	1	0	6.06	5.99	5.93

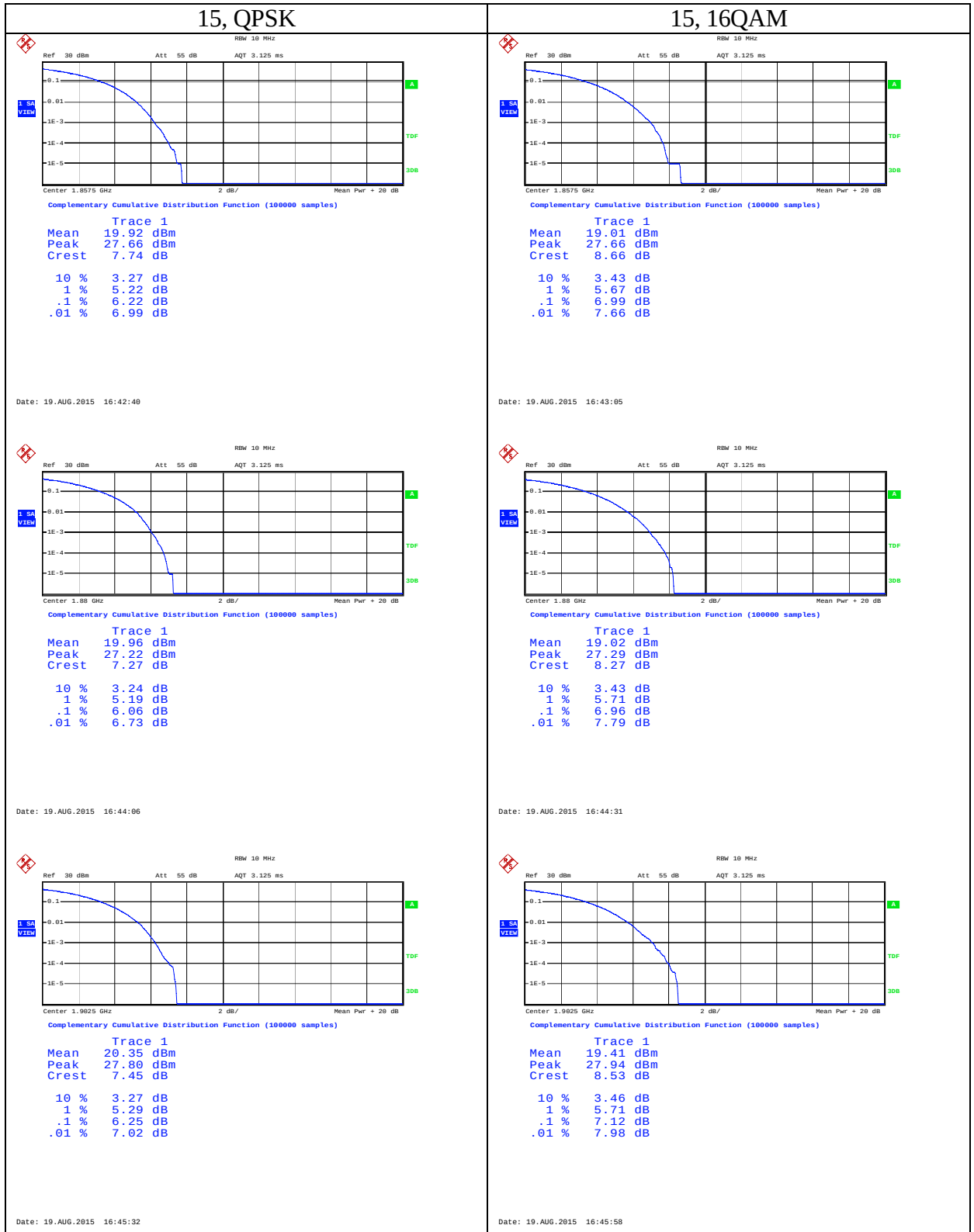
Band 2 test Graph

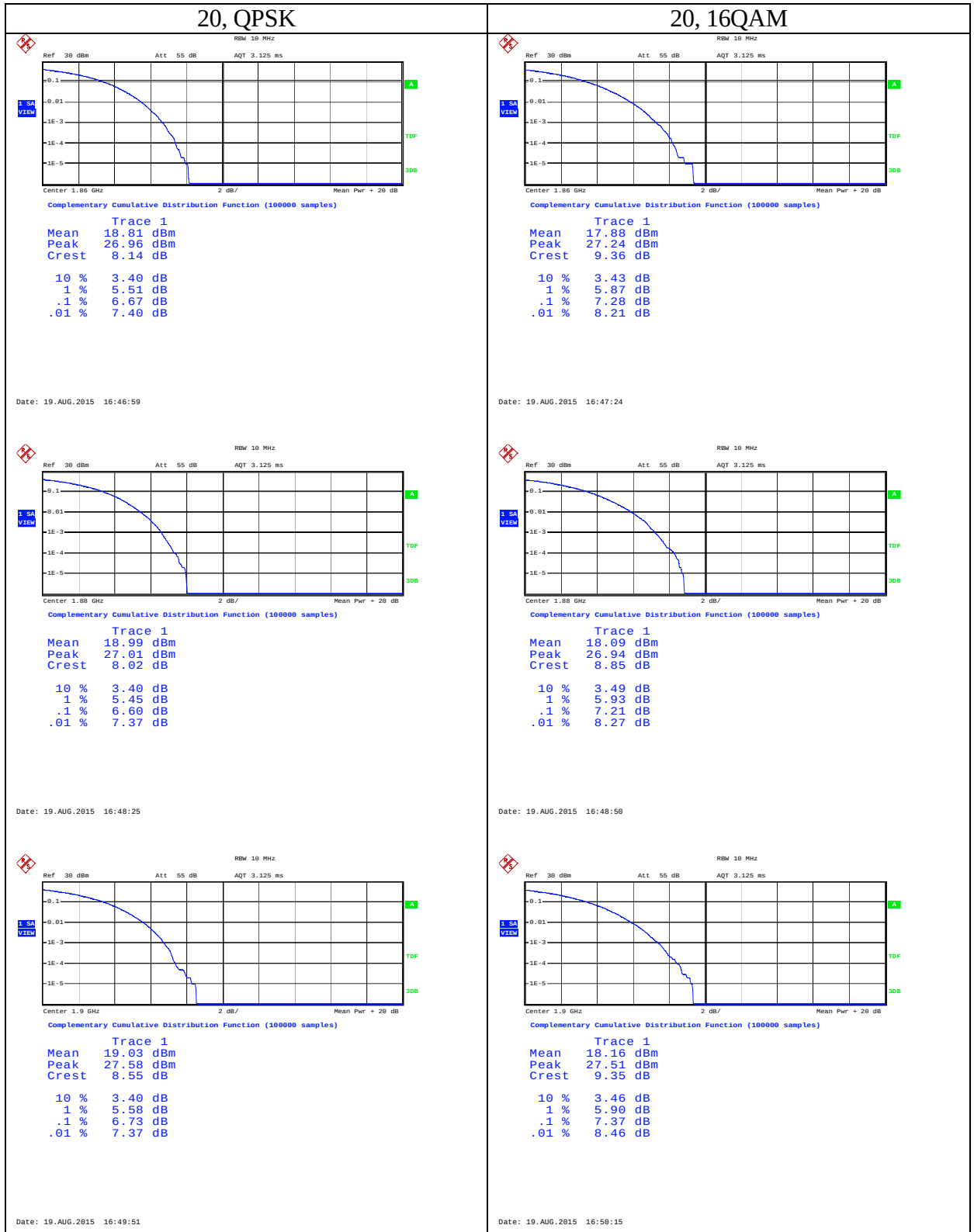




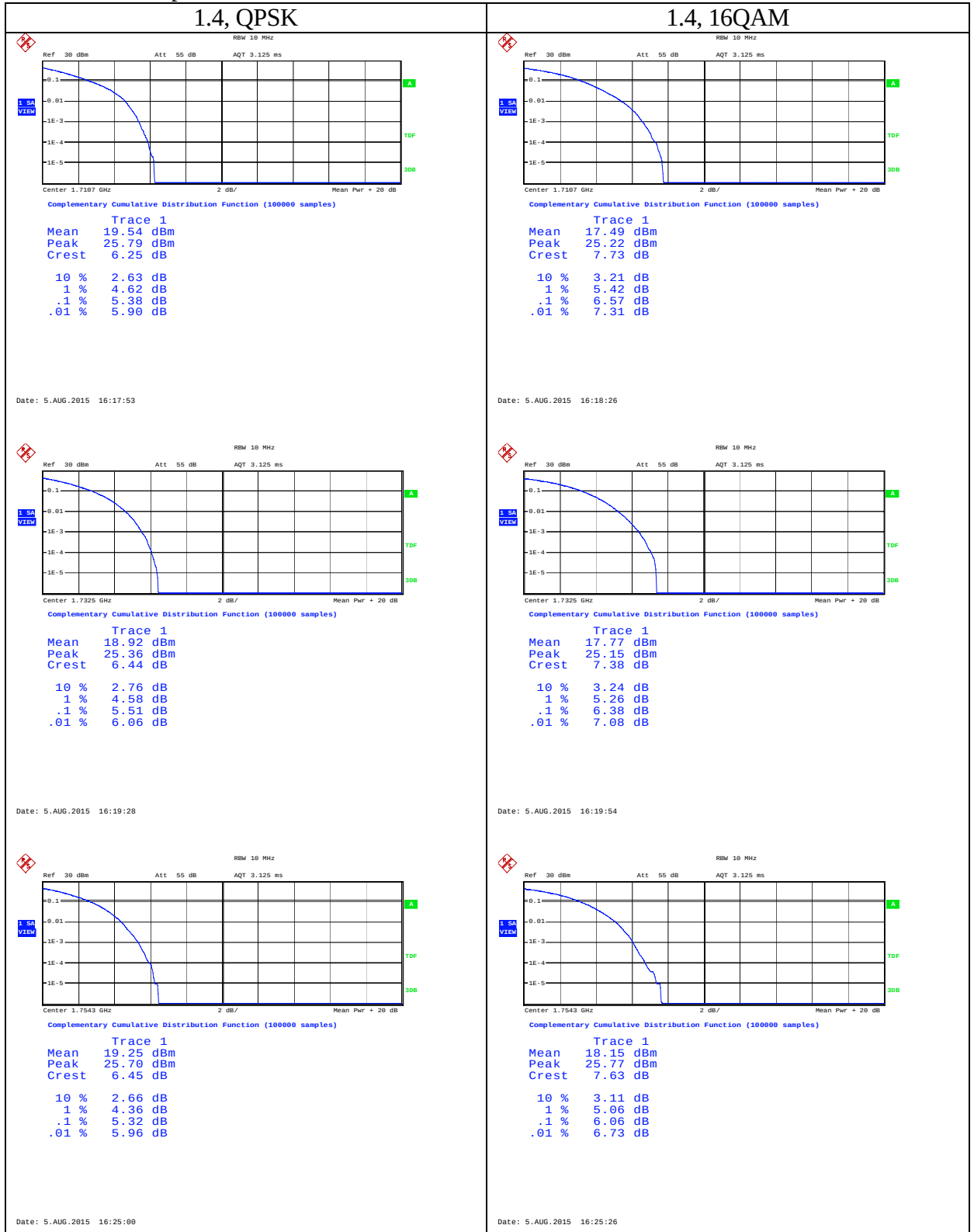


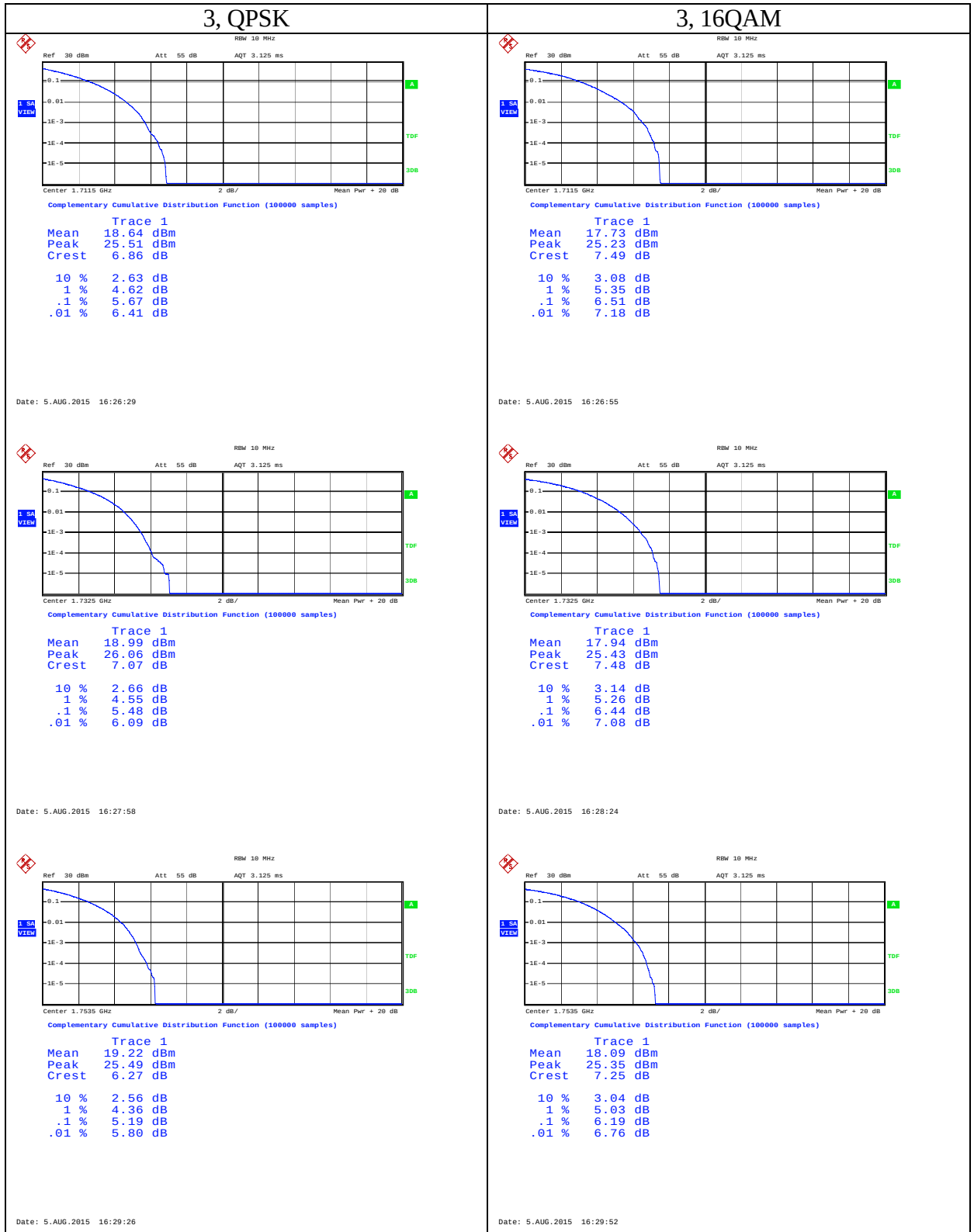


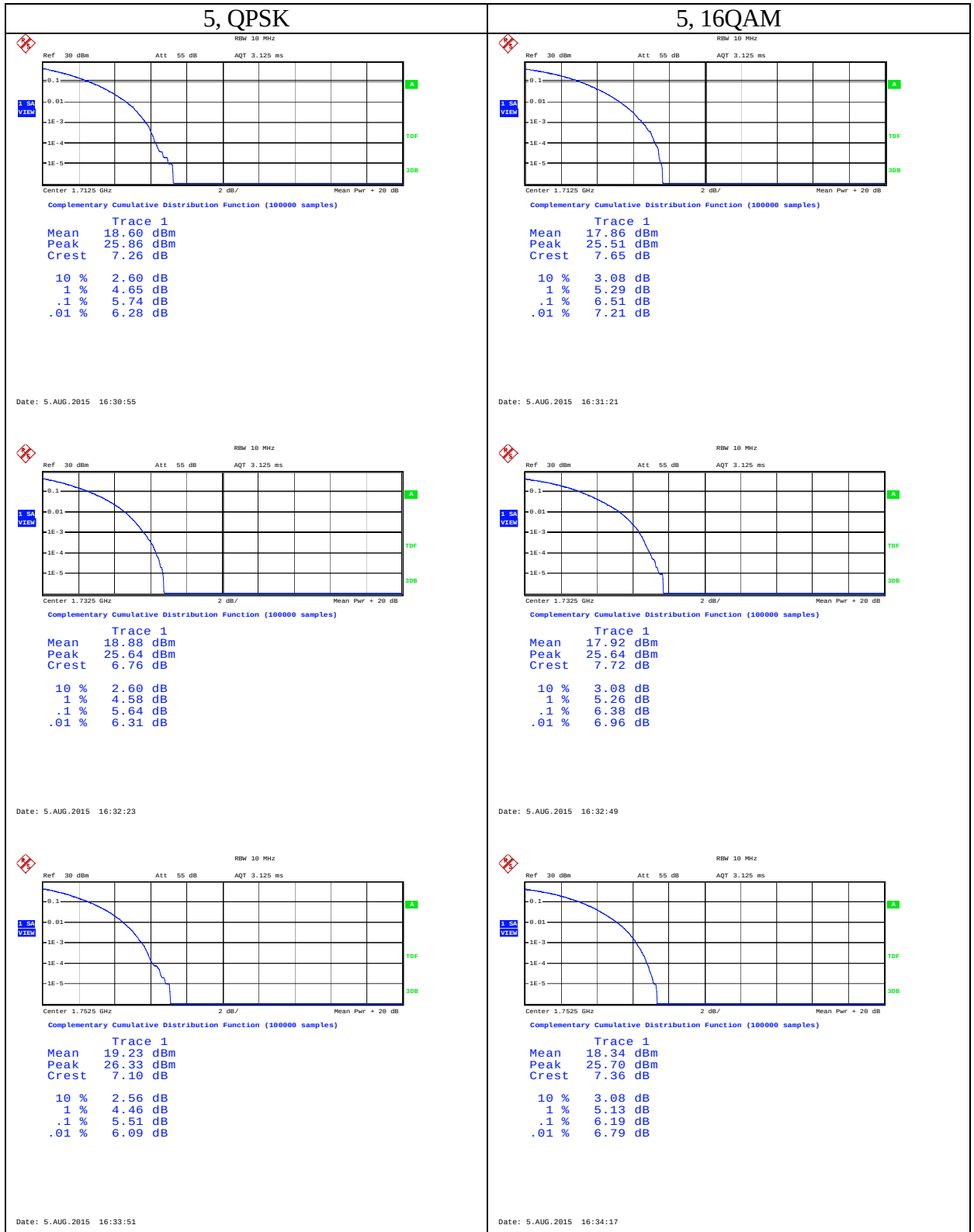


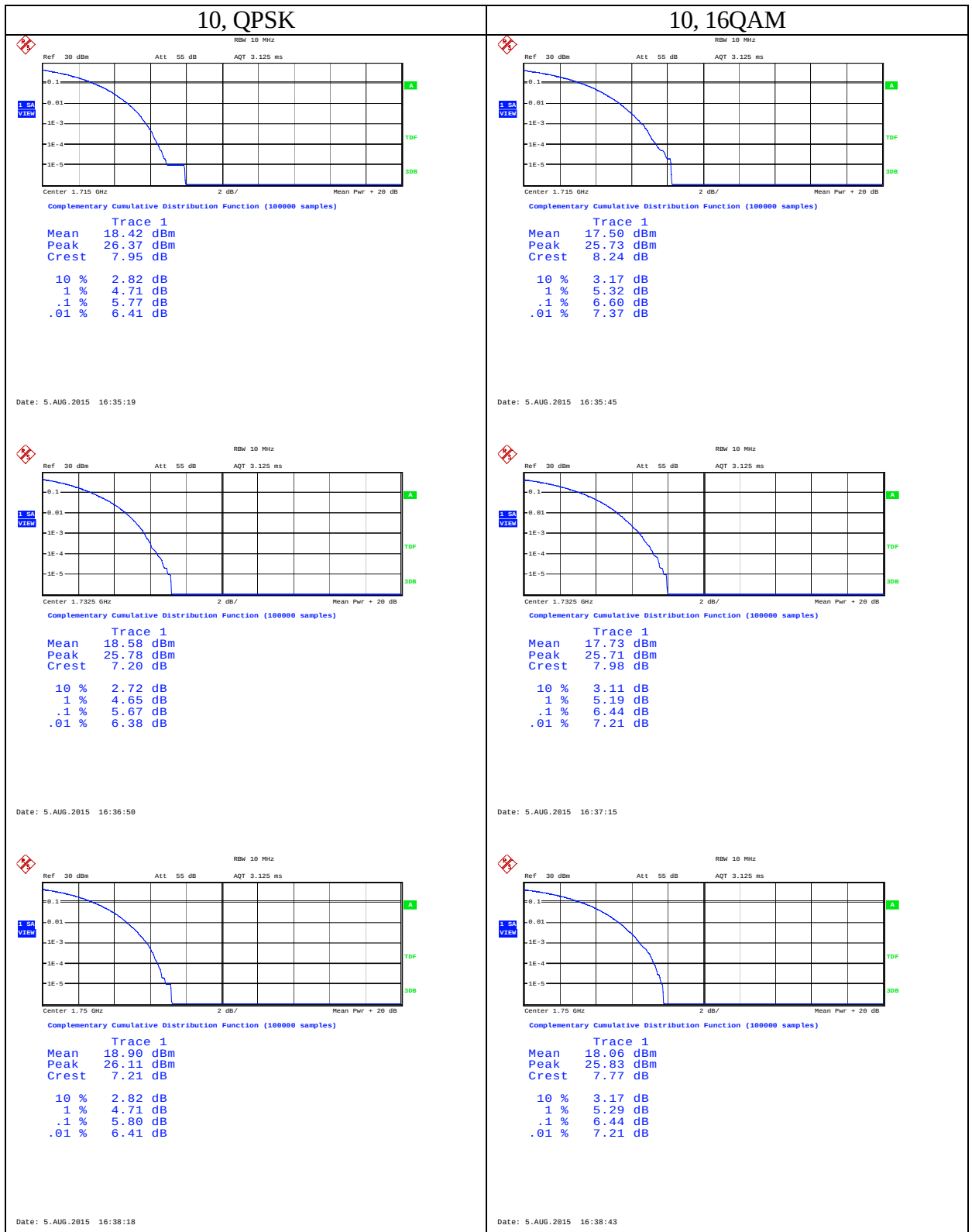


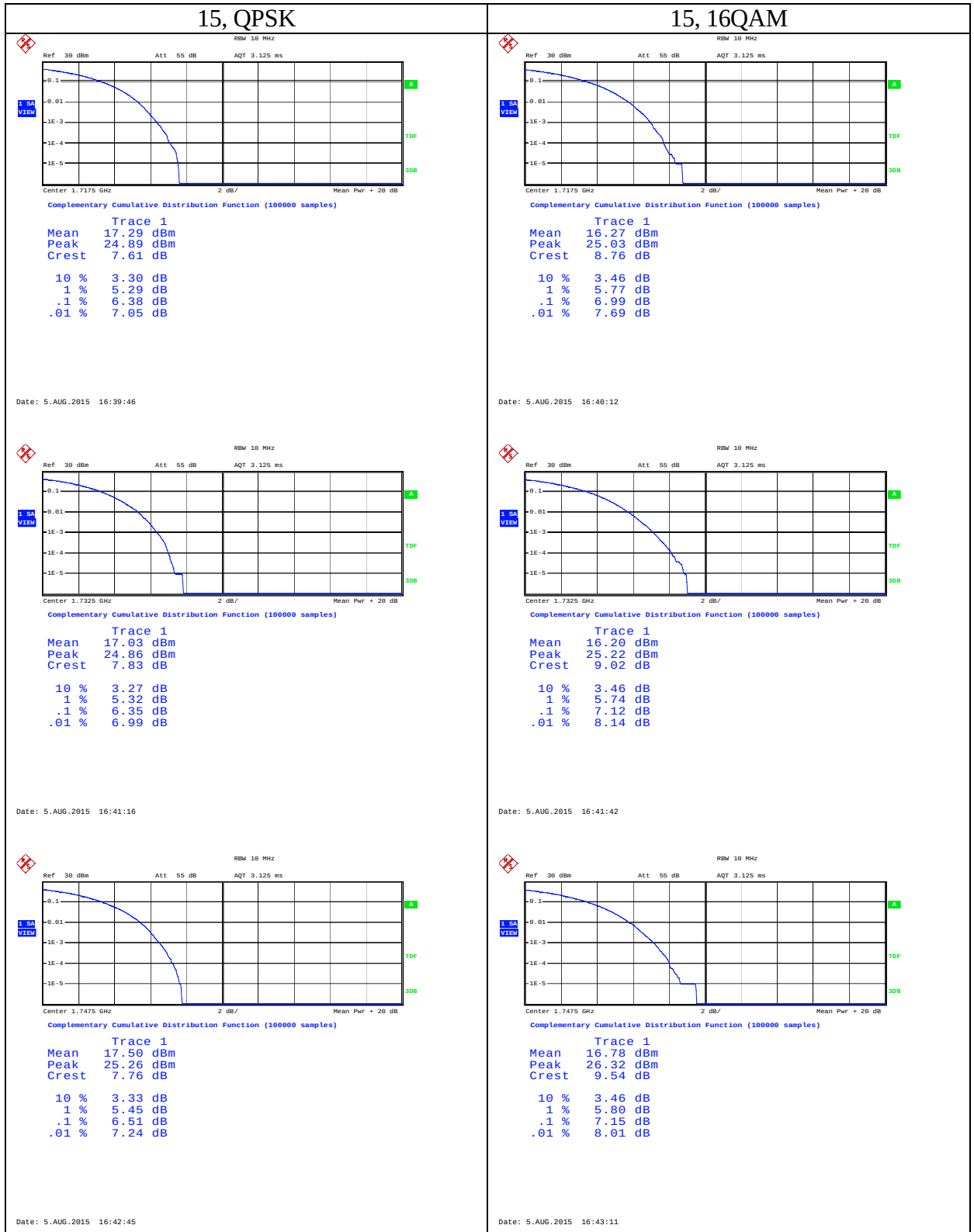
Band 4 test Graph

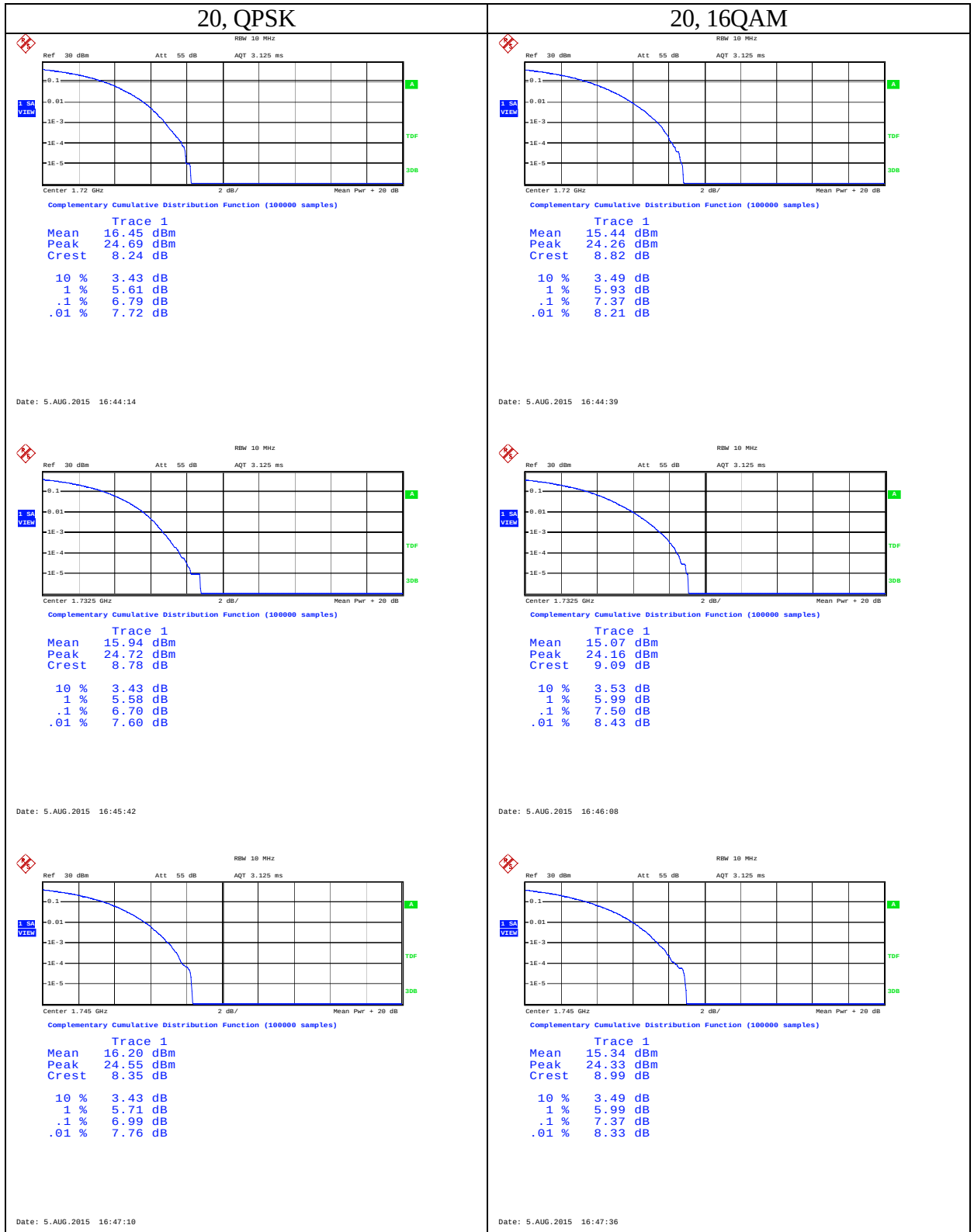




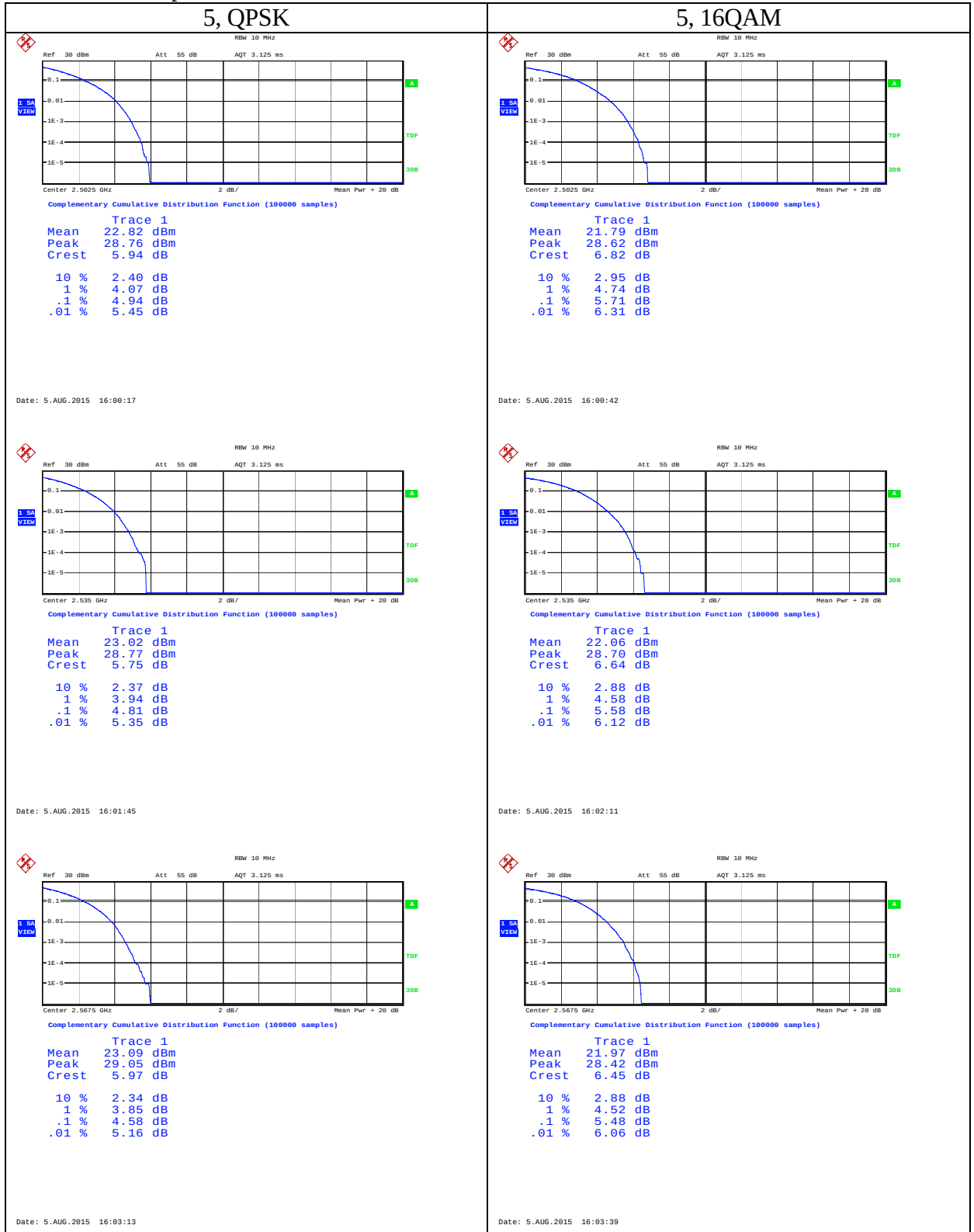


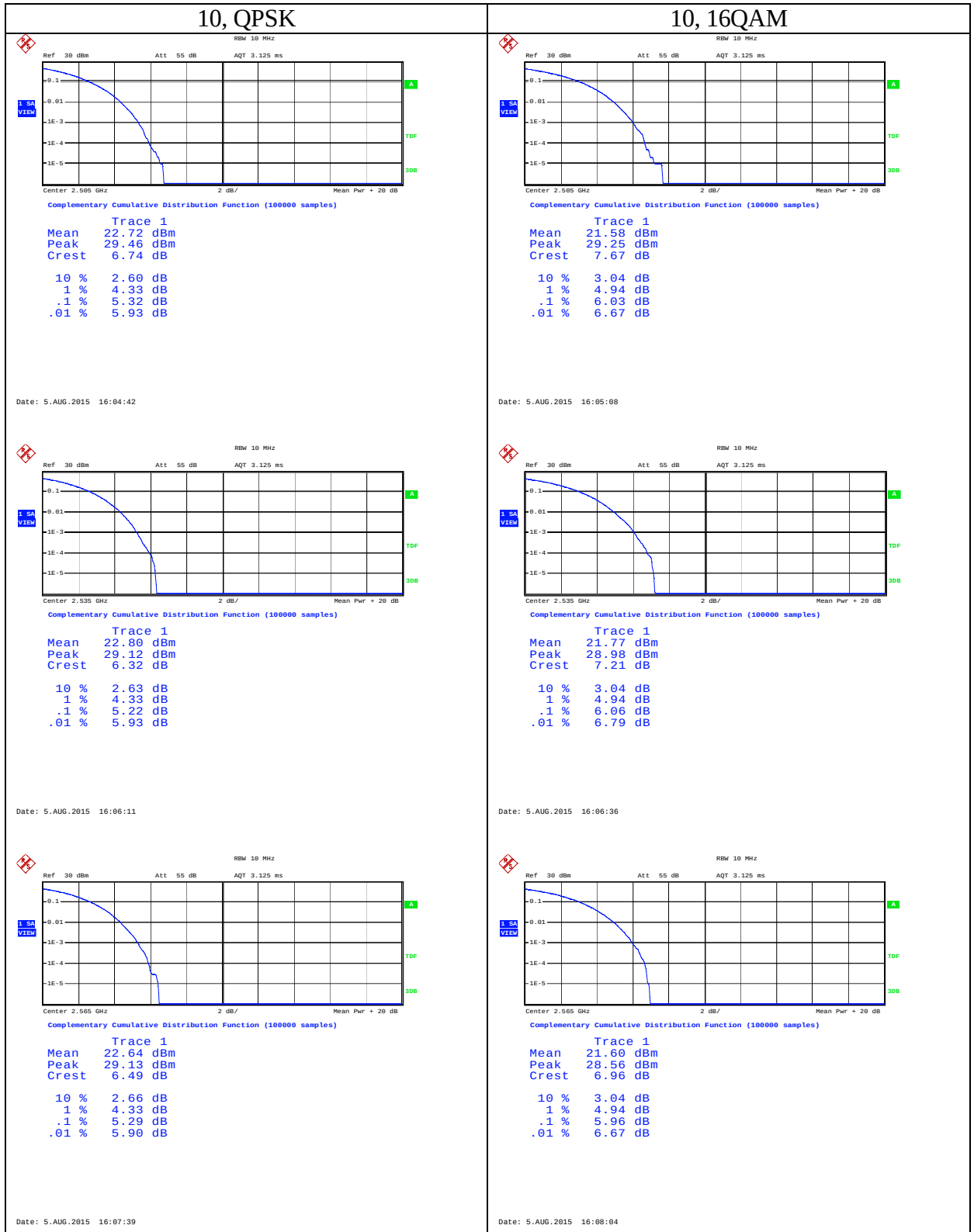


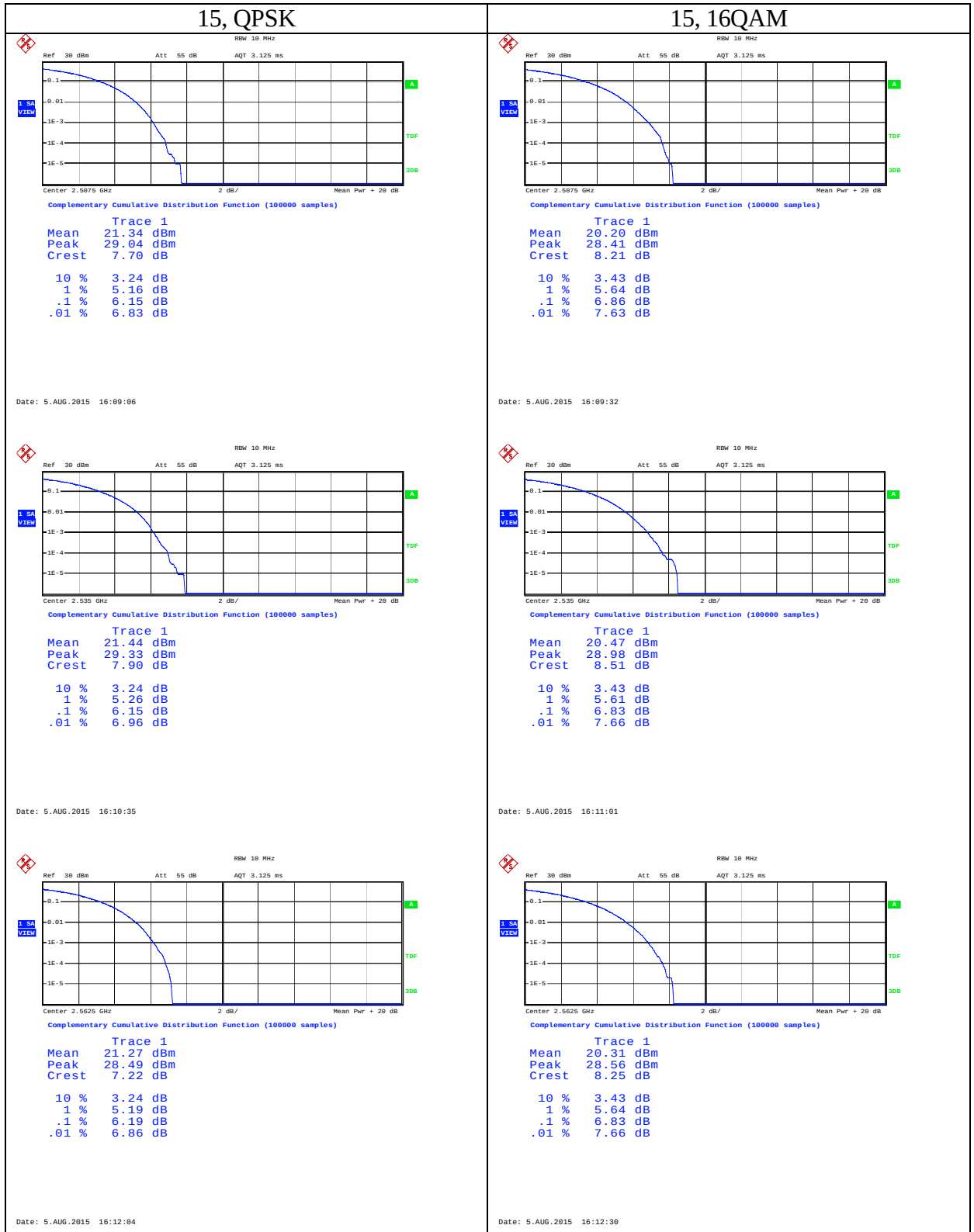


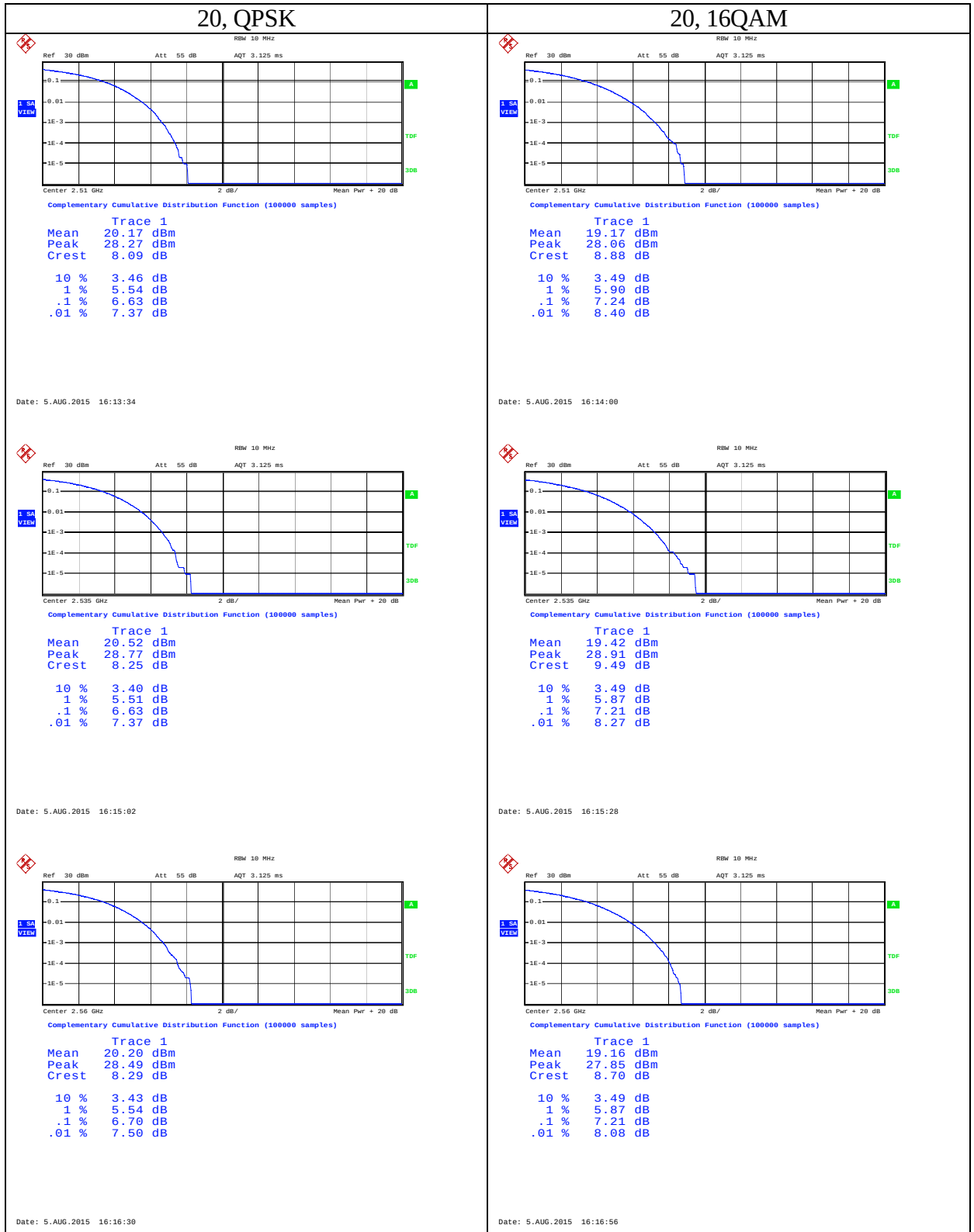


Band 7 test Graph

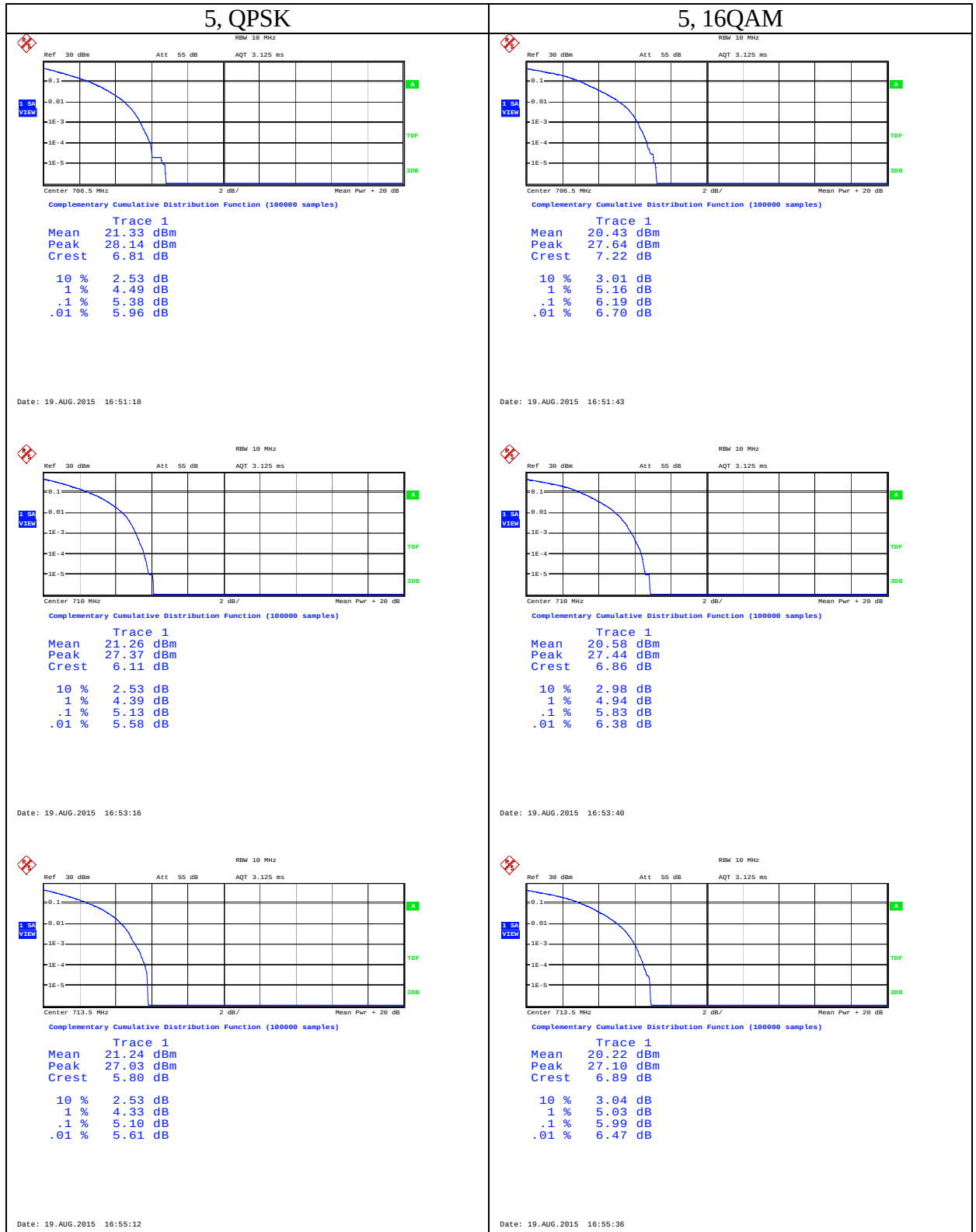


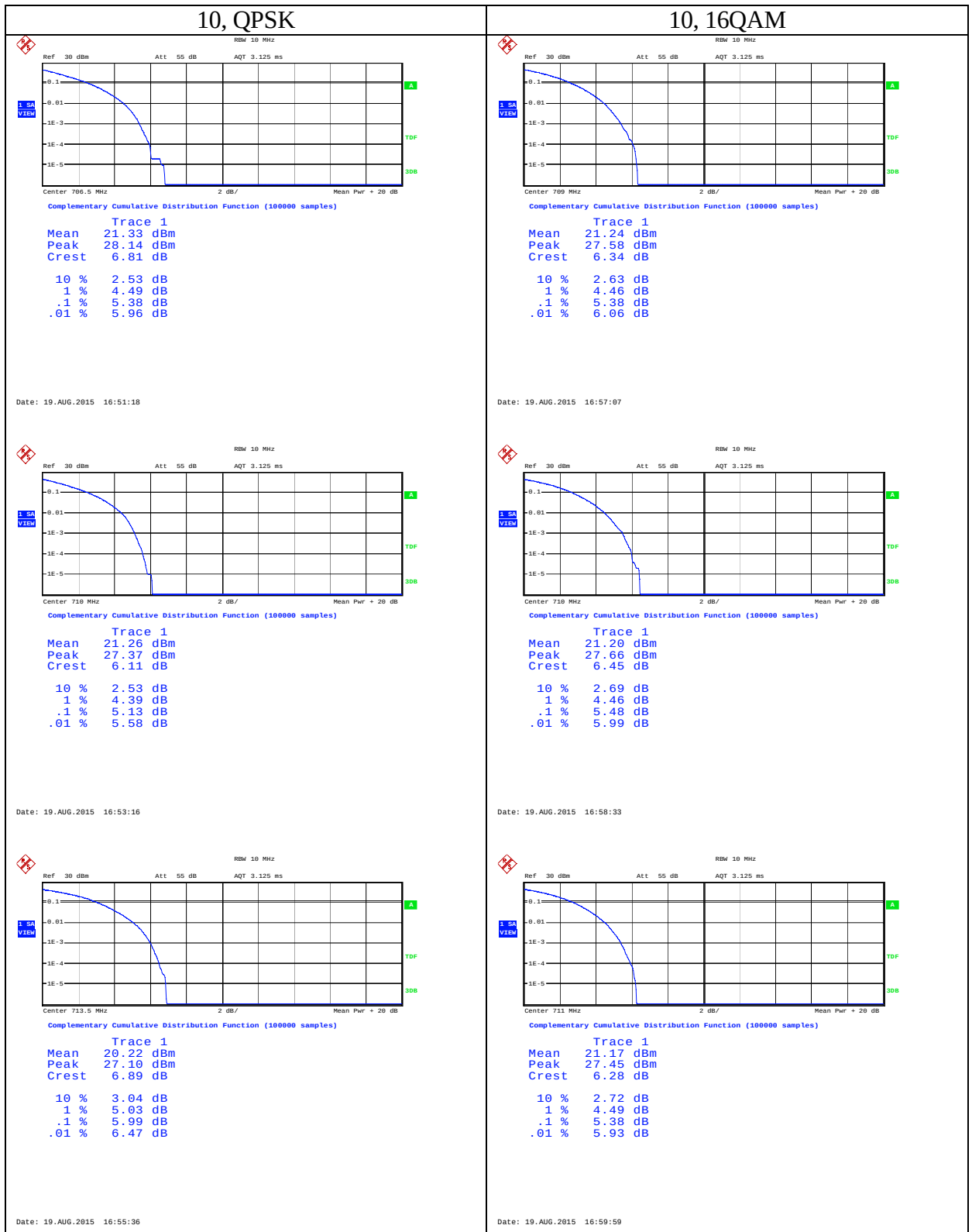






Band 17 test Graph





3.8 Frequency Stability (FCC Part 2.1055, 22.355, 24.235, 27.54) { tc \l 2 "4.7 Frequency Stability (FCC Part 2.1055, 22.355, 24.235)" }

The limit is as follows:

For the 850MHz band, according to 22.355, the stability requirements are: $\pm 1.5\text{ppm}$ for mobile units and $\pm 2.5\text{ppm}$ for portable units.

For the 1900MHz band, according to 24.235, the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

According to 27.54, the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Test Procedures:

1. Frequency Stability (Temperature Variation)

The temperature inside the climate chamber is varied from -30°C to $+50^{\circ}\text{C}$ in 10°C step size,

(1) With all power removed, the temperature was decreased to -30°C and permitted to stabilize for three hours.

(2) Measure the carrier frequency with the test equipment in a “call mode”. These measurements should be made within 1 minute of powering up the mobile station, to prevent significant self warming.

(3) Repeat the above measurements at 10°C increments from -30°C to $+50^{\circ}\text{C}$. Allow at least 1.5 hours at each temperature, un-powered, before making measurements.

2. Frequency Stability (Voltage Variation)

The frequency stability shall be measured with variation of primary supply voltage as follows:

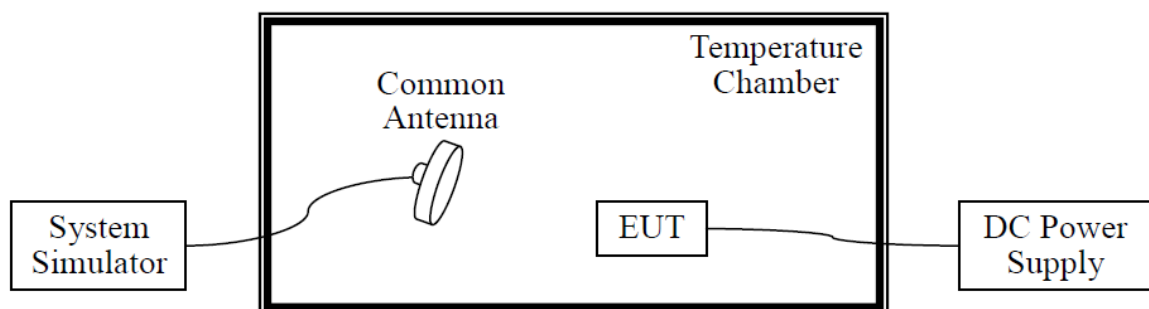
(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand

carried battery equipment.

(2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery-operating end point which shall be specified by the manufacturer.

[] AC nominal supply voltage: _____AC

[√] Battery nominal voltage: 4.2 VDC; lowest: 3.7 VDC; highest: 5 VDC



Test results:

Voltage (V)	Mode	Temperature (°C)	Frequency deviation (ppm)	Limit (ppm)
4.2	LTE Band 2 (QPSK, 10MHz)	-30	0.0042	2.5
		-20	0.0023	
		-10	0.0022	
		0	0.0012	
		+10	0.0012	
		+20	0.0011	
		+30	0.0012	
		+40	0.0011	
		+50	0.0011	
	LTE Band 4 (QPSK, 10MHz)	-30	0.0086	2.5
		-20	0.0043	
		-10	0.0040	
		0	0.0027	
		+10	0.0029	
		+20	0.0034	
		+30	0.0018	
		+40	0.0093	
		+50	0.0099	
	LTE Band 7 (QPSK, 10MHz)	-30	0.0007	2.5
		-20	0.0009	
		-10	0.0012	
		0	0.0010	
		+10	0.0008	
		+20	0.0009	
		+30	0.0009	
		+40	0.0014	
		+50	0.0028	
	LTE Band 17 (QPSK, 10MHz)	-30	0.0015	2.5
		-20	0.0015	
		-10	0.0028	
		0	0.0028	
		+10	0.0034	
		+20	0.0033	
		+30	0.0082	
		+40	0.0093	
		+50	0.0103	

Temperature (°C)	Mode	Voltage (V)	Frequency deviation (ppm)	Limit (ppm)
20	LTE Band 2 (QPSK, 10MHz)	3.7	0.0015	2.5
		4.2	0.0014	
		5	0.0017	
	LTE Band 4 (QPSK, 10MHz)	3.7	0.0033	2.5
		4.2	0.0032	
		5	0.0030	
	LTE Band 7 (QPSK, 10MHz)	3.7	0.0010	2.5
		4.2	0.0008	
		5	0.0010	
	LTE Band 17 (QPSK, 10MHz)	3.7	0.0028	2.5
		4.2	0.0031	
		5	0.0028	

END OF TEST REPORT