FCC CFR47 PART 24 SUBPART E
FCC CFR47 PART 27 SUBPART M
FCC CFR47 PART 22 SUBPART H

CERTIFICATION TEST REPORT

FOR

GSM/WCDMA/LTE Phone + Bluetooth, DTS/UNII a/b/g/n/ac, ANT+ & NFC

MODEL NUMBER: SM-G8508S

FCC ID: A3LSMG8508S

REPORT NUMBER: 14U18322-1 REVISION A
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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SAMSUNG ELECTRONICS CO., LTD.
EUT DESCRIPTION: GSM/WCDMA/LTE Phone + Bluetooth, DTS/UNII a/b/g/n/ac, ANT+ & NFC
MODEL: SM-G8508S
SERIAL NUMBER: FL-280-D (Conducted); FL-280-B (Radiated)
DATE TESTED: JULY 17 - 25, 2014

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 22H, 24E and 27M	PASS

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

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

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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with TIA-603-C, FCC CFR 47 Part 22, FCC CFR 47 Part 24, FCC CFR 47 Part 27.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

47173 Benicia Street	47266 Benicia Street
☒ Chamber A	☐ Chamber D
☒ Chamber B	☐ Chamber E
☒ Chamber C	☐ Chamber F

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at http://ts.nist.gov/standards/scopes/2000650.htm.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

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

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4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

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

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

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

4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	3.52 dB
Radiated Disturbance, 30 to 1000 MHz	4.94 dB

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

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5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a GSM/WCDMA/LTE Phone + Bluetooth, DTS/UNII a/b/g/n, ANT+ & NFC.

5.2. MAXIMUM OUTPUT POWER

FCC Part 22/24						
Band	Frequency Range(MHz)	Modulation Peak	Conducted		Radiated	
			Peak (dBm)	Peak (mW)	Peak (dBm)	Peak (mW)
GSM850	824~849	GMSK	33	1995.26		
	824~849	GPRS	33	1995.26	28.9	776.25
	824~849	EGPRS	27.2	524.81	25.4	346.74
GSM1900	1850~1910	GMSK	29.8	954.99		
	1850~1910	GPRS	29.8	954.99	28.29	674.53
	1850~1910	EGPRS	26.3	426.58	25.2	331.1

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FCC Part 22/24						
Band	Frequency Range(MHz)	Modulation Peak	Conducted		Radiated	
			Avg (dBm)	Avg (mW)	Avg (dBm)	Avg (mW)
Band 5	824~849	REL99	22.9	194.98	20.7	117.49
	824~849	HSDPA	21.5	141.25	17.6	57.54
	824~849	HSUPA	21.5	141.25		
	824~849	DC-HSDPA	21.3	134.90		
Band 2	1850~1910	REL99	23.2	208.93	23.4	218.78
	1850~1910	HSDPA	22.7	186.21	21.7	147.91
	1850~1910	HSUPA	22.7	186.21		
	1850~1910	DC-HSDPA	22.4	173.78		

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5.3. MAXIMUM OUTPUT POWER (LTE)

The transmitter has a maximum peak conducted and radiated ERP/EIRP output powers as follows:

FCC Part 27							
Band	Frequency Range(MHz)	BandWidth (MHz)	Modulation	Conducted		Radiated	
			Peak	Avg (dBm)	Avg (mW)	Avg (dBm)	Avg (mW)
LTE41	2496~2690	20MHz	QPSK	23.1	204.2	17.3	53.7
	2496~2690	20MHz	16QAM	22.2	166.0	16.7	46.8

FCC Part 27							
Band	Frequency Range(MHz)	BandWidth (MHz)	Modulation	Conducted		Radiated	
			Peak	Avg (dBm)	Avg (mW)	Avg (dBm)	Avg (mW)
LTE41	2496~2690	15MHz	QPSK	23.2	208.9	17.1	51.3
	2496~2690	15MHz	16QAM	22.4	173.8	16.3	42.7

FCC Part 27							
Band	Frequency Range(MHz)	BandWidth (MHz)	Modulation	Conducted		Radiated	
			Peak	Avg (dBm)	Avg (mW)	Avg (dBm)	Avg (mW)
LTE41	2496~2690	10MHz	QPSK	22.8	190.5	16.1	40.7
	2496~2690	10MHz	16QAM	22.4	173.8	15.2	33.1

FCC Part 27							
Band	Frequency Range(MHz)	BandWidth (MHz)	Modulation	Conducted		Radiated	
			Peak	Avg (dBm)	Avg (mW)	Avg (dBm)	Avg (mW)
LTE41	2496~2690	5MHz	QPSK	23.2	208.9	16.8	47.9
	2496~2690	5MHz	16QAM	22.5	177.8	16.4	43.7

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5.4. DESCRIPTION OF AVAILABLE ANTENNAS

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

Frequency (MHz)	Peak Gain (dBi)
Band 5, 824~849MHz	-2.69
Band 2, 1850~1910MHz	1.63
LTE41, 2496~2690MHz	-4.06

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5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
AC Adapter	SAMSUNG	EP-TA50CWC	N/A	N/A
Earphone	SAMSUNG	EO-EG900BW	N/A	N/A

I/O CABLES (CONDUCTED SETUP)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	RF Out	1	Spectrum Analyzer	Shielded	None	NA
2	Antenna Port	1	EUT	Shielded	0.1m	NA
3	RF In/Out	1	Communication Test Set	Shielded	1m	NA

I/O CABLES (RADIATED SETUP)

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	USB	1	AC Adapter	Un-shielded	1.2m	No
2	Jack	1	Headset	Shielded	1m	No
3	RF In/out	1	Communication Test Set	Un-shielded	2m	Yes

TEST SETUP

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

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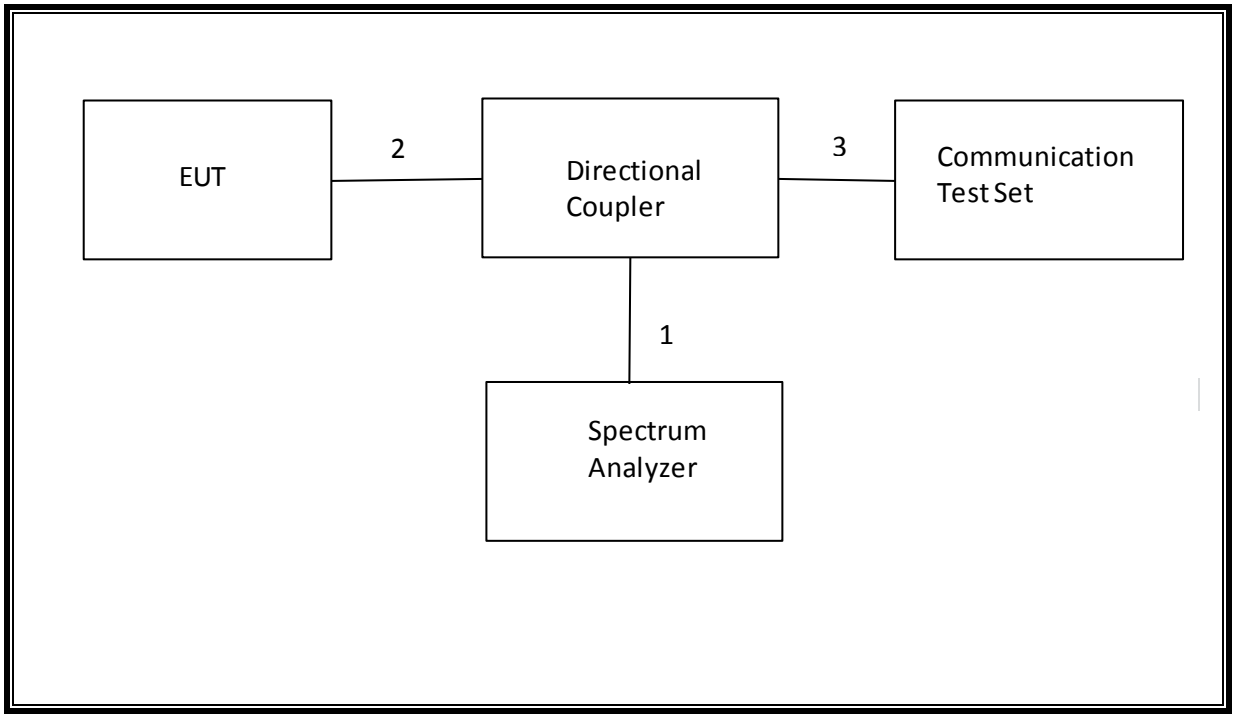
SETUP DIAGRAM FOR TESTS (CONDUCTED TEST SETUP)



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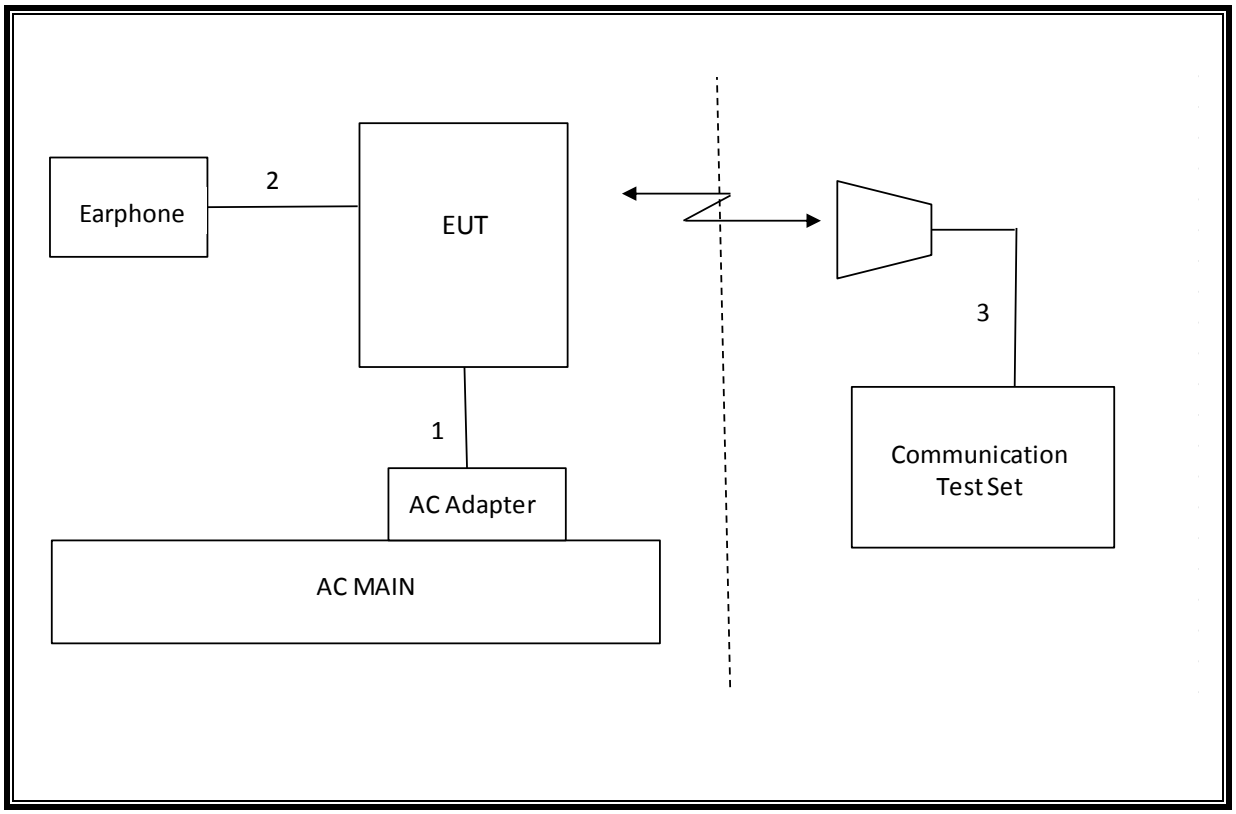
SETUP DIAGRAM FOR TESTS (RADIATED TEST SETUP)



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6. TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Asset**	**Cal Due**
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01179	02/26/15
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01011	08/14/14
Antenna, Horn, 18 GHz	EMCO	3115	C00783	10/25/14
Antenna, Horn, 18 GHz	EMCO	3115	C00784	10/25/14
Highpass Filter, 2.7 GHz	Micro-Tronics	HPM13194	N02687	CNR
Highpass Filter, 1.5 GHz	Micro-Tronics	HPM13193	N02688	CNR
Temperature / Humidity Chamber	Thermotron	SE 600-10-10	C00930	01/09/15
Communications Test Set	R&S	CMW500	T159	07/02/15
DC power supply, 8 V @ 3 A or 15 V	Agilent / HP	E3610A	None	CNR
Vector signal generator, 6 GHz	Agilent / HP	E4438C	None	07/06/15
Antenna, Tuned Dipole 400~1000	ETS	3121C DB4	C00993	02/14/15
Directional Coupler	RF-Lambda	RFDC5M06G15	None	CNR
Antenna, Horn, 26.5 GHz	ARA	MWH-1826/B	C00589	12/17/14

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7. Summary Table

FCC Part Section	RSS Section(s)	Test Description	Test Limit	Test Condition	Test Result	Worst Case
2.1049	N/A	Occupied Band width (99%)	N/A	Conducted	Pass	17.82 MHz
22.917(a) 24.238(a) 27.53(g) 90.691	RSS-132(4.5.1) RSS-133(6.5.1) RSS-139(6.5.1)	Band Edge / Conducted Spurious Emission	-13dBm		Pass	-16 dBm
27.53(m)	RSS-199(4.5)		-25dBm		Pass	-25.71 dBm
2.1046	N/A	Conducted output power	N/A		Pass	33 dBm
27.53(m) 90.691	RSS-199(4.5)	Emission Mask			Pass	
22.355 24.235 27.54 90.213	RSS-132(4.3) RSS-133(6.3) RSS-139(6.3) RSS-199(4.3)	Frequency Stability	2.5PPM		Pass	.009 PPM
22.913(a)(2)	RSS-132(4.4)	Effective Radiated Power	38 dBm	Radiated	Pass	28.9 dBm
24.232(c) 27.50(h)(2)	RSS-133(6.4) RSS-199(4.4)	Equivalent Isotropic Radiated Power	33dBm		Pass	28.29 dBm
22.917(a) 24.238(a) 27.53(g)	RSS-132(4.5.1) RSS-133(6.5.1) RSS-139(6.5.1)	Radiated Spurious Emission	-13dBm		Pass	-19.3 dBm
27.53(m)	RSS-199(4.5)		-25dBm		Pass	-32.3dBm

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8. RF POWER OUTPUT VERIFICATION

8.1. GSM/GPRS/EDGE

Function: Menu select > GSM Mobile Station > GSM 850/900/1800/1900

Press Connection control to choose the different menus

Press RESET > choose all to reset all settings

Connection Press Signal Off to turn off the signal and change settings

Network Support > GSM+GPRS or GSM+EGPRS

Main Service > Packet Data

Service selection > Test Mode A – Auto Slot Config. off

MS Signal Press Slot Config bottom on the right twice to select and change the number of time slots and power setting

> Slot configuration > Uplink/Gamma

> 33 dBm for GPRS 850/900

> 30 dBm for GPRS1800/1900

BS Signal Enter the same channel number for TCH channel (test channel) and BCCH channel

Frequency Offset > + 0 Hz

Mode > BCCH and TCH

BCCH Level > -85 dBm (May need to adjust if link is not stable)

BCCH Channel > choose desire test channel [Enter the same channel number for TCH channel (test channel) and BCCH channel]

Channel Type > Off

P0> 4 dB

Slot Config > Unchanged (if already set under MS Signal)

TCH > choose desired test channel

Hopping > Off

Main Timeslot > 3 (Default)

Network Coding Scheme > CS4 (GPRS) and MCS5 ~ MCS9 (EGPRS)

Bit Stream > 2E9-1PSR Bit Pattern

AF/RF Enter appropriate offsets for Ext. Att. Output and Ext. Att. Input

Connection Press Signal On to turn on the signal and change settings

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8.1.1. GSM OUTPUT POWER RESULT

Band	Mode	Ch.	f(MHz)	1 time slot	2 time slot	3 time slot	4 time slot
				Peak (dBm)	Peak (dBm)	Peak (dBm)	Peak (dBm)
GSM850	GMSK	128	824.2	32.6			
		190	836.6	33.0			
		251	848.8	32.8			
	GPRS	128	824.2	32.6	30.4	28.8	27.7
		190	836.6	33.0	30.5	28.9	27.7
		251	848.8	32.8	30.2	28.6	27.5
	EGPRS	128	824.2	27.2	26.9	24.4	24.1
		190	836.6	27.1	26.8	24.3	24.2
		251	848.8	27.0	26.8	24.1	23.9
GSM1900	GMSK	512	1850.2	29.8			
		661	1880	29.7			
		810	1909.8	29.5			
	GPRS	512	1850.2	29.8	27.5	25.4	24.2
		661	1880	29.6	27.4	25.3	24.1
		810	1909.8	29.5	27.4	25.2	24.0
	EGPRS	512	1850.2	26.3	26.3	23.7	23.6
		661	1880	26.2	26.1	23.5	23.4
		810	1909.8	26.2	26.2	23.6	23.5

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8.2. UMTS REL 99

TEST PROCEDURE

The following summary of these settings are illustrated below:

	Mode	Rel99
	Subtest	-
WCDMA General Settings	Loopback Mode	Test Mode 1
	Rel99 RMC	12.2kbps RMC
	HSDPA FRC	Not Applicable
	HSUPA Test	Not Applicable
	Power Control Algorithm	Algorithm2
	βc	Not Applicable
	βd	Not Applicable
	βec	Not Applicable
	βc/βd	8/15
	βhs	Not Applicable
	βed	Not Applicable

8.2.1. UMTS REL 99 OUTPUT POWER RESULT

Band	Mode	Ch.	f(MHz)	Conducted Power (dBm) Avg (dBm)
Band 5	REL99	4132	826.4	22.9
		4183	836.6	22.9
		4233	846.6	22.8
Band 2	REL99	9262	1852.4	23.2
		9400	1880	23.1
		9538	1907.6	23.1

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8.3. UMTS HSDPA

The following 4 Sub-tests were completed according to Release 5 procedures in section 5.2 of 3GPP TS34.121. A summary of these settings are illustrated below:

	Mode	Rel5 HSDPA			
	Subtest	1	2	3	4
WCDMA General Settings	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2kbps RMC			
	HSDPA FRC	H-Set1			
	Power Control Algorithm	Algorithm 2			
	βc	2/15	12/15	15/15	15/15
	βd	15/15	15/15	8/15	4/15
	Bd (SF)	64			
	βc/βd	2/15	12/15	15/8	15/4
	βhs	4/15	24/15	30/15	30/15
	MPR (dB)	0	0	0.5	0.5
HSDPA Specific Settings	D_{ACK}	8			
	D_{NAK}	8			
	DCQI	8			
	Ack-Nack repetition factor	3			
	CQI Feedback (Table 5.2B.4)	4ms			
	CQI Repetition Factor (Table 5.2B.4)	2			
	Ahs =βhs/βc	30/15			

8.3.1. UMTS HSDPA OUTPUT POWER RESULT

Band	Mode	Subset	Ch.	f(MHz)	Conducted Power (dBm) Avg (dBm)
Band 5	HSDPA	1	4132	826.4	21.5
			4183	836.6	21.3
			4233	846.6	21.4
		2	4132	826.4	21.1
			4183	836.6	21.0
			4233	846.6	21.0
		3	4132	826.4	21.0
			4183	836.6	21.0
			4233	846.6	21.0
		4	4132	826.4	21.1
			4183	836.6	21.0
			4233	846.6	21.0

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Band 2	HSDPA	1	9262	1852.4	22.5
			9400	1880	22.7
			9538	1907.6	22.4
		2	9262	1852.4	22.1
			9400	1880	22.2
			9538	1907.6	22.1
		3	9262	1852.4	22.1
			9400	1880	22.2
			9538	1907.6	21.9
		4	9262	1852.4	22.0
			9400	1880	22.1
			9538	1907.6	21.9

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8.3.2. UMTS HSUPA

TEST PROCEDURE

The following summary of these settings are illustrated below: (ETSI TS 134.121-1 Table C.11.1)

	Mode	Rel6 HSUPA	Rel6 HSUPA	Rel6 HSUPA	Rel6 HSUPA	Rel6 HSUPA
	Subtest	1	2	3	4	5
WCDMA General Settings	Loopback Mode	Test Mode 1				
	P-CPICH (dB)	-10				
	P-CCPCH (dB)	-12				
	SCH (dB)	-12				
	PICH(dB)	-15				
	DPCH (dB)	-9				
	HS-SCCH_1 (dB)	-8				
	HS-PDSCH (dB)	-3				
	Rel99 RMC	12.2kbps RMC				
	HSDPA FRC	H-Set1				
	HSUPA Test	HSUPA Loopback				
	Power Control Algorithm	Algorithm2				
	Bc	11/15	6/15	15/15	2/15	15/15
	Bd	15/15	15/15	9/15	15/15	15/15
	Bec	209/225	12/15	30/15	2/15	5/15
	βc/βd	11/15	6/15	15/9	2/15	15/15
	Bhs	22/15	12/15	30/15	4/15	30/15
	βed (note1)	1309/225	94/75	47/15 47/15	56/75	134/15
	MPR	0	2	1	2	0
HSDPA Specific Settings	DACK	8				
	DNAK	8				
	DCQI	8				
	Ack-Nack repetition factor	3				
	CQI Feedback (Table 5.2B.4)	4ms				
	CQI Repetition Factor (Table 5.2B.4)	2				
	Ahs = βhs/βc	30/15				
HSUPA Specific Settings	D E-DPCCH	6	8	8	5	7
	DHARQ	0	0	0	0	0
	AG Index	20	12	15	17	21
	Reference E-TFCIs	5	5	2	5	5
	ETFCI (from 34.121 Table C.11.1.3)	75	67	92	71	81
	Associated Max UL Data Rate kbps	242.1	174.9	482.8	205.8	308.9
	Reference E_TFCIs	E-TFCI 11 E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO 23 E-TFCI 75 E-TFCI PO 26 E-TFCI 81 E-TFCI PO 27		E-TFCI 11 E-TFCI PO 4 E-TFCI 92 E-TFCI PO 18	E-TFCI 11 E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO 23 E-TFCI 75 E-TFCI PO 26 E-TFCI 81 E-TFCI PO 27	

Note1: βed cannot be set directly, it is set by Absolute Grant Value.

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8.3.3. UMTS HSUPA OUTPUT POWER RESULT

Band	Mode	UL Ch No.	Freq. (MHz)	MPR	Avg Pwr (dBm)
W-CDMA Band V	Subtest 1	4132	826.4	0	21.0
		4183	836.6	0	21.4
		4233	846.6	0	21.0
	Subtest 2	4132	826.4	2	20.4
		4183	836.6	2	20.5
		4233	846.6	2	19.8
	Subtest 3	4132	826.4	1	19.7
		4183	836.6	1	19.7
		4233	846.6	1	20.2
	Subtest 4	4132	826.4	2	20.3
		4183	836.6	2	20.2
		4233	846.6	2	20.2
	Subtest 5	4132	826.4	0	21.6
		4183	836.6	0	21.5
		4233	846.6	0	21.4
W-CDMA Band II	Subtest 1	9262	1852.4	0	22.5
		9400	1880.0	0	22.7
		9538	1907.6	0	22.4
	Subtest 2	9262	1852.4	2	20.5
		9400	1880.0	2	20.6
		9538	1907.6	2	20.5
	Subtest 3	9262	1852.4	1	20.5
		9400	1880.0	1	20.5
		9538	1907.6	1	20.0
	Subtest 4	9262	1852.4	2	21.0
		9400	1880.0	2	21.0
		9538	1907.6	2	21.0
	Subtest 5	9262	1852.4	0	22.5
		9400	1880.0	0	22.7
		9538	1907.6	0	22.4

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8.3.4. DC-HSDPA

The following tests were completed according to procedures in section 7.3.13 of 3GPP TS34.108 v9.5.0. A summary of these settings are illustrated below:

Downlink Physical Channels are set as per 3GPP TS34.121-1 v9.0.0 E.5.0

Table E.5.0: Levels for HSDPA connection setup

Parameter During Connection setup	Unit	Value
P-CPICH_Ec/Ior	dB	-10
P-CCPCH and SCH_Ec/Ior	dB	-12
PICH _Ec/Ior	dB	-15
HS-PDSCH	dB	off
HS-SCCH_1	dB	off
DPCH_Ec/Ior	dB	-5
OCNS_Ec/Ior	dB	-3.1

Call is set up as per 3GPP TS34.108 v9.5.0 sub clause 7.3.13

The configurations of the fixed reference channels for HSDPA RF tests are described in 3GPP TS 34.121, annex C for FDD and 3GPP TS 34.122.

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Table C.8.1.12: Fixed Reference Channel H-Set 12

Parameter	Unit	Value
Nominal Avg. Inf. Bit Rate	kbps	60
Inter-TTI Distance	TTI's	1
Number of HARQ Processes	Processes	6
Information Bit Payload (N_{INF})	Bits	120
Number Code Blocks	Blocks	1
Binary Channel Bits Per TTI	Bits	960
Total Available SML's in UE	SML's	19200
Number of SML's per HARQ Proc.	SML's	3200
Coding Rate		0.15
Number of Physical Channel Codes	Codes	1
Modulation		QPSK
Note 1: The RMC is intended to be used for DC-HSDPA mode and both cells shall transmit with identical parameters as listed in the table. Note 2: Maximum number of transmission is limited to 1, i.e., retransmission is not allowed. The redundancy and constellation version 0 shall be used.		

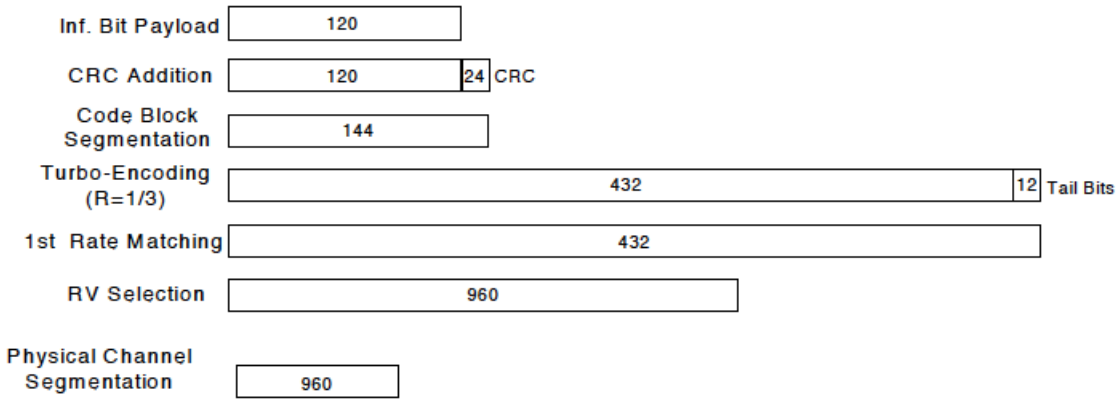

Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)

The following 4 Sub-tests for HSDPA were completed according to Release 6 procedures in section 5.2 of 3GPP TS34.121. A summary of subtest settings are illustrated below:

	Mode	Rel6 HSDPA	Rel6 HSDPA	Rel6 HSDPA	Rel6 HSDPA
	Subtest	1	2	3	4
WCDMA General Settings	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2kbps RMC			
	HSDPA FRC	H-Set1			
	Power Control Algorithm	Algorithm2			
	βc	2/15	12/15	15/15	15/15

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	βd	15/15	15/15	8/15	4/15
	βd (SF)	64			
	βc/βd	2/15	12/15	15/8	15/4
	βhs	4/15	24/15	30/15	30/15
	MPR	0	0	0.5	0.5
HSDPA Specific Settings	DACK	8			
	DNAK	8			
	DCQI	8			
	Ack-Nack Repetition factor	3			
	CQI Feedback	4ms			
	CQI Repetition Factor	2			
	Ahs = βhs/ βc	30/15			

Up commands are set continuously to set the UE to Max power.

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8.3.1. UMTS DC-HSDPA OUTPUT POWER RESULT

Band	Mode	UL Ch No.	Freq. (MHz)	MPR	Avg Pwr (dBm)
W-CDMA Band V	Subtest 1	4132	826.4	0	21.3
		4183	836.6	0	21.2
		4233	846.6	0	21.1
	Subtest 2	4132	826.4	0	20.8
		4183	836.6	0	21.2
		4233	846.6	0	21.0
	Subtest 3	4132	826.4	0.5	20.8
		4183	836.6	0.5	20.8
		4233	846.6	0.5	20.6
	Subtest 4	4132	826.4	0.5	20.8
		4183	836.6	0.5	20.8
		4233	846.6	0.5	20.6
Band	Mode	UL Ch No.	Freq. (MHz)	MPR	Avg Pwr (dBm)
W-CDMA Band II	Subtest 1	9262	1852.4	0	21.7
		9400	1880.0	0	22.4
		9538	1907.6	0	21.8
	Subtest 2	9262	1852.4	0	21.7
		9400	1880.0	0	22.0
		9538	1907.6	0	21.7
	Subtest 3	9262	1852.4	0.5	21.2
		9400	1880.0	0.5	21.9
		9538	1907.6	0.5	21.2
	Subtest 4	9262	1852.4	0.5	21.2
		9400	1880.0	0.5	21.9
		9538	1907.6	0.5	21.3

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8.4. LTE OUTPUT VERIFICATION

8.4.1. LTE OUTPUT RESULT

Band	Frequency	Modulation	BW (MHz)	RB Size	RB Offset	Average
LTE41	2506	QPSK	20	1	0	**23.1**
				1	49	23.0
				1	99	22.9
				50	0	**22.2**
				50	24	22.1
				50	49	22.0
				100	0	22.1
	2506	16QAM		1	0	21.9
				1	49	21.9
				1	99	21.7
				50	0	21.3
				50	24	21.2
				50	49	21.1
				100	0	21.1
	2593	QPSK		1	0	23.0
				1	49	23.0
				1	99	**23.1**
				50	0	22.1
				50	24	22.1
				50	49	**22.2**
				100	0	22.1
	2593	16QAM		1	0	22.2
				1	49	22.2
				1	99	22.2
				50	0	21.1
				50	24	21.1
				50	49	21.2
				100	0	21.1
	2680	QPSK		1	0	**22.9**
				1	49	22.8
				1	99	22.8
				50	0	**22.1**
				50	24	22.0
				50	49	21.9
				100	0	22.1
	2680	16QAM		1	0	21.8
				1	49	21.7
				1	99	21.6
				50	0	21.2
				50	24	20.9
				50	49	20.9
				100	0	20.9

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Band	Frequency	Modulation	BW (MHz)	RB Size	RB Offset	Average
LTE41	2503.5	QPSK	15	1	0	23.2
				1	37	23.2
				1	74	23.1
				37	0	22.1
				37	17	22.1
				37	36	22
				75	0	22.1
	2503.5	16QAM		1	0	22.1
				1	37	22
				1	74	21.9
				37	0	21.1
				37	17	21.1
				37	36	21
				75	0	21.1
	2593	QPSK		1	0	23
				1	37	23.1
				1	74	23.1
				37	0	22
				37	17	22.1
				37	36	22.2
				75	0	22.1
	2593	16QAM		1	0	22.3
				1	37	22.3
				1	74	22.4
				37	0	21
				37	17	21.1
				37	36	21.1
				75	0	21.2
	2682.5	QPSK		1	0	22.8
				1	37	22.8
				1	74	22.8
				37	0	22.1
				37	17	22
				37	36	22
				75	0	22.1
	2682.5	16QAM		1	0	22
				1	37	21.9
				1	74	21.9
				37	0	21
				37	17	21
				37	36	21
				75	0	21

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Band	Frequency	Modulation	BW (MHz)	RB Size	RB Offset	Average
LTE41	2501	QPSK	10	1	0	22.8
				1	24	22.8
				1	49	22.8
				25	0	22.1
				25	11	22.2
				25	24	22.2
				50	0	22.2
	2501	16QAM		1	0	21.9
				1	24	22
				1	49	21.9
				25	0	21.2
				25	11	21.1
				25	24	21.2
				50	0	21.2
	2593	QPSK		1	0	23
				1	24	23
				1	49	23
				25	0	22.1
				25	11	22.1
				25	24	22.1
				50	0	22.1
	2593	16QAM		1	0	22.3
				1	24	22.4
				1	49	22.4
				25	0	21
				25	11	21.2
				25	24	21.1
				50	0	21.1
	2685	QPSK		1	0	23.2
				1	24	23.2
				1	49	23.2
				25	0	22
				25	11	22.1
				25	24	22.1
				50	0	22
	2685	16QAM		1	0	22.4
				1	24	22.3
				1	49	22.3
				25	0	21
				25	11	21
				25	24	21
				50	0	21

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Band	Frequency	Modulation	BW (MHz)	RB Size	RB Offset	Average
LTE41	2498.5	QPSK	5	1	0	23.2
				1	11	23.1
				1	24	23.2
				12	0	22.2
				12	5	22.1
				12	11	22.1
				25	0	22.1
	2498.5	16QAM		1	0	22.4
				1	11	22.4
				1	24	22.5
				12	0	21.1
				12	5	21.1
				12	11	21.1
				25	0	21.2
	2593	QPSK		1	0	23.1
				1	11	23.1
				1	24	23.2
				12	0	22.1
				12	5	22
				12	11	22.1
				25	0	22.1
	2593	16QAM		1	0	22.3
				1	11	22.3
				1	24	22.3
				12	0	21.2
				12	5	21.2
				12	11	21.2
				25	0	21.1
	2687.5	QPSK		1	0	23.1
				1	11	23.1
				1	24	23.1
				12	0	22
				12	5	22.1
				12	11	22
				25	0	22.1
	2687.5	16QAM		1	0	21.8
				1	11	21.7
				1	24	21.8
				12	0	21.1
				12	5	21.1
				12	11	21.1
				25	0	21

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9. PEAK TO AVERAGE RATIO

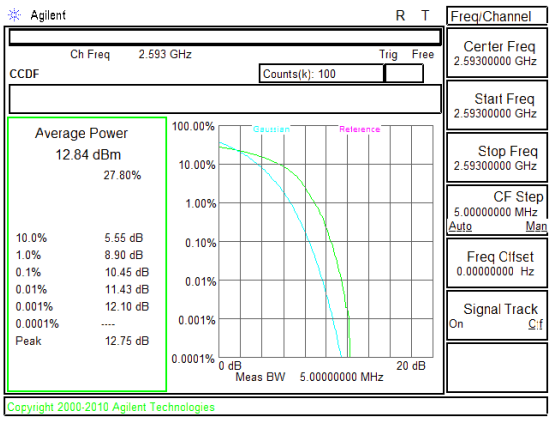
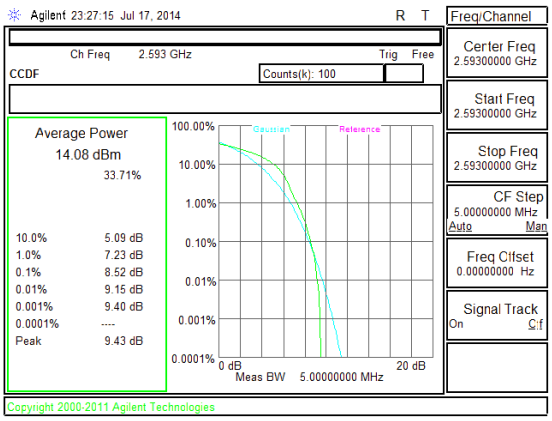
Test Procedure

Per KDB 971168 D01 Power Meas License Digital Systems v02r01

Test Spec

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

9.1. CONDUCTED PEAK TO AVERAGE RESULT

Band LTE41 20MHz 16QAM	 Band LTE41 20MHz 16QAM Mid channel	 Band LTE41 20MHz QPSK Mid channel

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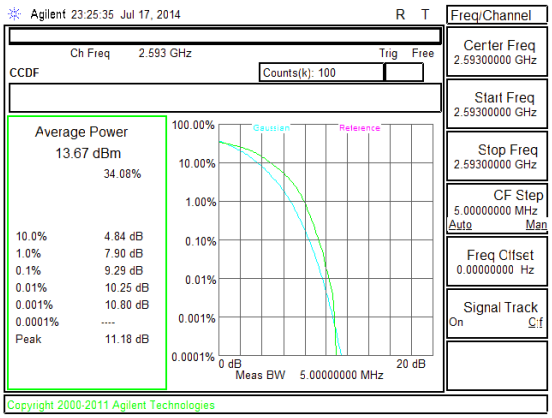
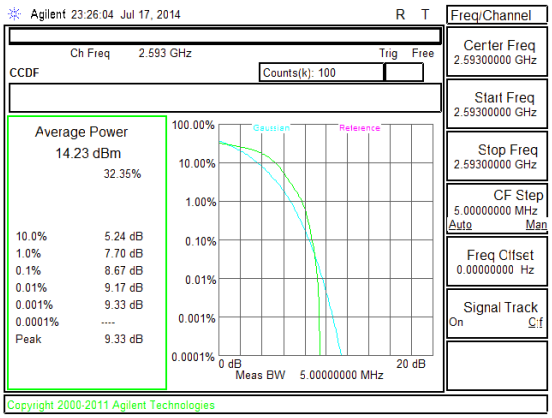
Band LTE41 15MHz 16QAM	 Band LTE41 15MHz 16QAM Mid channel	 Band LTE41 15MHz QPSK Mid channel

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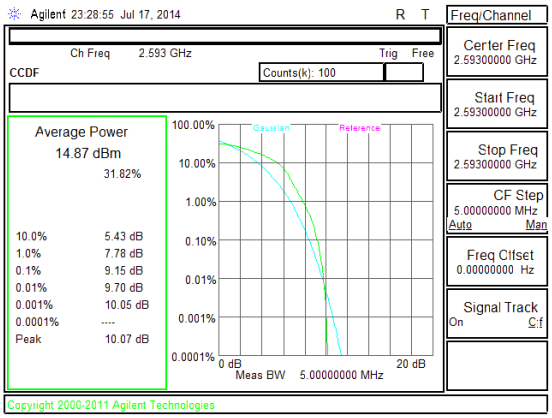
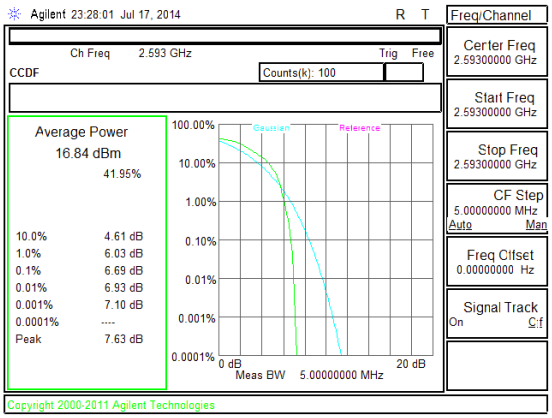
Band LTE41 10MHz 16QAM	 Band LTE41 10MHz 16QAM Mid channel	 Band LTE41 10MHz QPSK Mid channel

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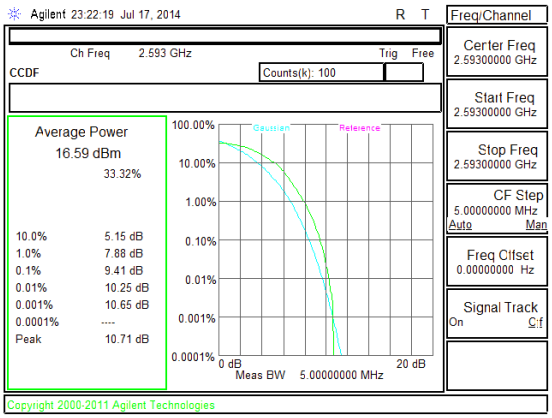
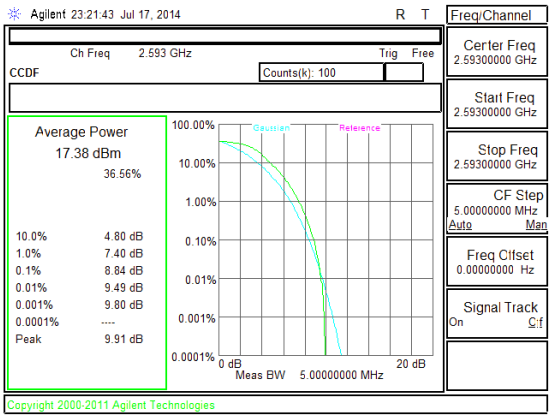
Band LTE41 5MHz 16QAM	 Band LTE41 5MHz 16QAM Mid channel	 Band LTE41 5MHz QPSK Mid channel

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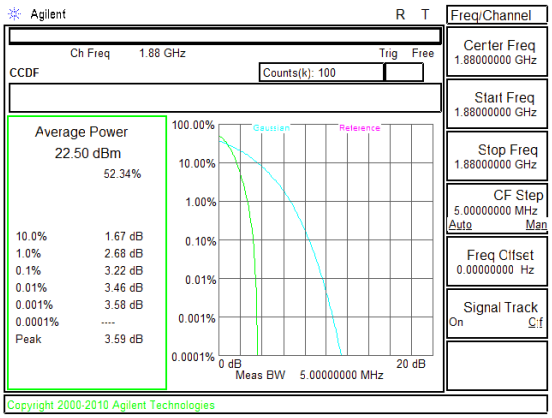
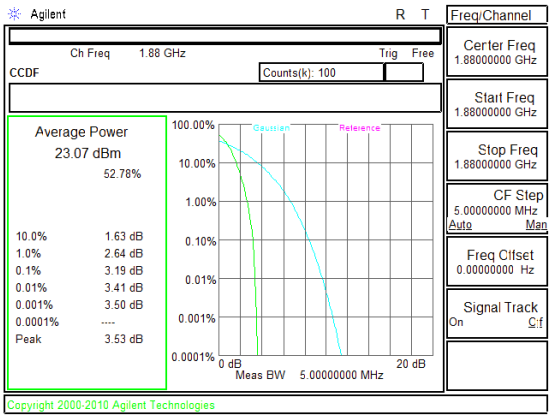
Band Band 2 HSDPA	 Band WCDMA B2 HSDPA	 Band WCDMA B2 REL99

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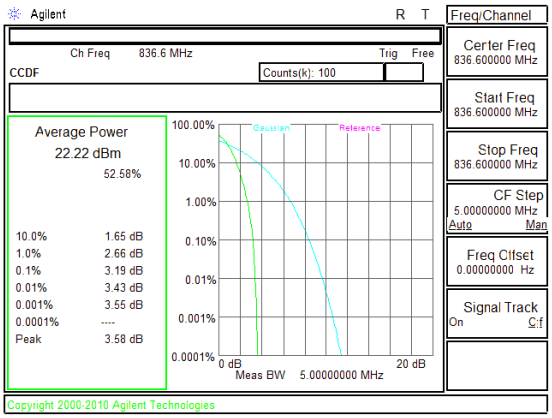
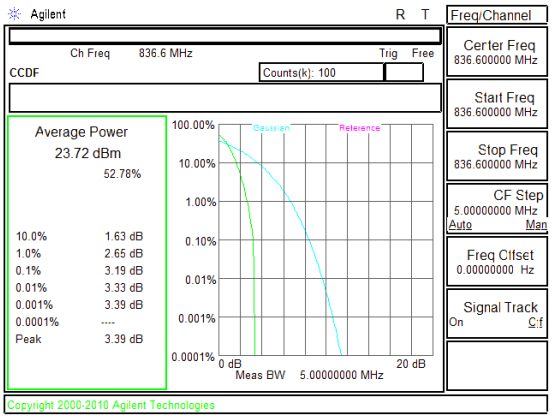
Band Band 5 HSDPA	 Band WCDMA B5 HSDPA	 Band WCDMA B5 REL99

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10. LIMITS AND CONDUCTED RESULTS

10.1. OCCUPIED BANDWIDTH

RULE PART(S)

FCC: §2.1049
IC: RSS-132, 4.5; RSS-133, 6.5

LIMITS

For reporting purposes only

TEST PROCEDURE

The transmitter output was connected to a calibrated coaxial cable and coupler, the other end of which was connected to a spectrum analyzer. The occupied bandwidth was measured with the spectrum analyzer at the low, middle and high channel in each band. The -26dB bandwidth was also measured and recorded.

(KDB 971168 D01 Power Meas License Digital Systems v02r01 - 06/07/2013)

MODES TESTED

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10.1.1. OCCUPIED BANDWIDTH RESULTS

Band	Mode	Channel	f (MHz)	99% BW (MHz)	-26dB BW (MHz)
GSM850	GMSK	128	824.2		
		190	836.6		
		251	848.8		
	GPRS	128	824.2	0.26	0.36
		190	836.6	0.26	0.36
		251	848.8	0.26	0.36
	EGPRS	128	824.2	0.26	0.36
		190	836.6	0.26	0.36
		251	848.8	0.26	0.36
GSM1900	GMSK	512	1850.2		
		661	1880		
		810	1909.8		
	GPRS	512	1850.2	0.26	0.36
		661	1880	0.26	0.36
		810	1909.8	0.26	0.36
	EGPRS	512	1850.2	0.26	0.36
		661	1880	0.26	0.36
		810	1909.8	0.26	0.36

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Band	Mode	Channel	f (MHz)	99% BW (MHz)	-26dB BW (MHz)
Band 5	REL99	4132	826.4	4.16	4.63
		4183	836.6	4.16	4.65
		4233	846.6	4.16	4.65
	HSDPA	4132	826.4	4.35	4.84
		4183	836.6	4.16	4.63
		4233	846.6	4.16	4.64
	HSUPA	4132	826.4		
		4183	836.6		
		4233	846.6		
Band 2	REL99	9262	1852.4	4.17	4.64
		9400	1880	4.16	4.64
		9538	1907.6	4.16	4.62
	HSDPA	9262	1852.4	4.15	4.65
		9400	1880	4.16	4.64
		9538	1907.6	4.17	4.62
	HSUPA	9262	1852.4		
		9400	1880		
		9538	1907.6		

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10.1.2. LTE OCCUPIED BANDWIDTH RESULTS

Band	BW(MHz)	Mode	RB/RB Size	f (MHz)	99% BW (MHz)	-26dB BW (MHz)
LTE41	20	QPSK	100/0	2506	17.79	19.12
			100/0	2593	17.78	18.86
			100/0	2680	17.82	18.81
		16QAM	100/0	2506	17.8	18.95
			100/0	2593	17.82	18.62
			100/0	2680	17.78	18.79

Band	BW(MHz)	Mode	RB/RB Size	f (MHz)	99% BW (MHz)	-26dB BW (MHz)
LTE41	15	QPSK	75/0	2503.5	13.36	14.26
			75/0	2593	13.35	14.33
			75/0	2682.5	13.38	14.31
		16QAM	75/0	2503.5	13.4	14.42
			75/0	2593	13.35	14.33
			75/0	2682.5	13.41	14.3

Band	BW(MHz)	Mode	RB/RB Size	f (MHz)	99% BW (MHz)	-26dB BW (MHz)
LTE41	10	QPSK	50/0	2501	8.93	9.65
			50/0	2593	8.92	9.68
			50/0	2685	8.94	9.72
		16QAM	50/0	2501	8.93	9.6
			50/0	2593	8.93	9.47
			50/0	2685	8.92	9.56

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Band	BW(MHz)	Mode	RB/RB Size	f (MHz)	99% BW (MHz)	-26dB BW (MHz)
LTE41	5	QPSK	25/0	2498.5	4.46	4.91
			25/0	2593	4.46	4.9
			25/0	2687.5	4.46	4.9
		16QAM	25/0	2498.5	4.45	4.85
			25/0	2593	4.46	4.83
			25/0	2687.5	4.46	4.85

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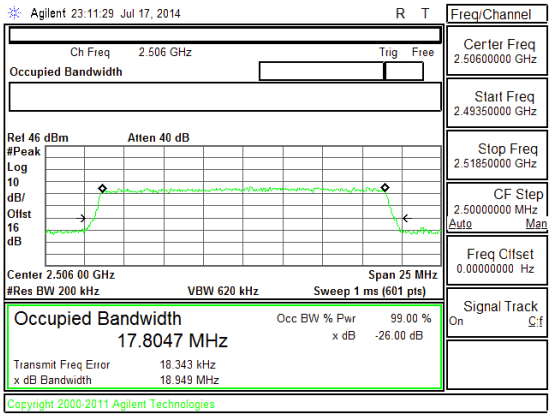
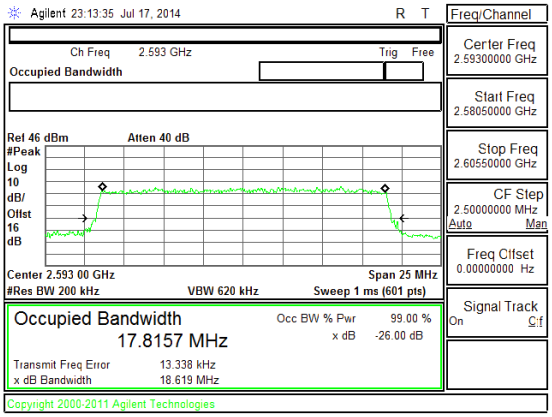
10.1.3. OCCUPIED BANDWIDTH PLOTS

Band LTE41 20MHz 16QAM	 Band LTE41 20MHz OBW 16QAM Low Channel FRB.gif	 Band LTE41 20MHz OBW 16QAM Mid Channel FRB.gif

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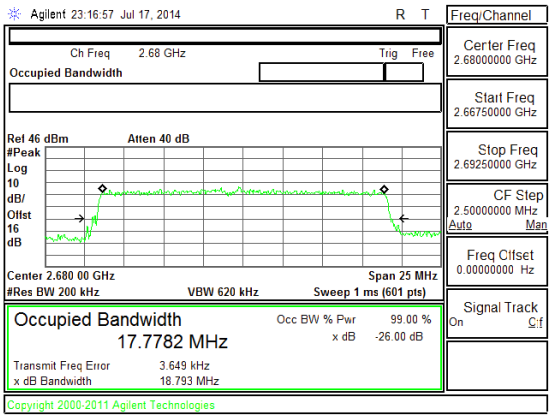
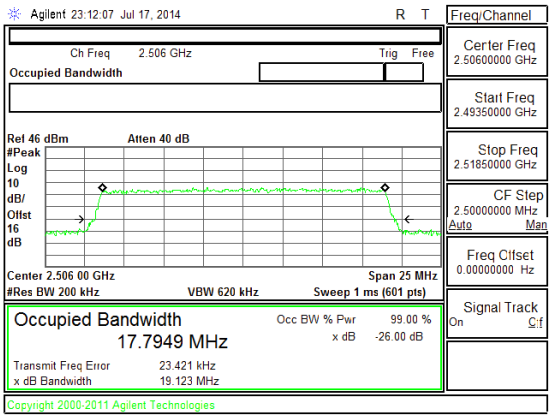
Band LTE41 20MHz 16QAM

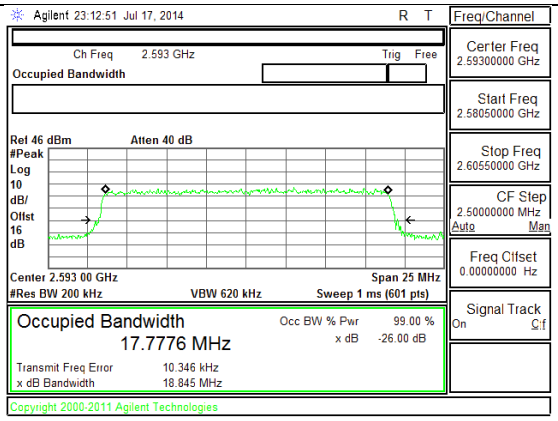


Band LTE41 20MHz OBW 16QAM High Channel FRB.gif



Band LTE41 20MHz OBW QPSK Low Channel FRB.gif

Band LTE41 20MHz QPSK



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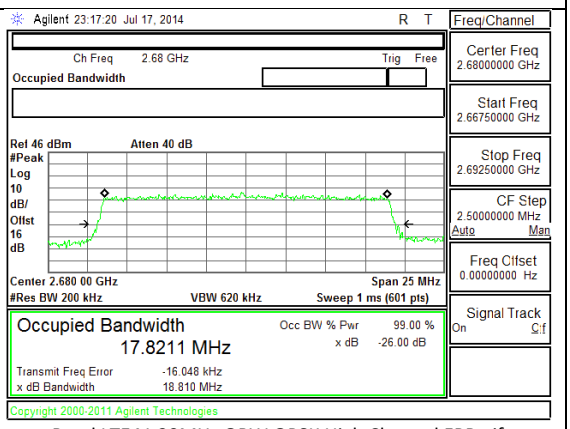

Band LTE41 20MHz OBW QPSK High Channel FRB.gif

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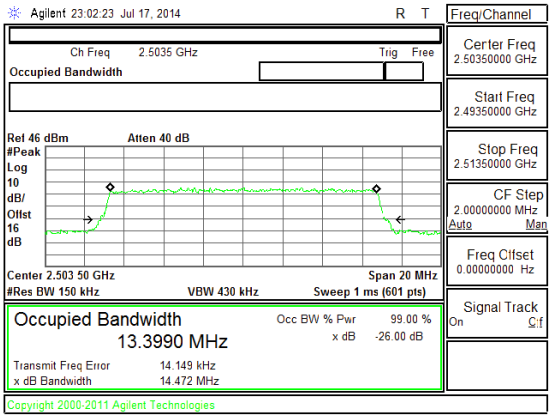
Band LTE41 15MHz 16QAM



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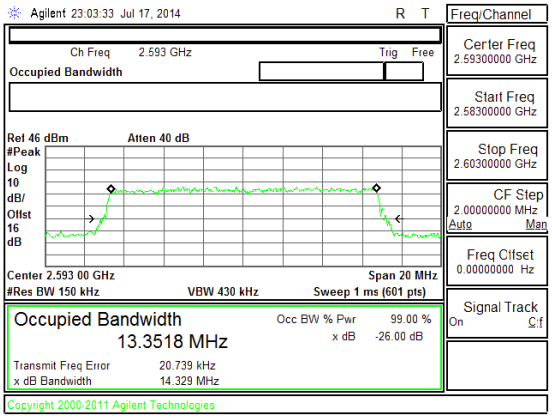
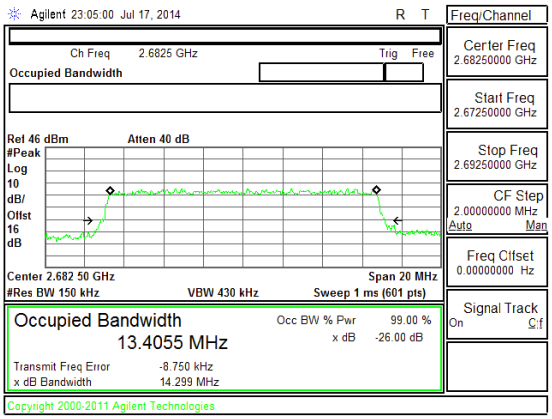


Band LTE41 15MHz OBW 16QAM Mid Channel FRB.gif

and LTE41 15MHz 16QAM



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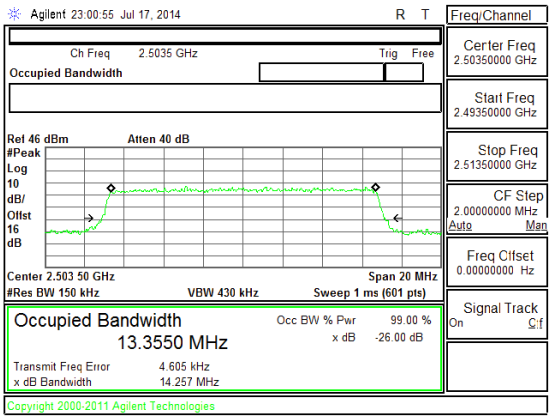

Band LTE41 15MHz OBW QPSK Low Channel FRB.gif

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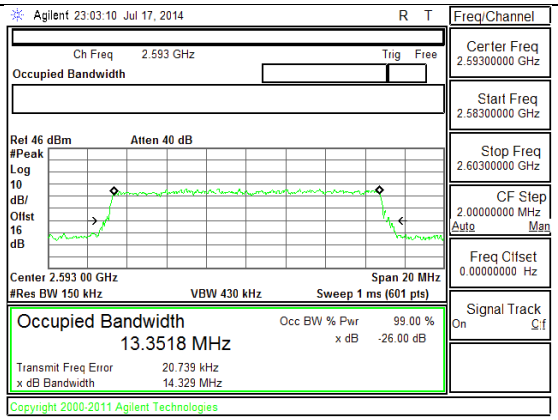
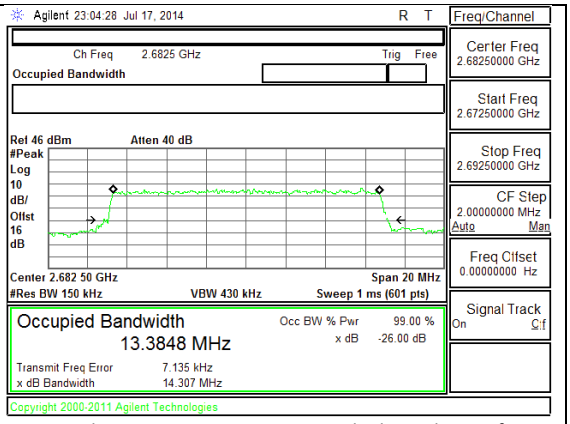
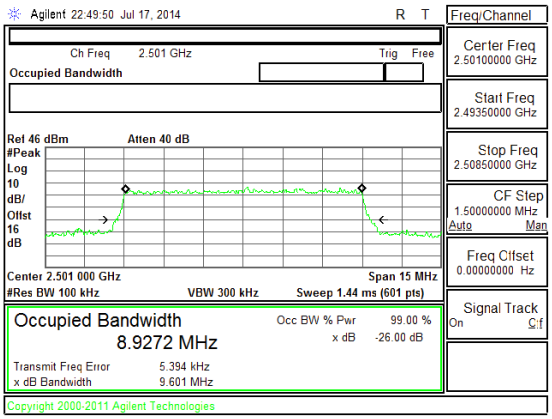
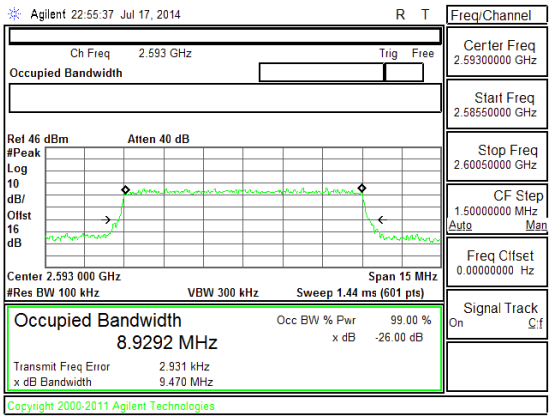
Band LTE41 15MHz QPSK	 Band LTE41 15MHz OBW QPSK Mid Channel FRB.gif	 Band LTE41 15MHz OBW QPSK High Channel FRB.gif
Band LTE41 10MHz 16QAM	 Band LTE41 10MHz OBW 16QAM Low Channel FRB.gif	 Band LTE41 10MHz OBW 16QAM Mid Channel FRB.gif

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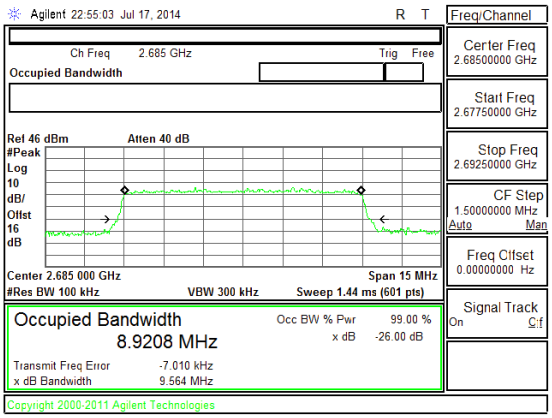
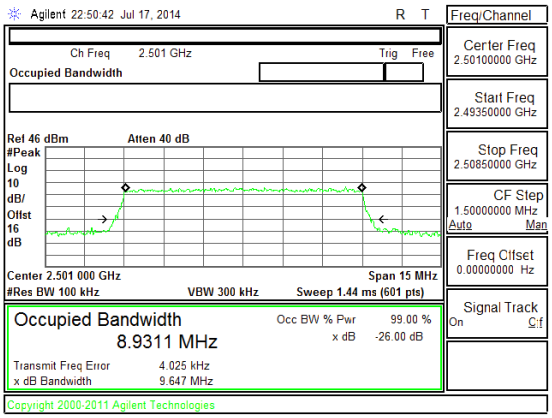
Band LTE41 10MHz 16QAM

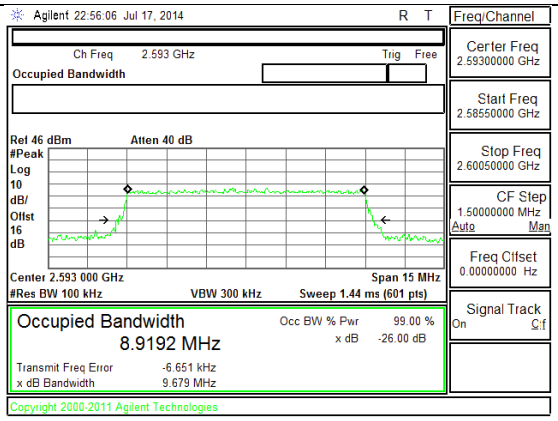


Band LTE41 10MHz OBW 16QAM High Channel FRB.gif



Band LTE41 10MHz OBW QPSK Low Channel FRB.gif

Band LTE41 10MHz QPSK



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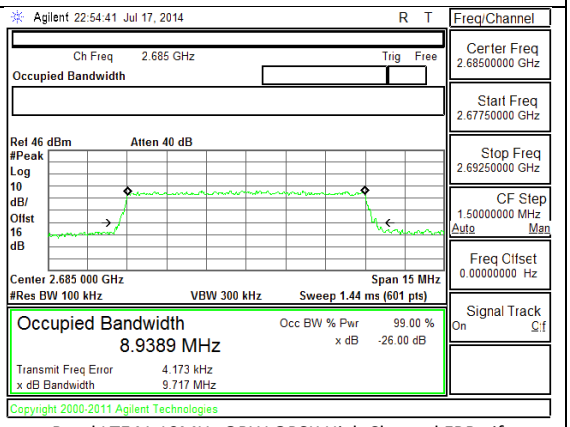

Band LTE41 10MHz OBW QPSK High Channel FRB.gif

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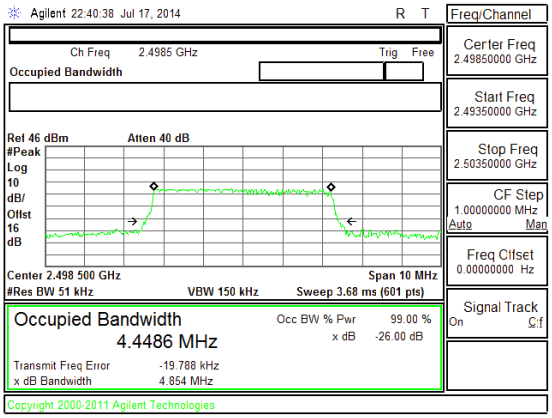
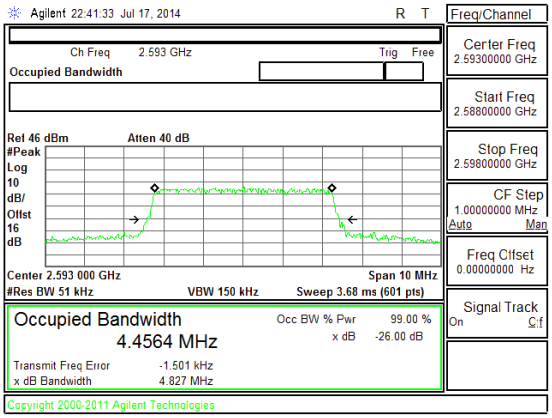
Band LTE41 5MHz 16QAM

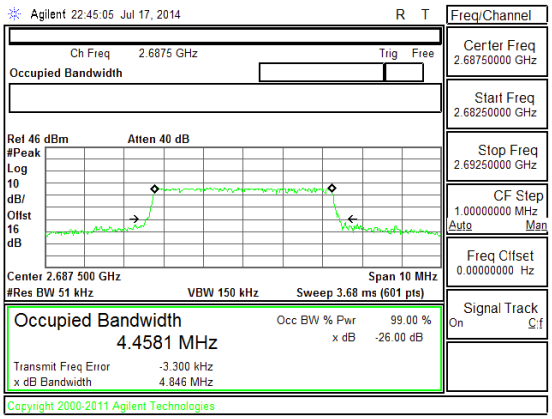


Band LTE41 5MHz OBW 16QAM Low Channel FRB.gif



Band LTE41 5MHz OBW 16QAM Mid Channel FRB.gif

Band LTE41 5MHz 16QAM



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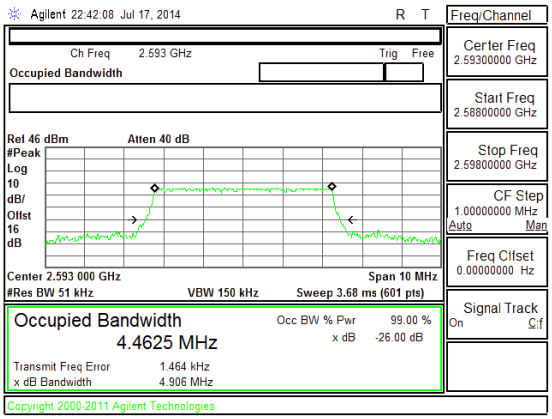

Band LTE41 5MHz OBW QPSK Low Channel FRB.gif

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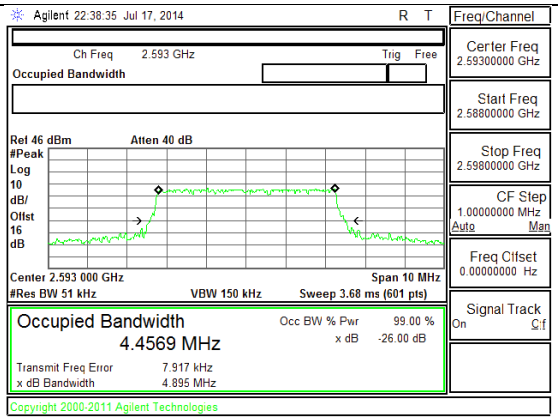
Band LTE41 5MHz QPSK



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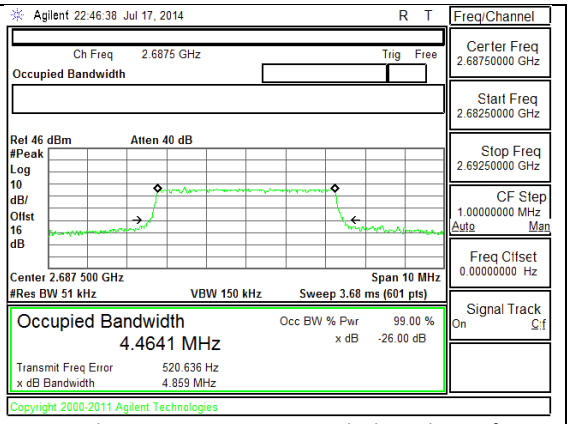
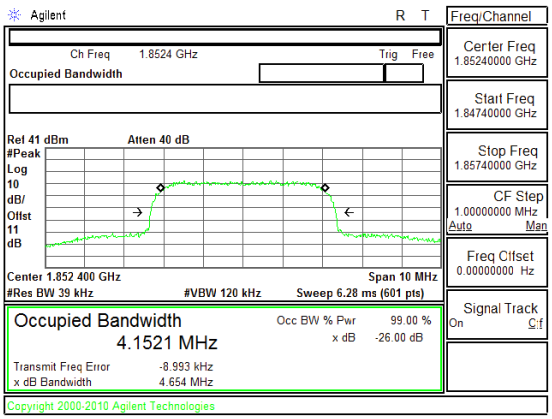
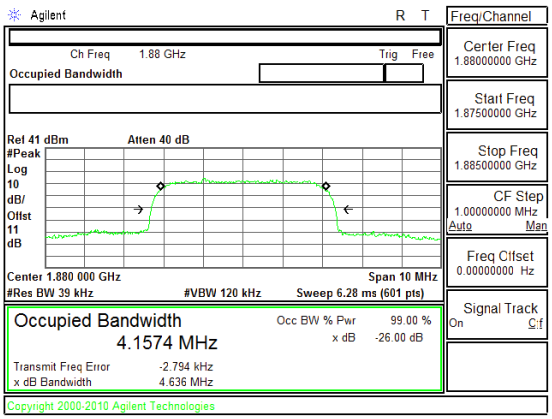


Band LTE41 5MHz OBW QPSK High Channel FRB.gif

Band Band 2 HSDPA



Band WCDMA B2 low HSDPA OBW



Band WCDMA B2 mid HSDPA OBW

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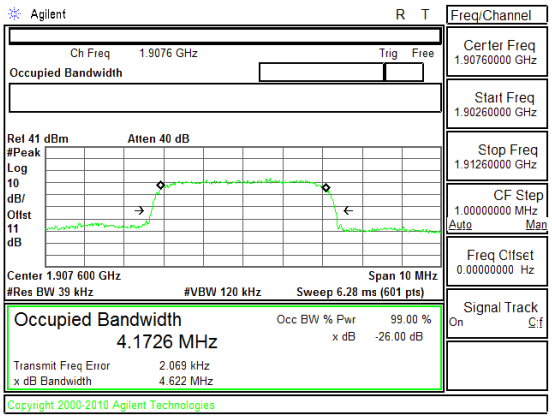
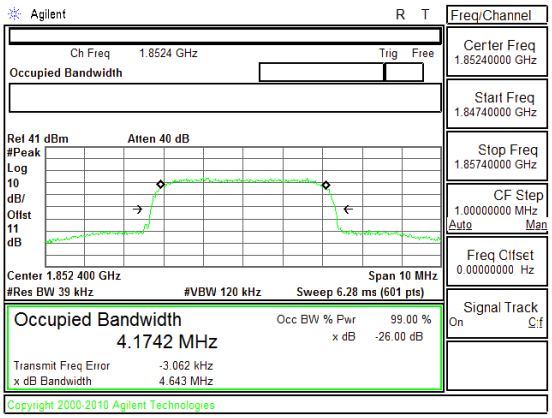
Band

Band 2

HSDPA



Band WCDMA B2 high HSDPA OBW

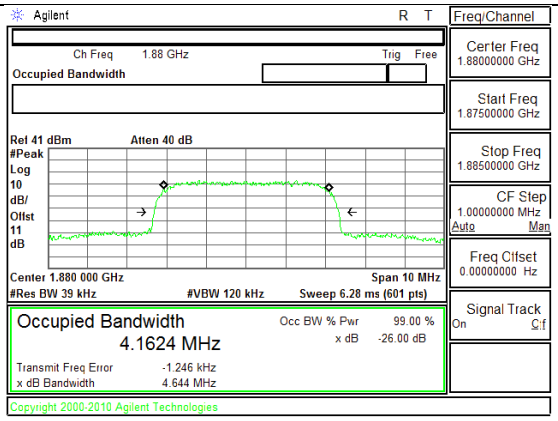


Band WCDMA B2 low REL99 OBW

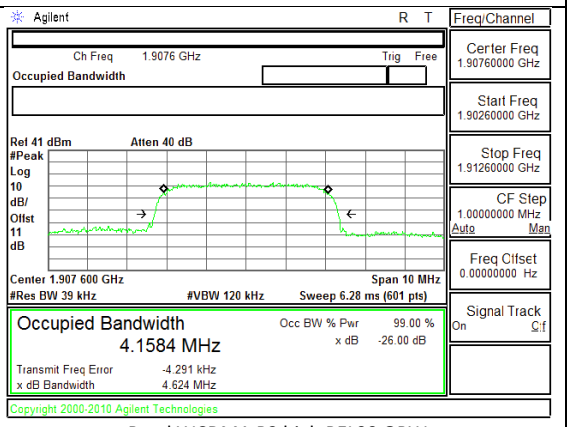
Band

Band 2

REL99



Band WCDMA B2 mid REL99 OBW



Band WCDMA B2 high REL99 OBW

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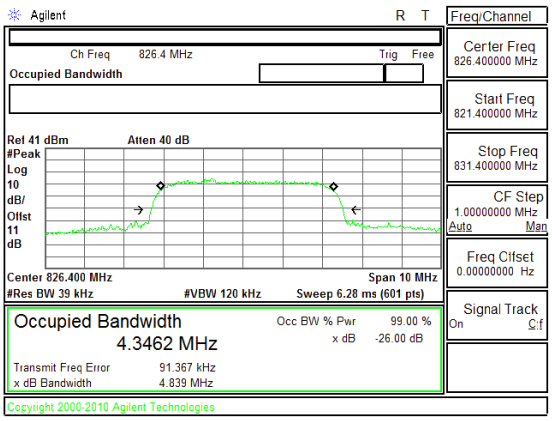
Band

Band 5

HSDPA



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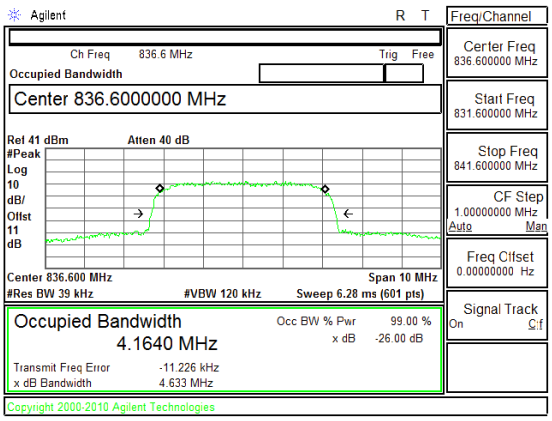
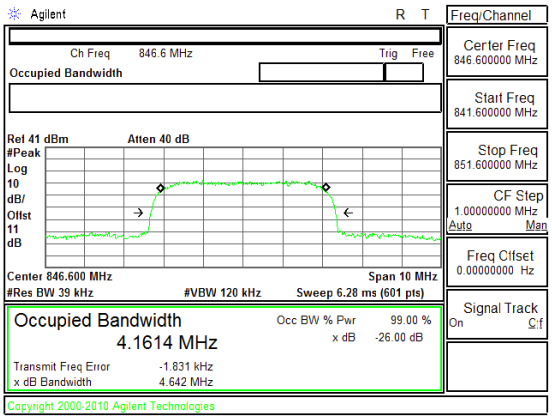


Band WCDMA B5 mid HSDPA OBW

Band

Band 5

HSDPA



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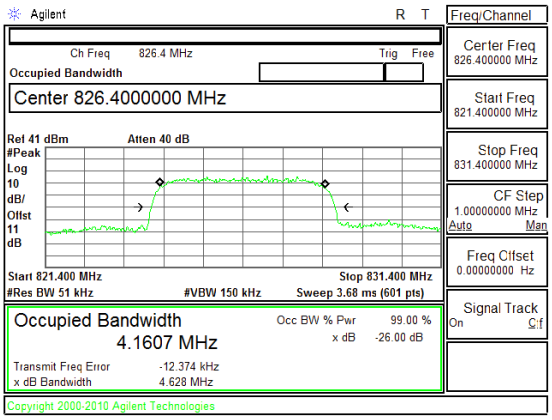

Band WCDMA B5 low REL99 OBW

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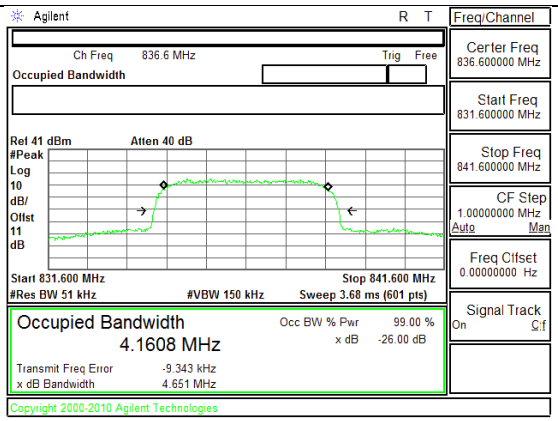
Band

Band 5

REL99



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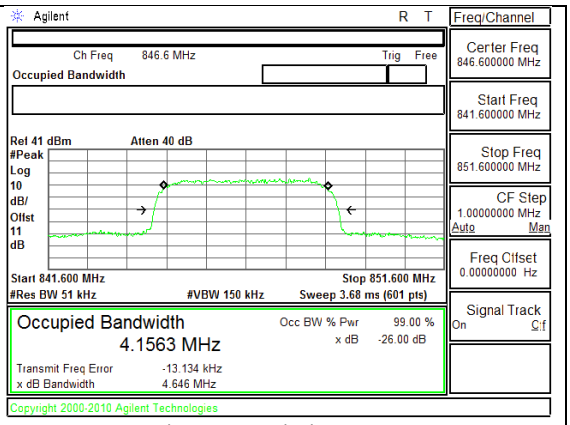
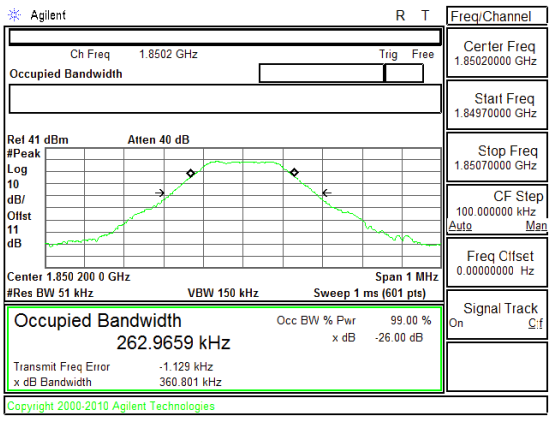


Band WCDMA B5 high REL99 OBW

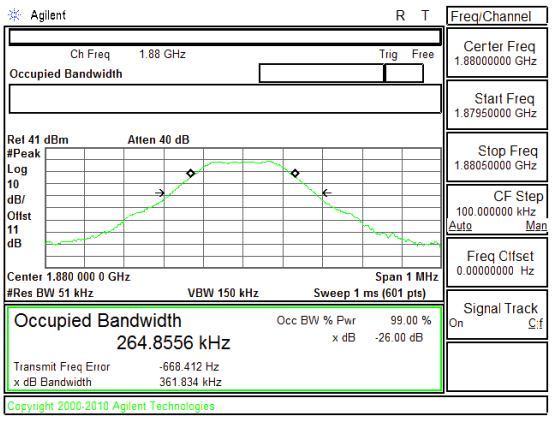
Band

GSM1900

EGPRS



Band GSM1900 EGPRS OBW Low channel



Band GSM1900 EGPRS OBW Mid channel

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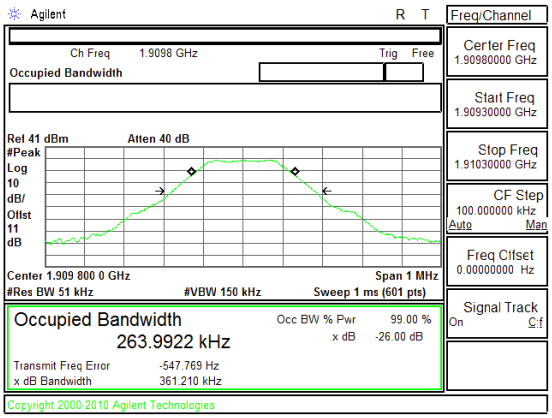
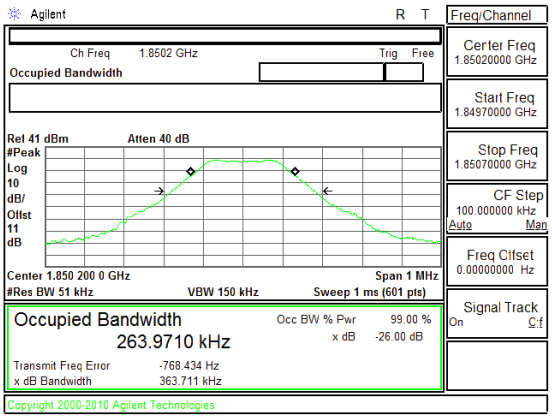
Band GSM1900 EGPRS

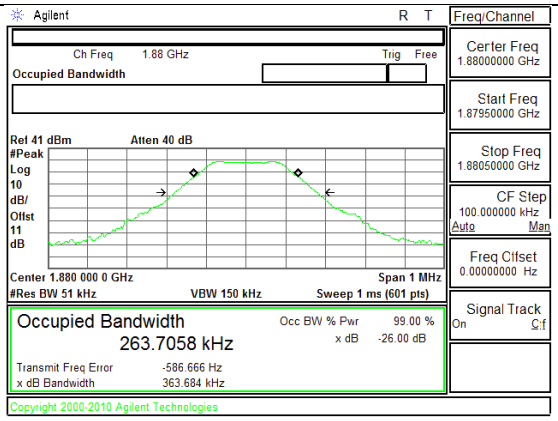


Band GSM1900 EGPRS OBW High channel



Band GSM1900 GPRS OBW Low channel

Band GSM1900 GPRS



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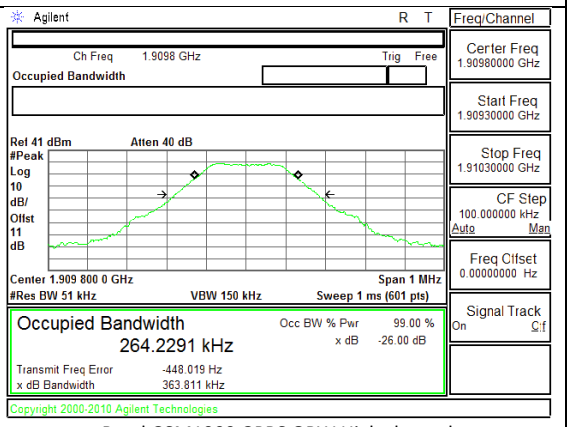

Band GSM1900 GPRS OBW High channel

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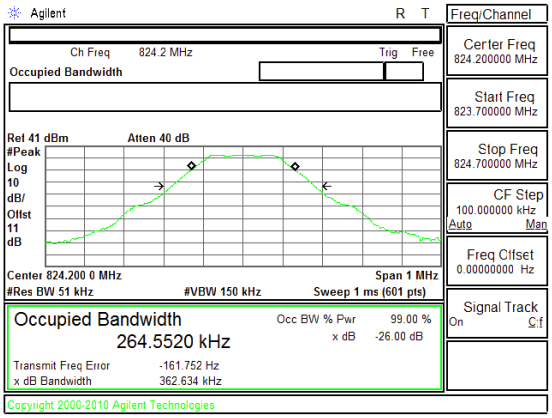
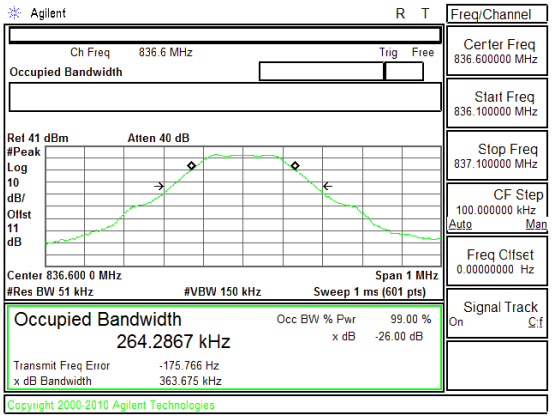
Band GSM850 EGPRS

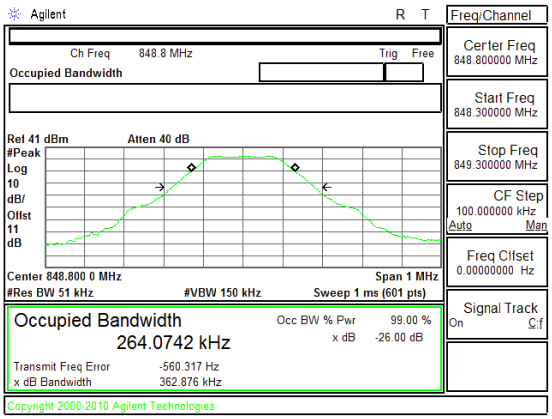


Band GSM850 EGPRS OBW Low channel



Band GSM850 EGPRS OBW Mid channel

Band GSM850 EGPRS



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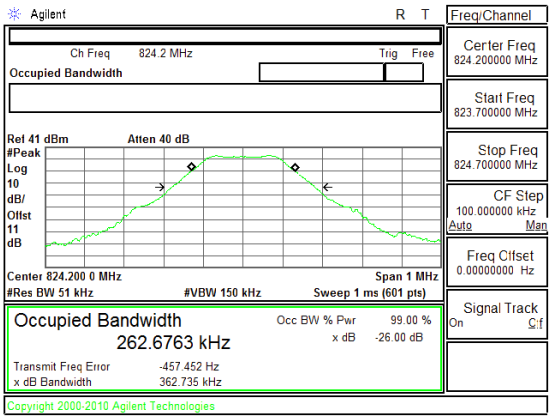

Band GSM850 GPRS OBW Low channel

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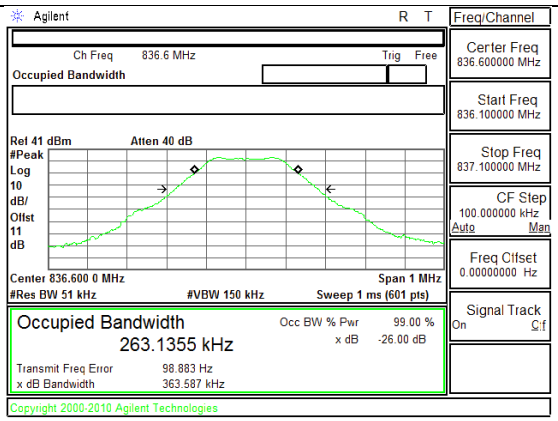
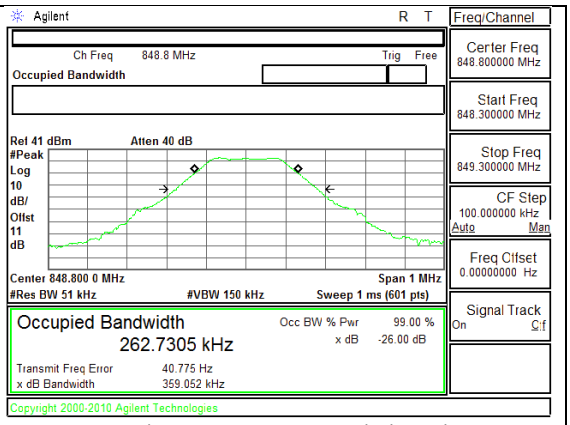
Band GSM850 GPRS	 Band GSM850 GPRS OBW Mid channel	 Band GSM850 GPRS OBW High channel

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10.2. BAND EDGE EMISSIONS

RULE PART(S)

FCC: §22.359, §24.238 and § 27

LIMITS

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.

TEST PROCEDURE

Per KDB 971168 D01 Power Meas License Digital Systems v02r01
The transmitter output was connected to an Agilent 8960 or a CMW500 Test Set and configured to operate at maximum power. The band edge emissions were measured at the required operating frequencies in each band on the Spectrum Analyzer.

RESULTS

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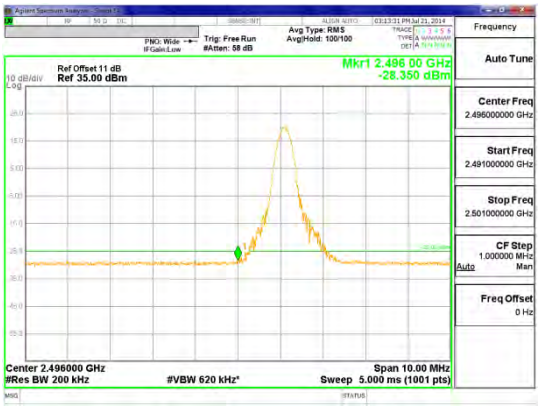
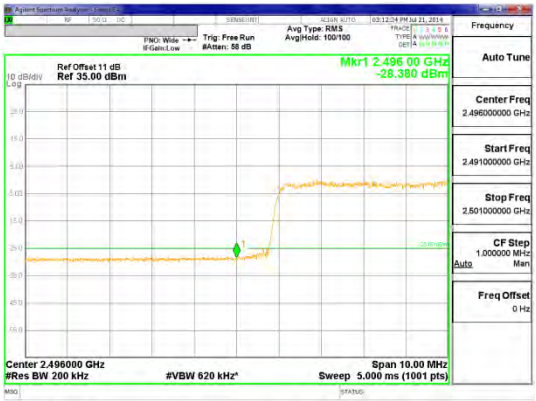
10.2.1. BAND EDGE PLOTS

Band LTE41 20MHz QPSK	 Band LTE41 20MHz CBE QPSK Low Channel 1RB.gif	 Band LTE41 20MHz CBE QPSK Low Channel FRB.gif

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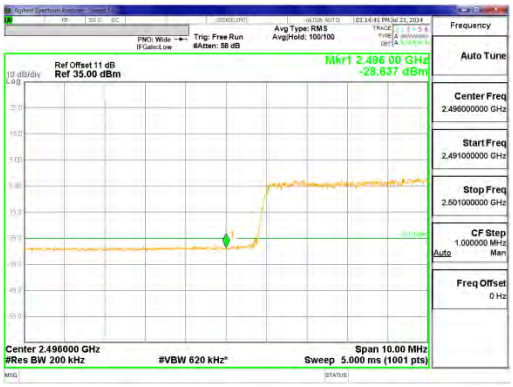
Band LTE41 20MHz QPSK	 Band LTE41 20MHz CBE QPSK High Channel 1RB.gif	 Band LTE41 20MHz CBE QPSK High Channel FRB.gif
Band LTE41 20MHz 16QAM	 Band LTE41 20MHz CBE 16QAM Low Channel 1RB.gif	 Band LTE41 20MHz CBE 16QAM Low Channel FRB.gif
Band		

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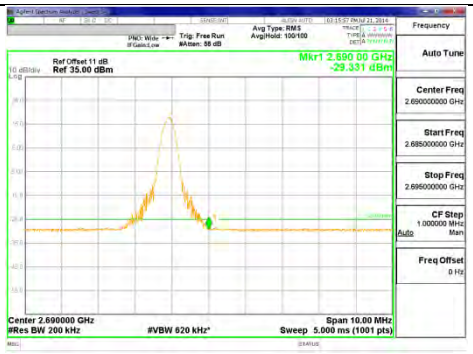
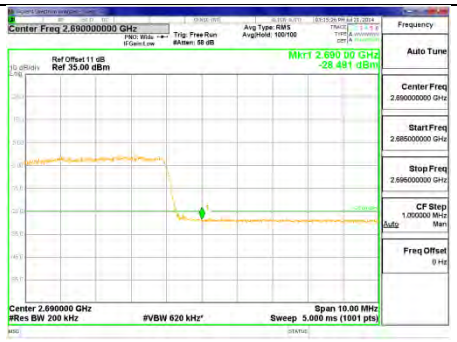
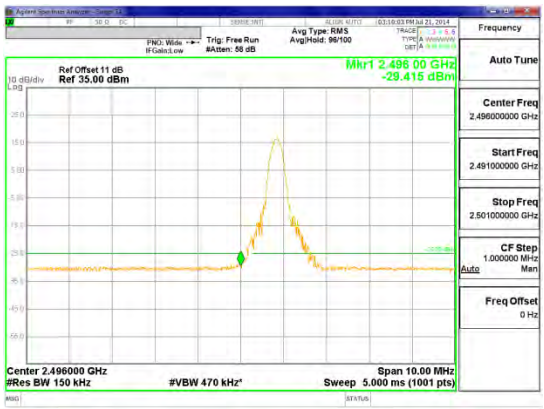
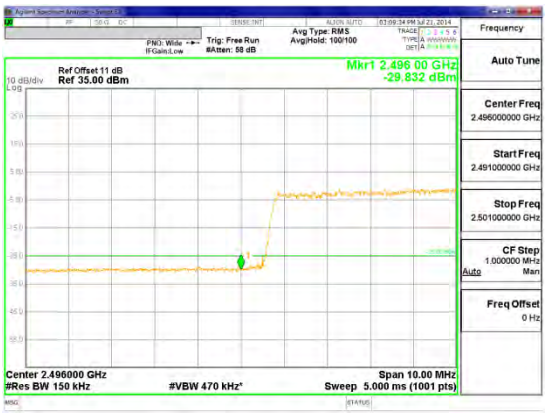
LTE41 20MHz 16QAM	 Band LTE41 20MHz CBE 16QAM High Channel 1RB.gif	 Band LTE41 20MHz CBE 16QAM High Channel FRB.gif

Band LTE41 15MHz 16QAM	 Band LTE41 15MHz CBE 16QAM Low Channel 1RB.gif	 Band LTE41 15MHz CBE 16QAM Low Channel FRB.gif

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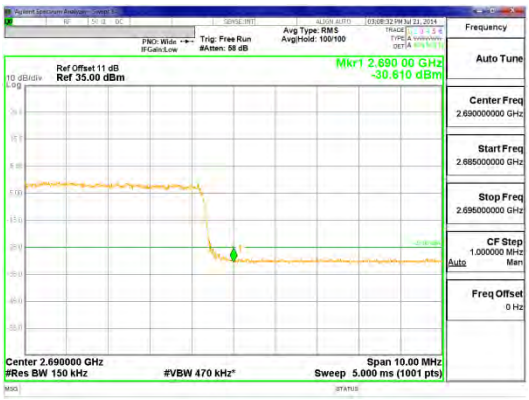
Band LTE41 15MHz 16QAM	 Band LTE41 15MHz CBE 16QAM High Channel 1RB.gif	 Band LTE41 15MHz CBE 16QAM High Channel FRB.gif

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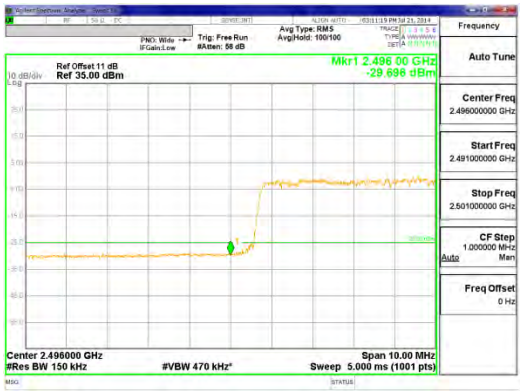
Band LTE41 15MHz QPSK	 Band LTE41 15MHz CBE QPSK Low Channel 1RB.gif	 Band LTE41 15MHz CBE QPSK Low Channel FRB.gif

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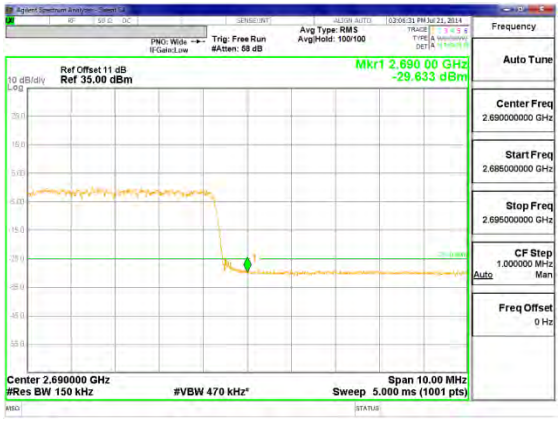
Band LTE41 15MHz QPSK	 Band LTE41 15MHz CBE QPSK High Channel 1RB.gif	 Band LTE41 15MHz CBE QPSK High Channel FRB.gif

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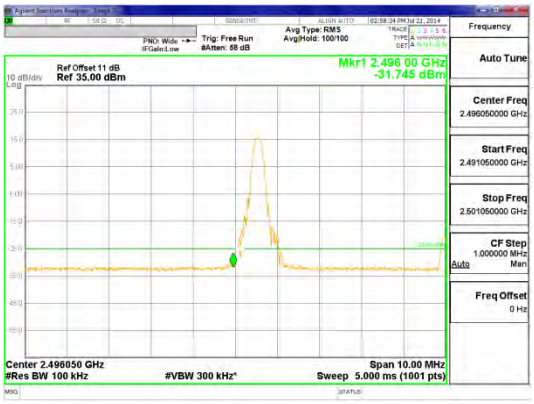
Band LTE41 10MHz 16QAM	 Band LTE41 10MHz CBE 16QAM Low Channel 1RB.gif	 Band LTE41 10MHz CBE 16QAM Low Channel FRB.gif

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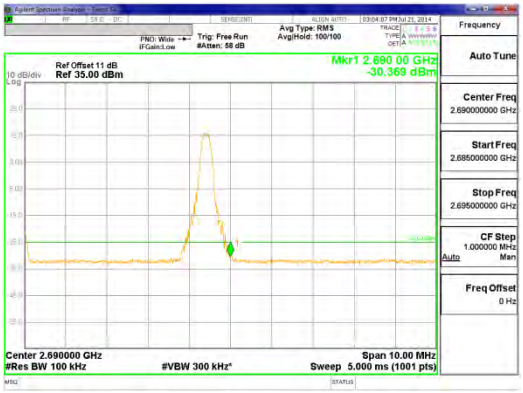
Band LTE41 10MHz 16QAM	 Band LTE41 10MHz CBE 16QAM High Channel 1RB.gif	 Band LTE41 10MHz CBE 16QAM High Channel FRB.gif

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Band LTE41 10MHz QPSK	 Band LTE41 10MHz CBE QPSK Low Channel 1RB.gif	 Band LTE41 10MHz CBE QPSK Low Channel FRB.gif

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Band LTE41 10MHz QPSK	 Band LTE41 10MHz CBE QPSK High Channel 1RB.gif	 Band LTE41 10MHz CBE QPSK High Channel FRB.gif

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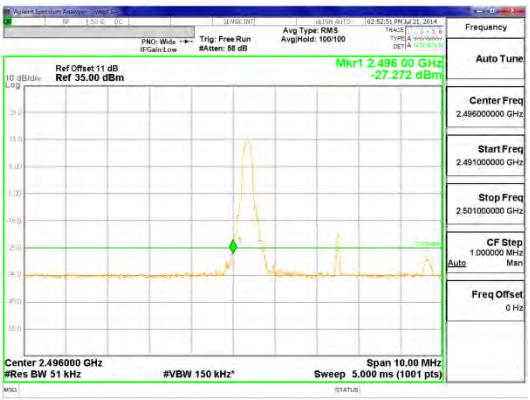
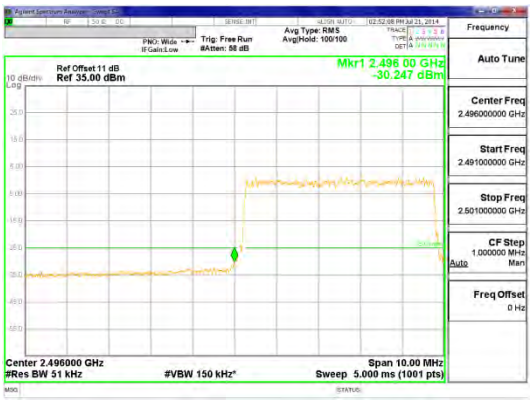
Band LTE41 5MHz QPSK	 Band LTE41 5MHz CBE QPSK Low Channel 1RB.gif	 Band LTE41 5MHz CBE QPSK Low Channel FRB.gif

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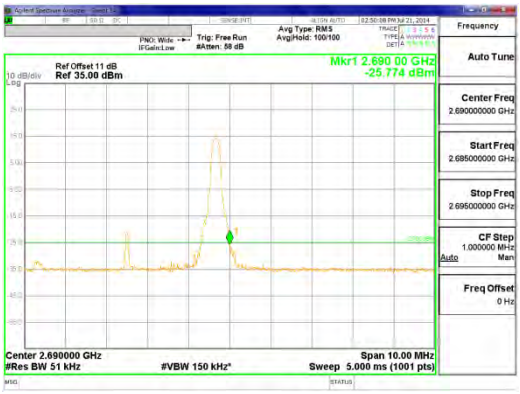
Band LTE41 5MHz QPSK	 Band LTE41 5MHz CBE QPSK High Channel 1RB.gif	 Band LTE41 5MHz CBE QPSK High Channel FRB.gif

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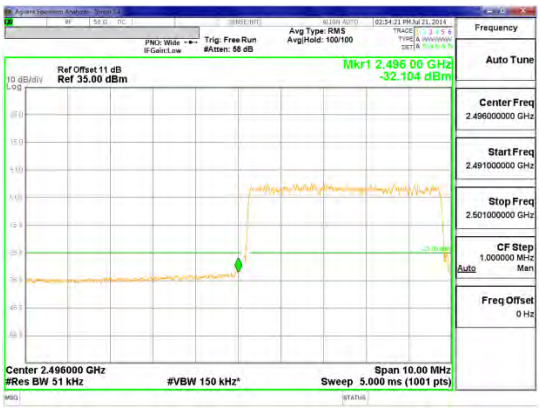
Band LTE41 5MHz 16QAM	 Band LTE41 5MHz CBE 16QAM Low Channel 1RB.gif	 Band LTE41 5MHz CBE 16QAM Low Channel FRB.gif

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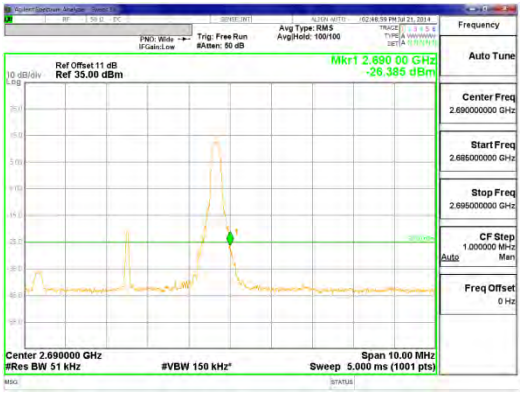
Band LTE41 5MHz 16QAM	 Band LTE41 5MHz CBE 16QAM High Channel 1RB.gif	 Band LTE41 5MHz CBE 16QAM High Channel FRB.gif

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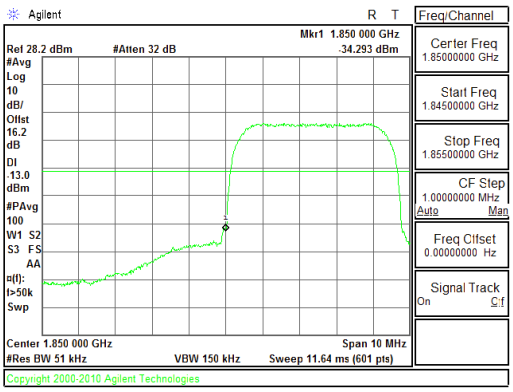
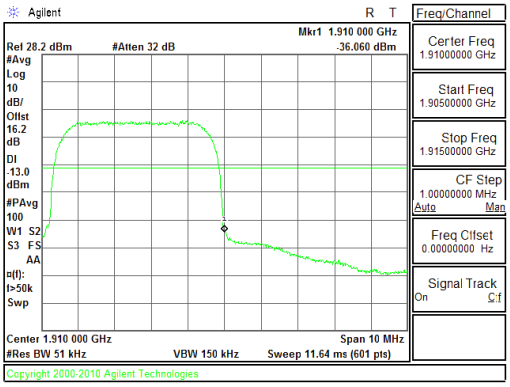
Band Band 2 HSDPA	 Band WCDMA B2 HSDPA CBE	 Band WCDMA B2 HSDPA CBE

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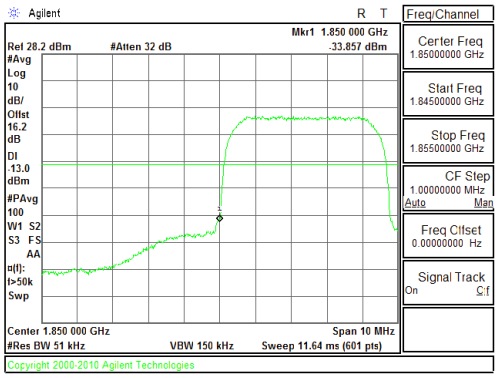
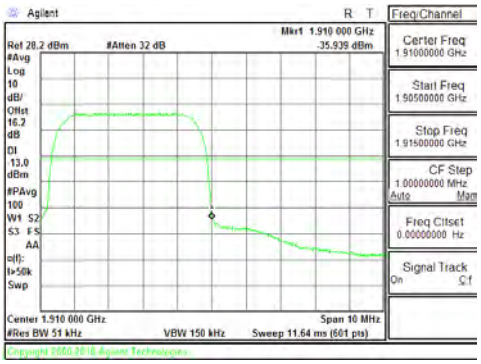
Band Band 2 REL99	 Band WCDMA B2 REL99 CBE	 Band WCDMA B2 REL99 CBE

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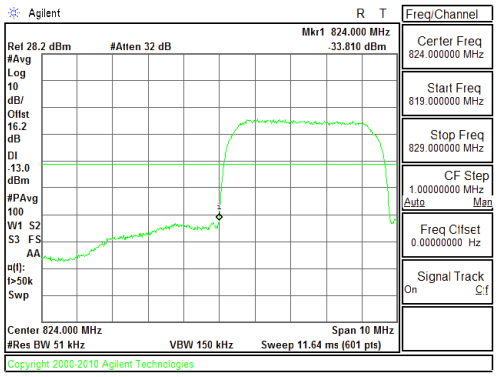
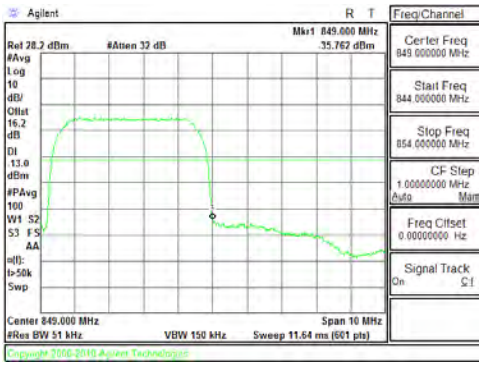
Band Band 5 HSDPA	 Band WCDMA B5 HSDPA CBE	 Band WCDMA B5 HSDPA CBE

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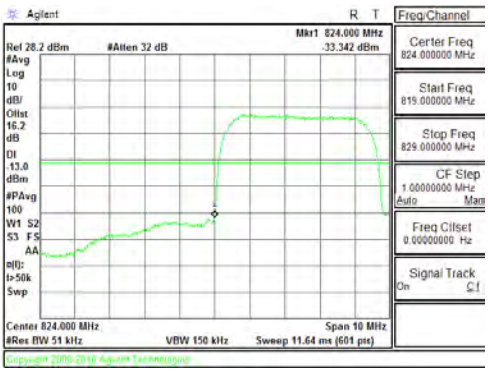
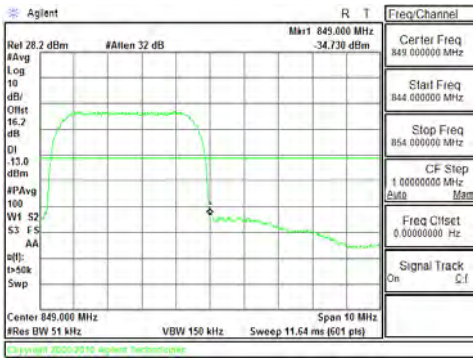
Band Band 5 REL99	 Band WCDMA B5 REL99 CBE	 Band WCDMA B5 REL99 CBE

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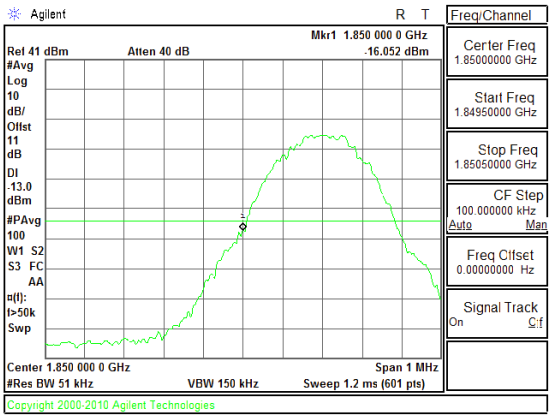
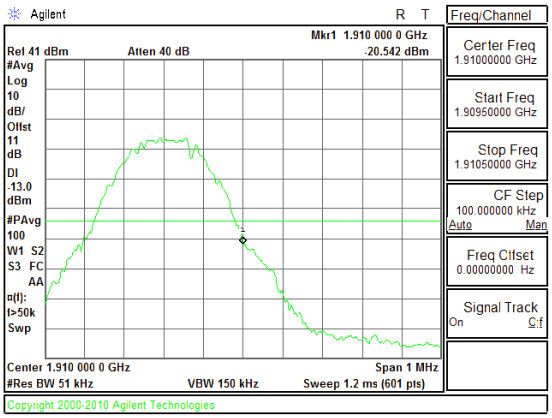
Band GSM1900 EGPRS	 Band GSM1900 EGPRS CBE Low channel	 Band GSM1900 EGPRS CBE High channel

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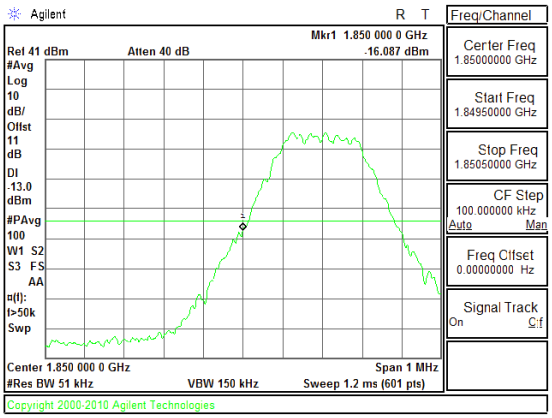
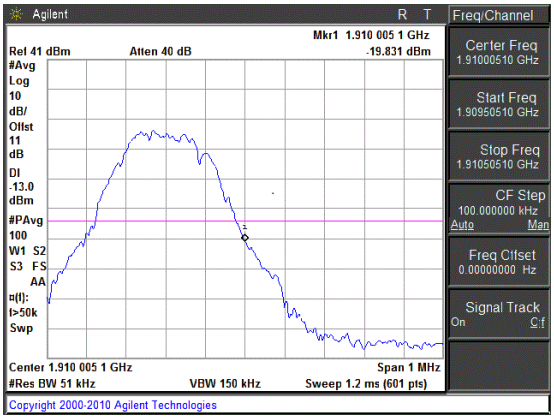
Band GSM1900 GPRS	 Band GSM1900 GPRS CBE Low channel	 Band GSM1900 GPRS CBE High channel

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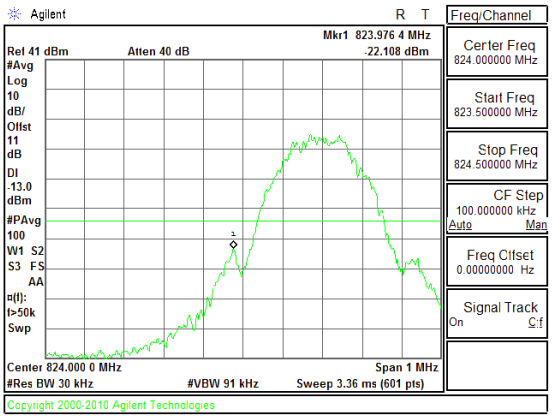
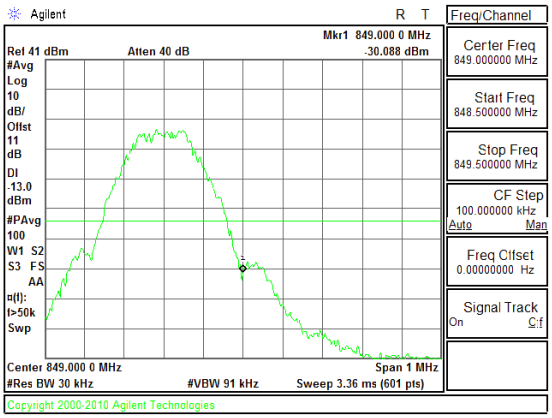
Band GSM850 EGPRS	 Band GSM850 EGPRS CBE Low channel	 Band GSM850 EGPRS CBE High channel

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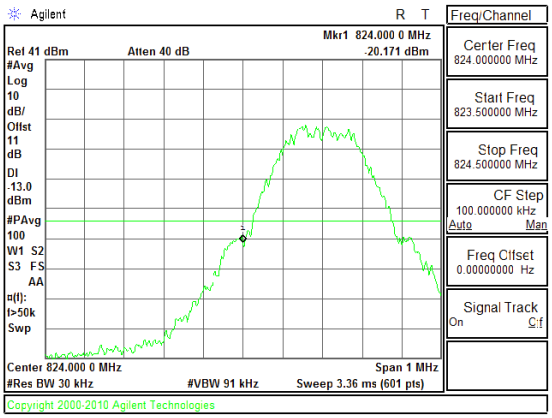
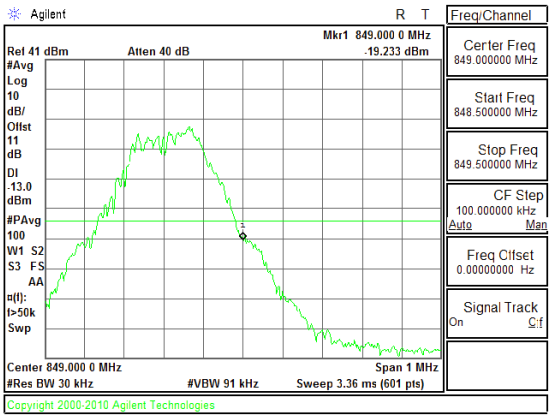
Band GSM850 GPRS	 Band GSM850 GPRS CBE Low channel	 Band GSM850 GPRS CBE High channel

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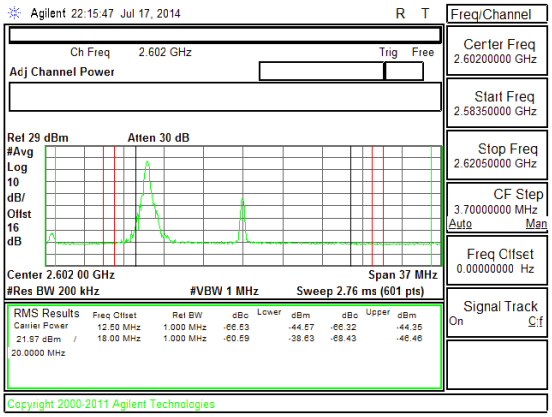
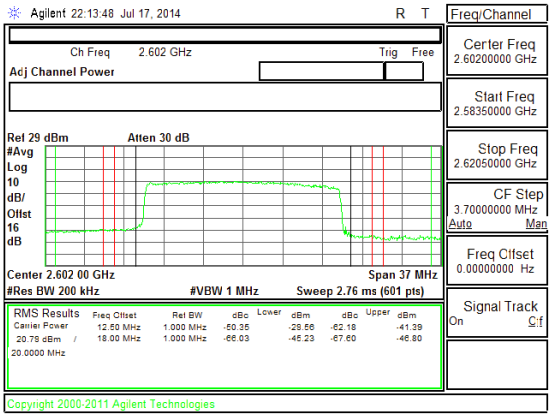
10.2.2. EMISSION MASK PLOTS

Band LTE41 20MHz 16QAM	 Band LTE41 20MHz EM 16QAM 1RB.gif	 Band LTE41 20MHz EM 16QAM FRB.gif

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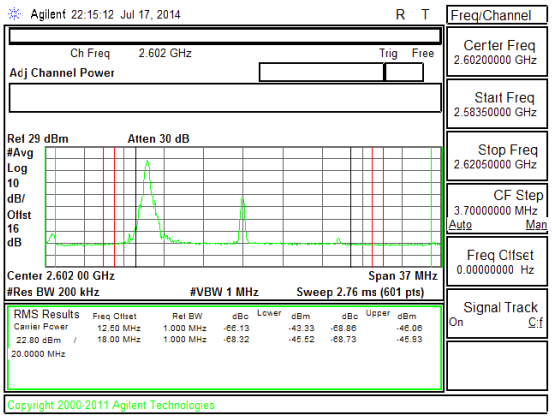
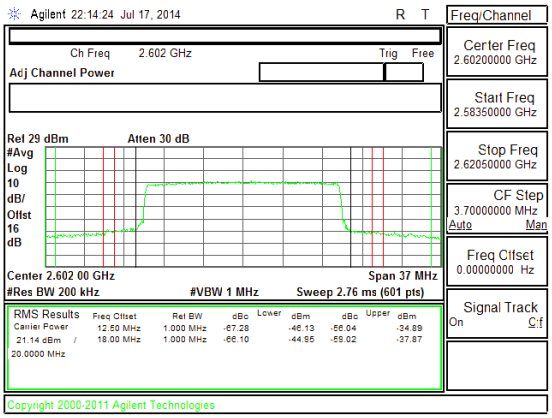
Band LTE41 20MHz QPSK	 Band LTE41 20MHz EM QPSK 1RB.gif	 Band LTE41 20MHz EM QPSK FRB.gif

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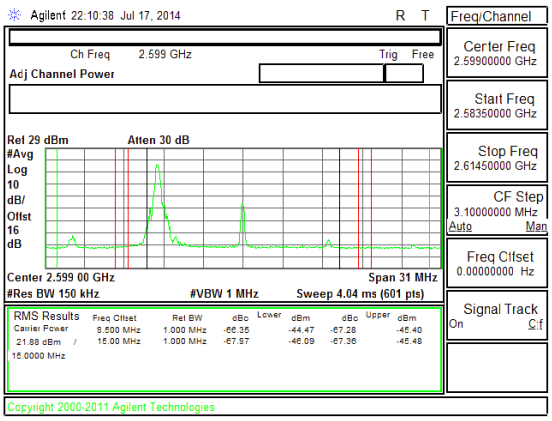
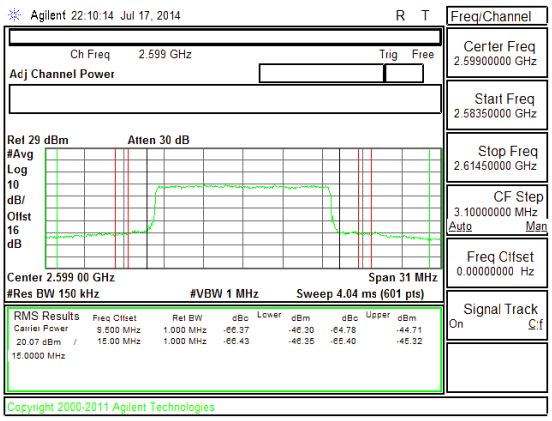
Band LTE41 15MHz 16QAM

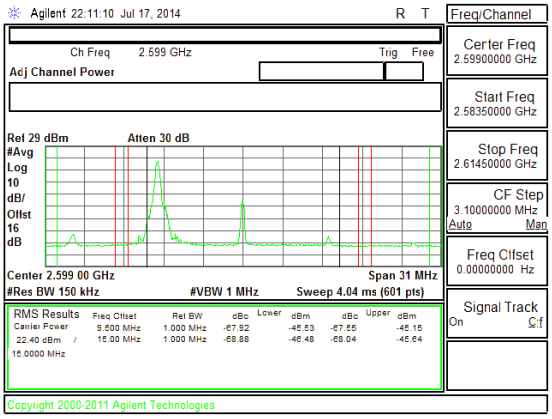


Band LTE41 15MHz EM 16QAM 1RB.gif

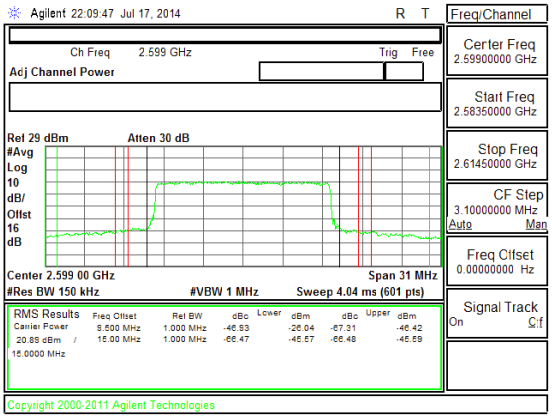


Band LTE41 15MHz EM 16QAM FRB.gif

Band LTE41 15MHz QPSK



Band LTE41 15MHz EM QPSK 1RB.gif



Band LTE41 15MHz EM QPSK FRB.gif

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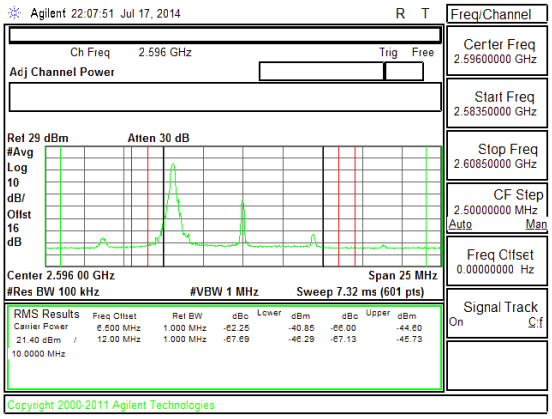
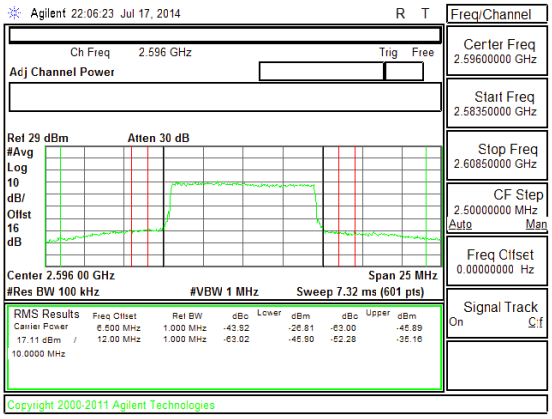
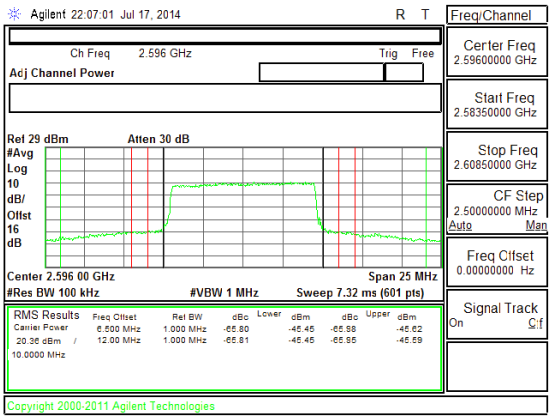
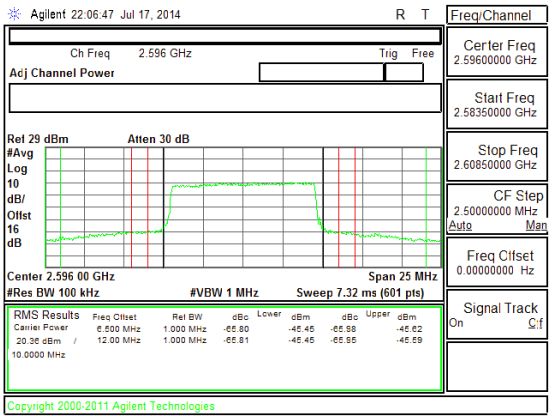
Band LTE41 10MHz 16QAM	 Band LTE41 10MHz EM 16QAM 1RB.gif	 Band LTE41 10MHz EM 16QAM FRB.gif
Band LTE41 10MHz QPSK	 Band LTE41 10MHz EM QPSK 1RB.gif	 Band LTE41 10MHz EM QPSK FRB.gif

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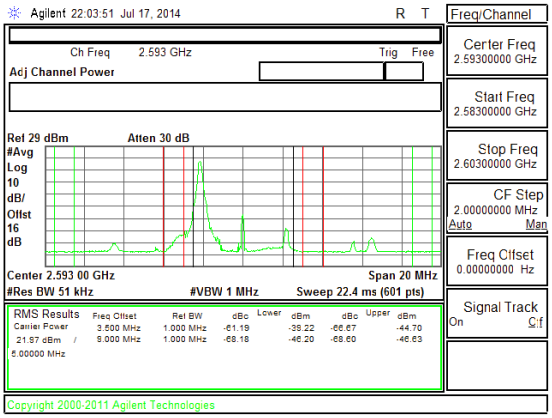
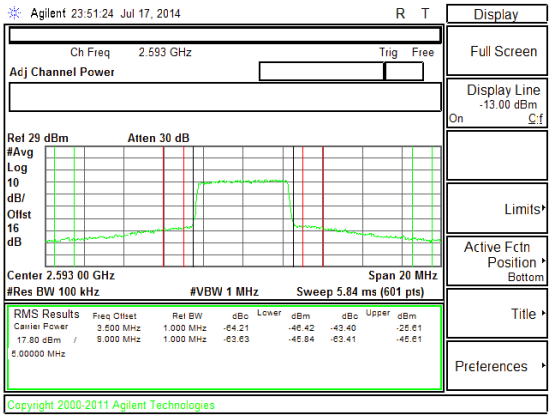
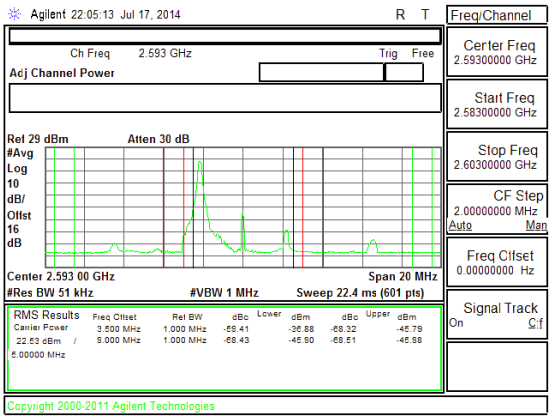
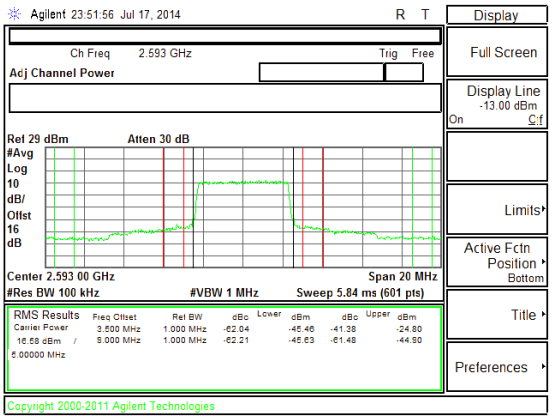
Band LTE41 5MHz 16QAM	 Band LTE41 5MHz EM 16QAM Mid Channel 1RB.gif	 Band LTE41 5MHz EM 16QAM Mid Channel FRB.gif
Band LTE41 5MHz QPSK	 Band LTE41 5MHz EM QPSK Mid Channel 1RB.gif	 Band LTE41 5MHz EM QPSK Mid Channel FRB.gif

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10.3. OUT OF BAND EMISSIONS

RULE PART(S)

FCC: §2.1051, §22.901, §22.917, §24.238 and §27

LIMITS

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.

TEST PROCEDURE

Per KDB 971168 D01 Power Meas License Digital Systems v02r01

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

RESULTS

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10.3.1. OUT OF BAND EMISSIONS RESULT

Band	BW (MHz)	Mode	f (MHz)	Spur (dBm)	Spec (dBm)	Delta (dB)
LTE41	20	QPSK	2506	-28.30	-25	-3.3
			2593	-27.46	-25	-2.46
			2680	-27.91	-25	-2.91
		16QAM	2506	-26.85	-25	-1.85
			2593	-26.12	-25	-1.12
			2680	-27.54	-25	-2.54

Band	BW (MHz)	Mode	f (MHz)	Spur (dBm)	Spec (dBm)	Delta (dB)
LTE41	15	QPSK	2503.5	-27.72	-25	-2.72
			2593	-26.32	-25	-1.32
			2682.5	-28.47	-25	-3.47
		16QAM	2503.5	-27.33	-25	-2.33
			2593	-26.41	-25	-1.41
			2682.5	-26.96	-25	-1.96

Band	BW (MHz)	Mode	f (MHz)	Spur (dBm)	Spec (dBm)	Delta (dB)
LTE41	10	QPSK	2501	-26.53	-25	-1.53
			2593	-27.13	-25	-2.13
			2685	-27.77	-25	-2.77
		16QAM	2501	-27.11	-25	-2.11
			2593	-25.71	-25	-0.71
			2685	-26.35	-25	-1.35

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Band	BW (MHz)	Mode	f (MHz)	Spur (dBm)	Spec (dBm)	Delta (dB)
LTE41	5	QPSK	2498.5	-26.99	-25	-1.99
			2593	-26.44	-25	-1.44
			2687.5	-26.03	-25	-1.03
		16QAM	2498.5	-26.04	-25	-1.04
			2593	-25.95	-25	-0.95
			2687.5	-27.65	-25	-2.65

Band	Mode	f (MHz)	Spur (dBm)	Spec (dBm)	Delta (dB)
GSM850	GMSK	824.2			
		836.6			
		848.8			
	GPRS	824.2	-24.88	-13	-11.88
		836.6	-25.15	-13	-12.15
		848.8	-25.73	-13	-12.73
	EGPRS	824.2	-24.05	-13	-11.05
		836.6	-25.57	-13	-12.57
		848.8	-24.32	-13	-11.32
GSM1900	GMSK	1850.2			
		1880			
		1909.8			
	GPRS	1850.2	-25.4	-13	-12.4
		1880	-24.87	-13	-11.87
		1909.8	-25.59	-13	-12.59
	EGPRS	1850.2	-25.43	-13	-12.43
		1880	-24.12	-13	-11.12
		1909.8	-24.4	-13	-11.4

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Band	Mode	f (MHz)	Spur (dBm)	Spec (dBm)	Delta (dB)
Band 5	REL99	826.4	-25.43	-13	-12.43
		836.6	-24.4	-13	-11.4
		846.6	-25.54	-13	-12.54
	HSDPA	826.4	-24.61	-13	-11.61
		836.6	-25.28	-13	-12.28
		846.6	-25.22	-13	-12.22
Band 2	REL99	1852.4	-25.65	-13	-12.65
		1880	-26.03	-13	-13.03
		1907.6	-24.99	-13	-11.99
	HSDPA	1852.4	-24.88	-13	-11.88
		1880	-23.8	-13	-10.8
		1907.6	-25.55	-13	-12.55

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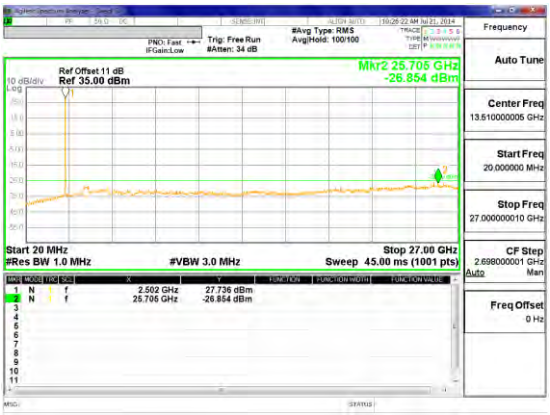
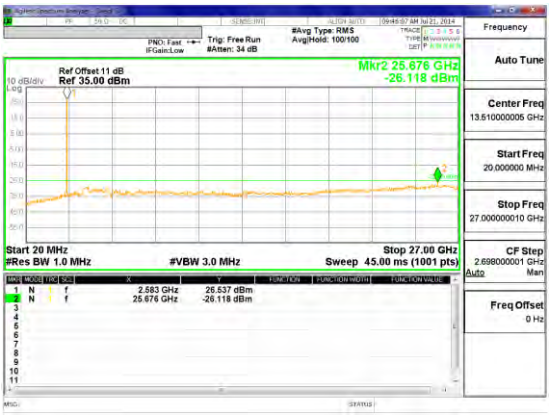
10.3.2. OUT OF BAND EMISSIONS PLOTS

Band LTE41 20MHz 16QAM	 Band LTE41 20MHz CSE 16QAM Low channel	 Band LTE41 20MHz CSE 16QAM Mid channel

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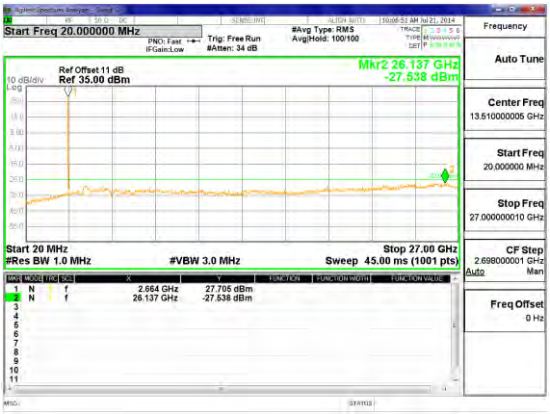
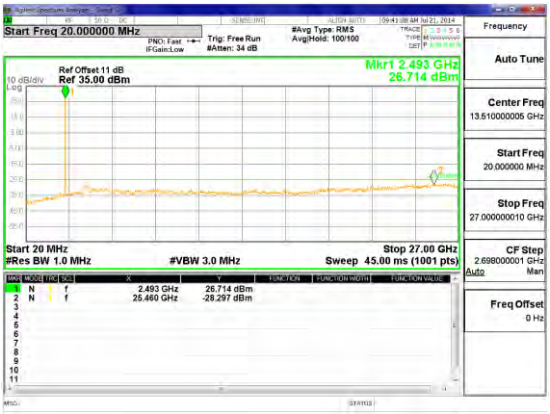
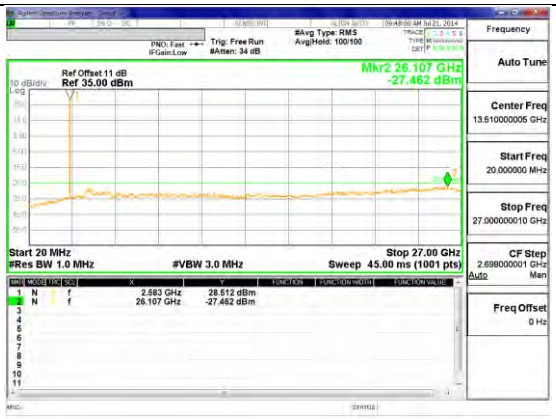
Band LTE41 20MHz 16QAM	 Band LTE41 20MHz CSE 16QAM High channel	 Band LTE41 20MHz CSE QPSK Low channel
Band LTE41 20MHz QPSK	 Band LTE41 20MHz CSE QPSK Mid channel	 Band LTE41 20MHz CSE QPSK High channel

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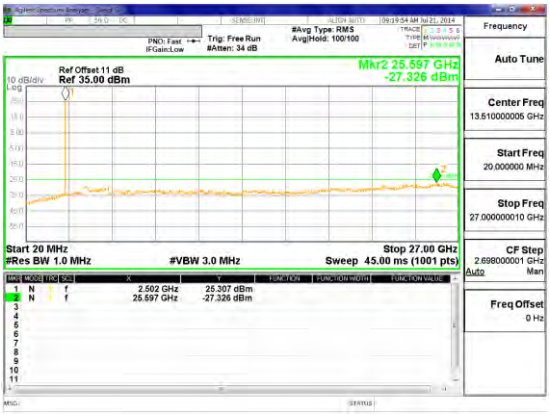
Band LTE41 15MHz 16QAM	 Band LTE41 15MHz CSE 16QAM Low channel	 Band LTE41 15MHz CSE 16QAM Mid channel

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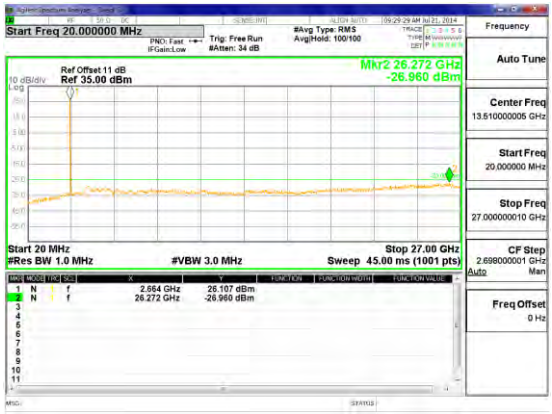
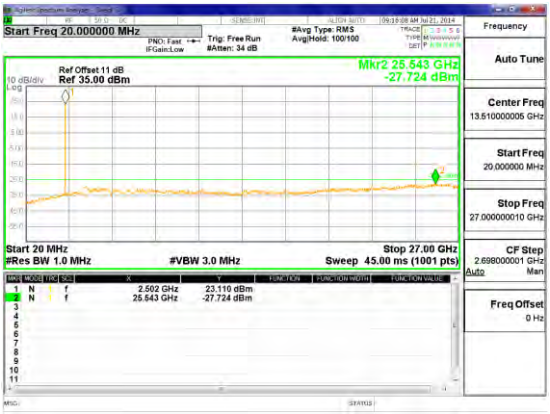
Band LTE41 15MHz 16QAM	 Band LTE41 15MHz CSE 16QAM High channel	 Band LTE41 15MHz CSE QPSK Low channel
Band LTE41 15MHz QPSK	 Band LTE41 15MHz CSE QPSK Mid channel	 Band LTE41 15MHz CSE QPSK High channel

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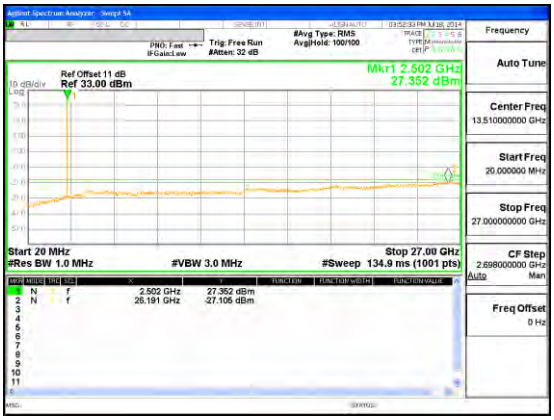
Band LTE41 10MHz 16QAM	 Band LTE41 10MHz CSE 16QAM Low channel	 Band LTE41 10MHz CSE 16QAM Mid channel

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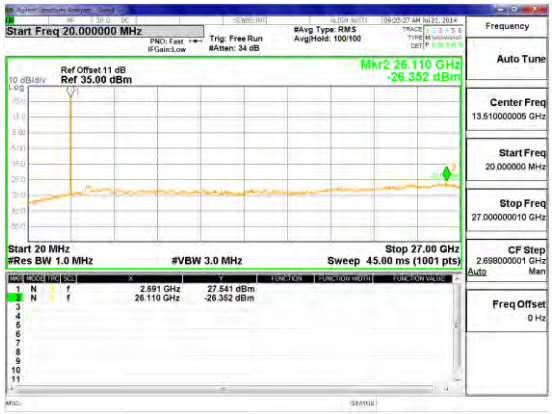
Band LTE41 10MHz 16QAM	 Band LTE41 10MHz CSE 16QAM High channel	 Band LTE41 10MHz CSE QPSK Low channel
Band LTE41 10MHz QPSK	 Band LTE41 10MHz CSE QPSK Mid channel	 Band LTE41 10MHz CSE QPSK High channel

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Band LTE41 5MHz 16QAM	 Band LTE41 5MHz CSE 16QAM Low channel	 Band LTE41 5MHz CSE 16QAM Mid channel

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Band LTE41 5MHz 16QAM	 Band LTE41 5MHz CSE 16QAM High channel	 Band LTE41 5MHz CSE QPSK Low channel
Band LTE41 5MHz QPSK	 Band LTE41 5MHz CSE QPSK Mid channel	 Band LTE41 5MHz CSE QPSK High channel

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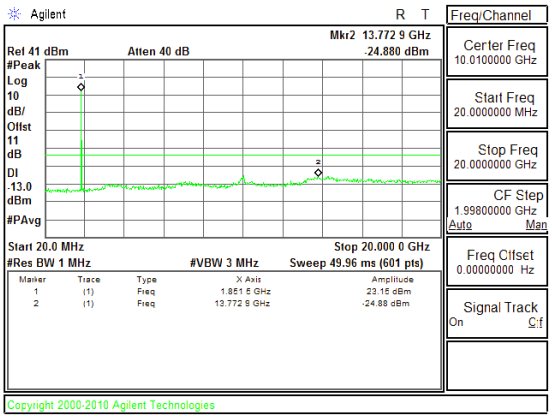
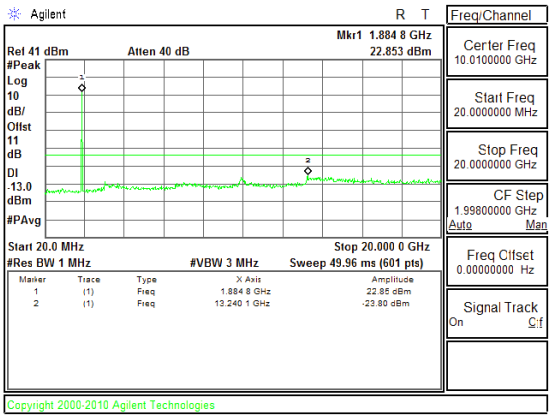
Band Band 2 HSDPA	 Band WCDMA B2 HSDPA CSE	 Band WCDMA B2 HSDPA CSE

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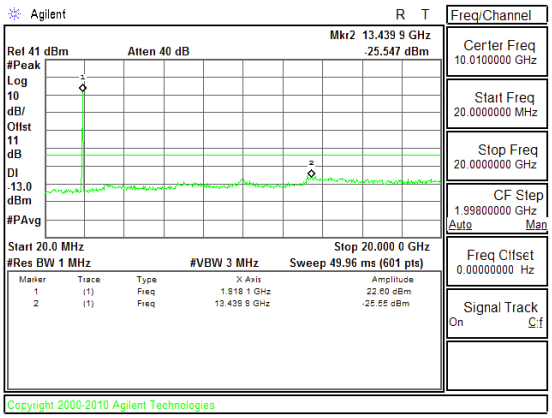
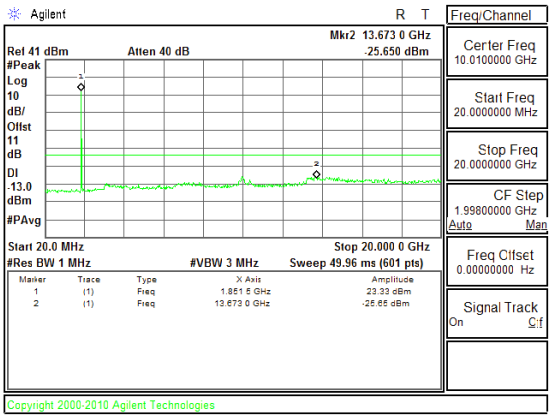
Band

Band 2

HSDPA



Band WCDMA B2 HSDPA CSE

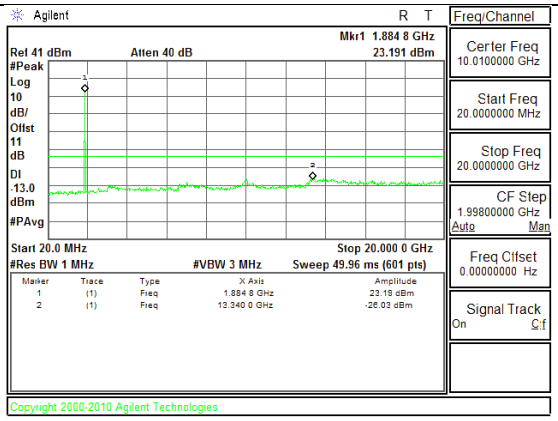


Band WCDMA B2 REL99 CSE

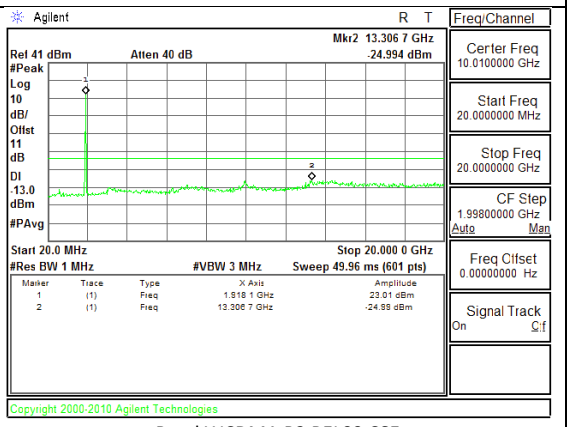
Band

Band 2

REL99



Band WCDMA B2 REL99 CSE



Band WCDMA B2 REL99 CSE

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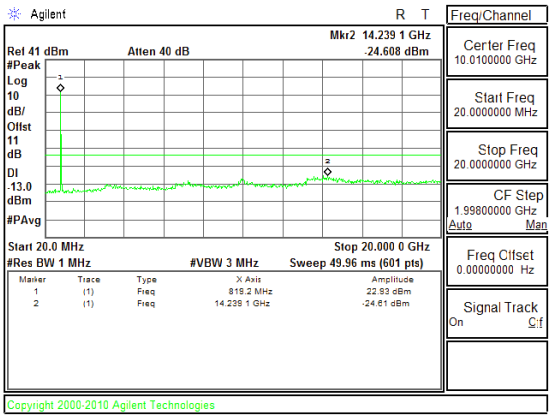
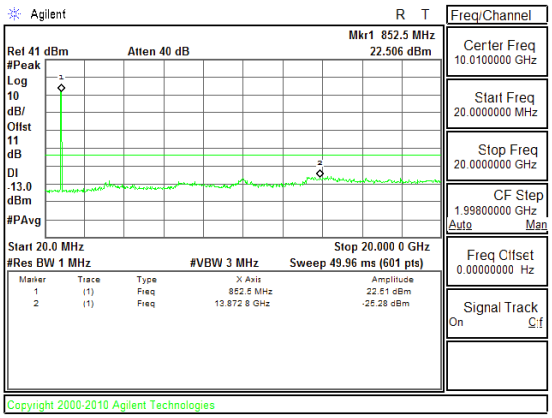
Band Band 5 HSDPA	 Band WCDMA B5 HSDPA CSE	 Band WCDMA B5 HSDPA CSE

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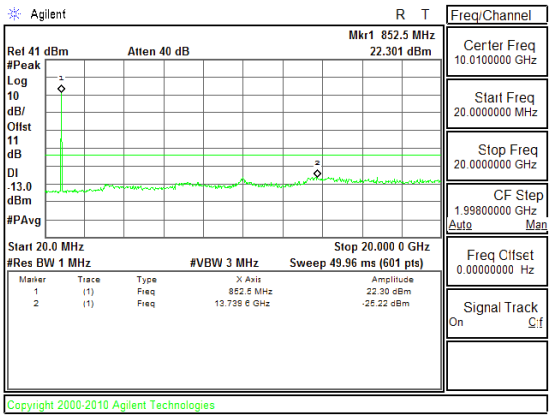
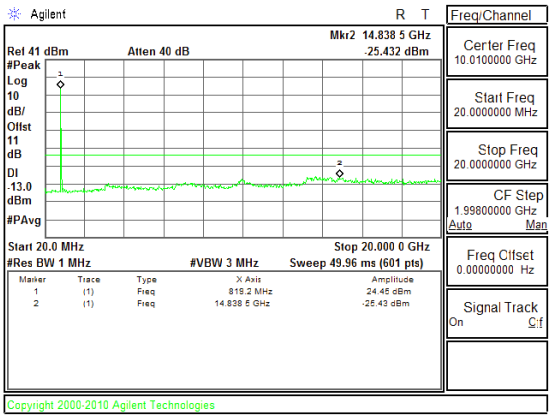
Band

Band 5

HSDPA



Band WCDMA B5 HSDPA CSE

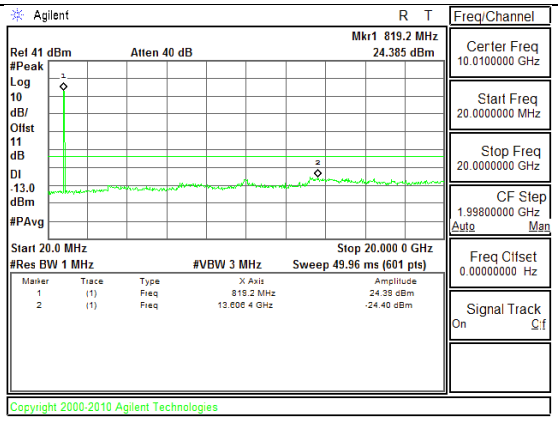


Band WCDMA B5 REL99 CSE

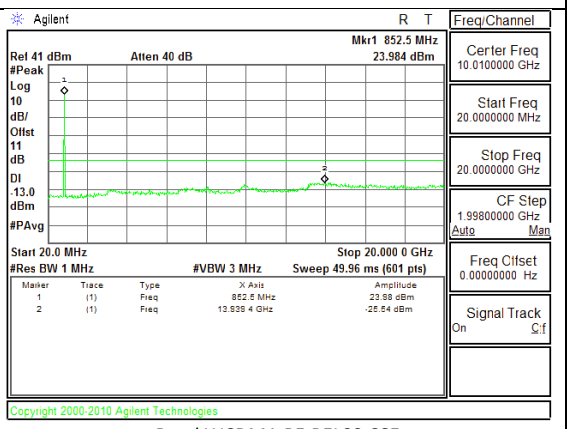
Band

Band 5

REL99



Band WCDMA B5 REL99 CSE



Band WCDMA B5 REL99 CSE

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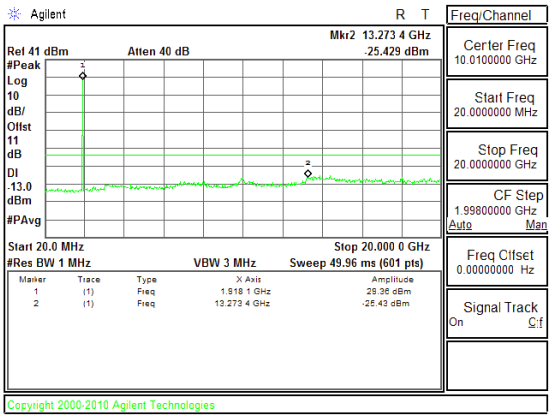
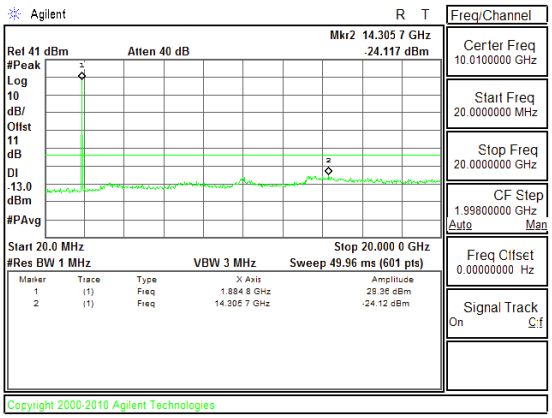
Band GSM1900 EGPRS	 Band GSM1900 EGPRS CSE Low channel	 Band GSM1900 EGPRS CSE Mid channel

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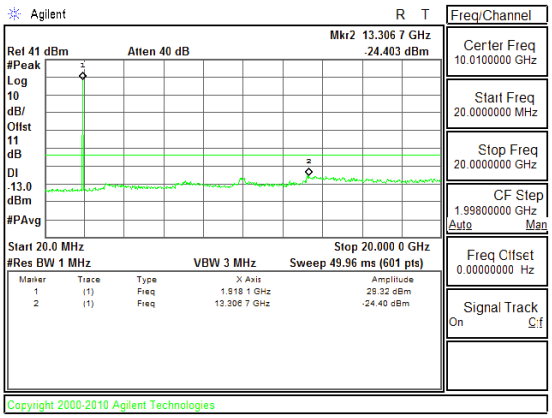
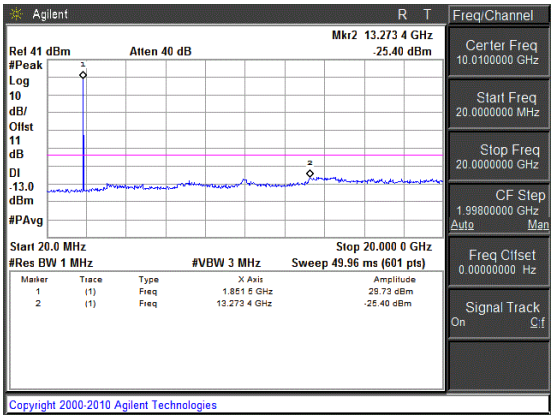
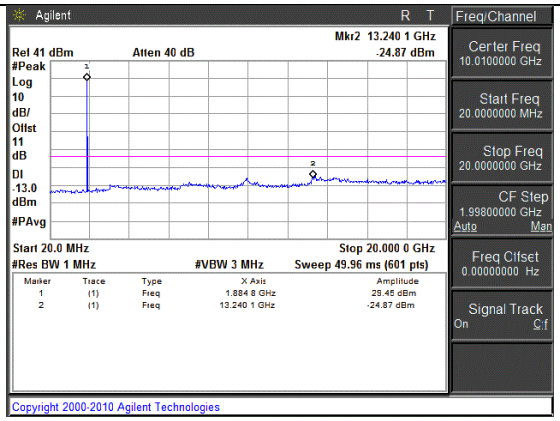
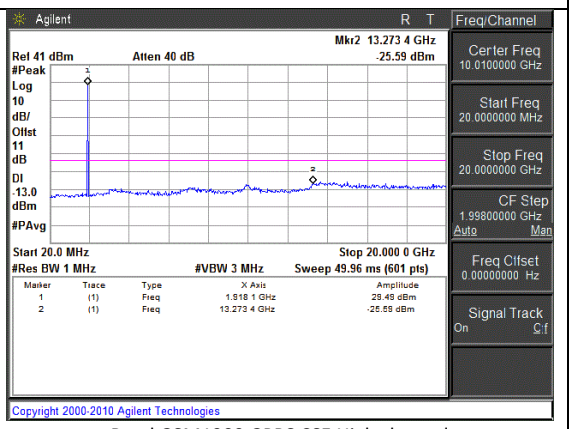
Band GSM1900 EGPRS	 Band GSM1900 EGPRS CSE High channel	 Band GSM1900 GPRS CSE Low channel
Band GSM1900 GPRS	 Band GSM1900 GPRS CSE Mid channel	 Band GSM1900 GPRS CSE High channel

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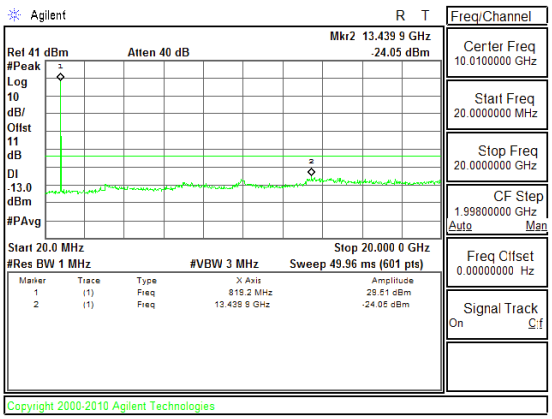
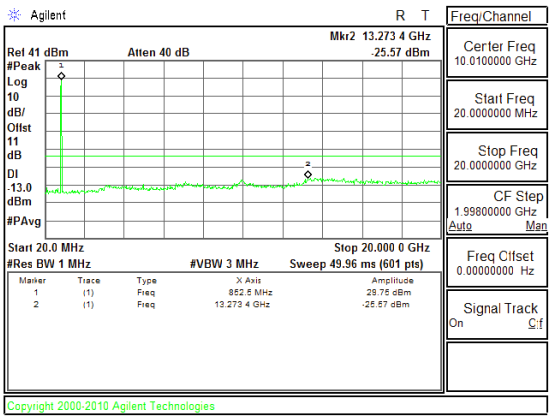
Band GSM850 EGPRS

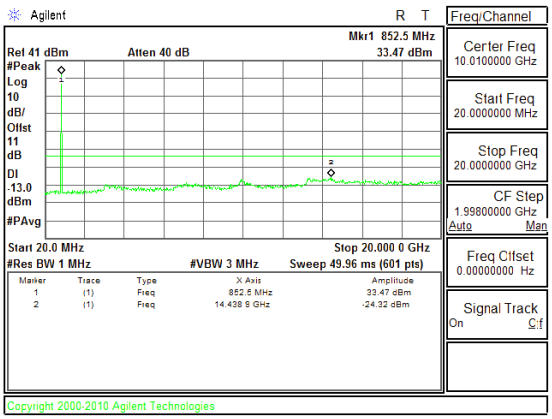


Band GSM850 EGPRS CSE Low channel

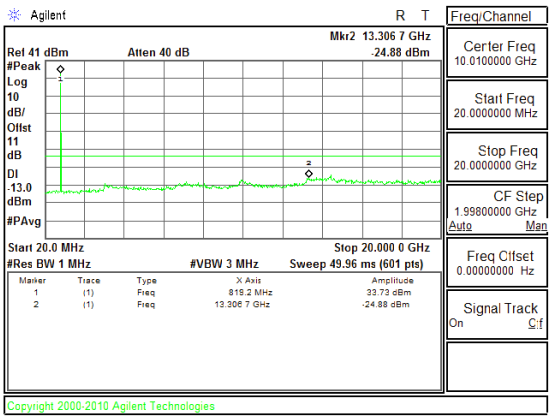


Band GSM850 EGPRS CSE Mid channel

Band GSM850 EGPRS



Band GSM850 EGPRS CSE High channel



Band GSM850 GPRS CSE Low channel

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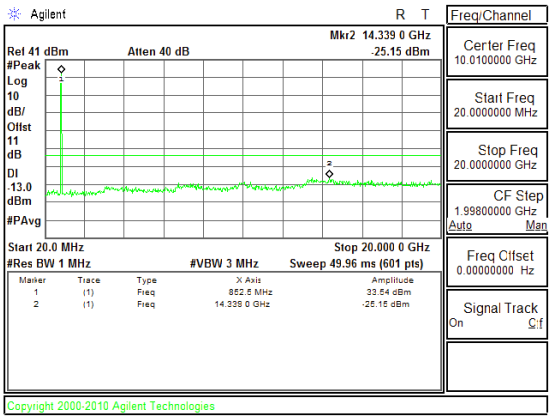
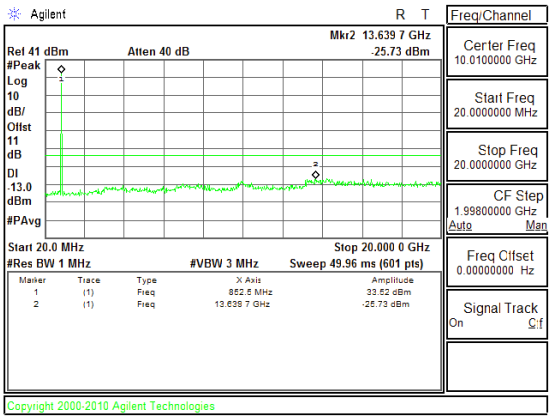
Band

GSM850

GPRS



Band GSM850 GPRS CSE Mid channel



Band GSM850 GPRS CSE High channel

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10.4. FREQUENCY STABILITY

RULE PART(S)

FCC: §2.1055, §22.355, §24.235, and §27.54

LIMITS

§22.355 - The carrier frequency shall not depart from the reference frequency in excess of ±2.5 ppm for mobile stations.

§24.235 - The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

§27.54 - The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

TEST PROCEDURE

Per KDB 971168 D01 Power Meas License Digital Systems v02r01

RESULTS

See the following pages.

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10.4.1. FREQUENCY STABILITY RESULTS

LTE 41 Frequency Stability

Reference Frequency: Cellular Mid Channel 2593.000012 MHz @ 20°C Limit: to stay +- 2.5 ppm = 6482.500 Hz				
Power Supply (Vdc)	Environment Temperature (°C)	Frequency Deviation Measureed with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
3.80	50	2592.999985	0.000	2.5
3.80	40	2592.999987	-0.001	2.5
3.80	30	2592.999988	-0.001	2.5
3.80	***20***	***2592.999985***	***0***	***2.5***
3.80	10	2592.999981	0.002	2.5
3.80	0	2592.999984	0.000	2.5
3.80	-10	2592.999984	0.000	2.5
3.80	-20	2592.999984	0.000	2.5
3.80	-30	2592.999986	-0.001	2.5

Reference Frequency: Cellular Mid Channel 2535.000012 MHz @ 20°C Limit: to stay +- 2.5 ppm = 6482.500 Hz				
Power Supply (Vdc)	Environment Temperature (°C)	Frequency Deviation Measureed with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
3.80	***20***	***2592.999985***	***0***	***2.5***
4.30	20	2592.999988	*-0.001*	2.5
3.40	20	2592.999985	*0.000*	2.5

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BAND V, Channel 4183, Freq: 836.6MHz – MID CHANNEL

Reference Frequency: Cell Mid Channel 836.6 MHz @ 20ºC Limit: +- 2.5 ppm = 2091.500 Hz				
Power Supply (Vdc)	Environment Temperature (*C)	Frequency Deviation Measureed with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
3.80	50	836.600002	0.000	2.5
3.80	40	836.599997	0.007	2.5
3.80	30	836.600004	-0.001	2.5
3.80	***20***	***836.600003***	***0***	***2.5***
3.80	10	836.599997	0.006	2.5
3.80	0	836.599999	0.004	2.5
3.80	-10	836.599995	0.009	2.5
3.80	-20	836.600002	0.001	2.5
3.80	-30	836.599997	0.006	2.5

Reference Frequency: Mid Channel 836.6 MHz @ 20ºC Limit: +- 2.5 ppm = 2091.500 Hz				
Power Supply (Vdc)	Environment Temperature (*C)	Frequency Deviation Measureed with Time Elapse		
			Delta (ppm)	Limit (ppm)
3.80	***20***	***836.600003***	***0.00000***	***2.5***
4.30	20	836.599997	*0.00686*	2.5
3.40	20	836.600003	*0.00001*	2.5

BAND II, Channel 9400 Freq: 1880MHz– MID CHANNEL

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Power Supply (Vdc)	Environment Temperature (°C)	Frequency Deviation Measureed with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
3.80	50	1880.000007	0.001	2.5
3.80	40	1880.000006	0.001	2.5
3.80	30	1880.000007	0.000	2.5
3.80	***20***	***1880.000008***	***0***	***2.5***
3.80	10	1880.000006	0.001	2.5
3.80	0	1880.000006	0.001	2.5
3.80	-10	1880.000007	0.000	2.5
3.80	-20	1880.000006	0.001	2.5
3.80	-30	1880.000009	0.000	2.5

Reference Frequency: PCS Mid Channel 1880 MHz @ 20°C Limit: to stay +- 2.5 ppm = 4700.000 Hz				
Power Supply (Vdc)	Environment Temperature (°C)	Frequency Deviation Measureed with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
3.80	***20***	***1880.000008***	***0***	***2.5***
4.30	20	1880.000005	*0.002*	2.5
3.40	20	1880.000008	*0.000*	2.5

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11. RADIATED TEST RESULTS

11.1. RADIATED POWER (ERP & EIRP)

RULE PART(S)

FCC: §2.1046, §22.913, §24.232, and § 27

LIMITS

22.913(a) - The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

24.232(c) - Mobile/portable stations are limited to 2 watts e.i.r.p. peak power and the equipment must employ means to limit the power to the minimum necessary for successful communications.

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

TEST PROCEDURE

ANSI / TIA / EIA 603C Clause 2.2.17

TEST RESULTS

11.1.1. ERP/EIRP Results

Band	Mode	Channel	f(MHz)	ERP / EIRP	
				dBm	mW
Band 2	REL99	9262	1852.4	23.0	201.35
		9400	1880	23.4	218.78
		9538	1907.6	22.3	168.81
	HSDPA	9262	1852.4	21.5	140.93
		9400	1880	20.3	106.41
		9538	1907.6	21.7	147.91

Band	Mode	Channel	f(MHz)	ERP / EIRP	
				dBm	mW
Band 5	REL99	4132	826.4	19.2	82.62
		4183	836.6	19.5	88.13
		4233	846.6	20.7	117.49
	HSDPA	4132	826.4	17.6	57.54

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		4183	836.6	17.3	53.94
		4233	846.6	16.9	49.4

Band	Mode	Channel	f(MHz)	ERP / EIRP	
				dBm	mW
GSM1900	GPRS	512	1850.2	28.29	674.53
		661	1880	26.6	457.09
		810	1909.8	28.03	635.33
	EGPRS	512	1850.2	25.2	331.1
		661	1880	25.07	321.37
		810	1909.8	23.6	229.1

Band	Mode	Channel	f(MHz)	ERP / EIRP	
				dBm	mW
GSM850	GPRS	128	824.2	28.9	776.25
		190	836.6	27.9	611.22
		251	848.8	27.9	620.01
	EGPRS	128	824.2	25.4	346.74
		190	836.6	24.1	255.8
		251	848.8	25.2	328.25

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11.1.2. LTE ERP/EIRP Results

Band	BW (MHz)	Mode	RB/RB Size	f (MHz)	ERP / EIRP	
					dBm	mW
LTE41	20	QPSK	1/0	2506	17.3	53.7
			1/0	2593	16.4	44.06
			1/0	2680	14	25.12
		16QAM	1/0	2506	16.7	46.8
			1/0	2593	15.9	39.17
			1/0	2680	12.9	19.59

Band	BW (MHz)	Mode	RB/RB Size	f (MHz)	ERP / EIRP	
					dBm	mW
LTE41	15	QPSK	1/0	2503.5	17.1	51.3
			1/0	2593	15.21	33.19
			1/0	2682.5	13.89	24.49
		16QAM	1/0	2503.5	16.3	42.7
			1/0	2593	14.69	29.44
			1/0	2682.5	13.62	23.01

Band	BW (MHz)	Mode	RB/RB Size	f (MHz)	ERP / EIRP	
					dBm	mW
LTE41	10	QPSK	1/0	2501	15.82	38.19
			1/0	2593	16.1	40.7
			1/0	2685	15.97	39.54
		16QAM	1/0	2501	15.04	31.92
			1/0	2593	15.2	33.1
			1/0	2685	15.2	33.1

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Band	BW (MHz)	Mode	RB/RB Size	f (MHz)	ERP / EIRP	
					dBm	mW
LTE41	5	QPSK	1/0	2498.5	16.26	42.27
			1/0	2593	16.8	47.9
			1/0	2687.5	15.97	39.54
		16QAM	1/0	2498.5	15.96	39.45
			1/0	2593	16.4	43.7
			1/0	2687.5	15.05	31.99

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11.1.3. ERP/EIRP DATA

Band

LTE41

20MHz

16QAM

High Frequency Substitution Measurement
UL Verification Services, Inc. Chamber C

Company: Samsung
Project #: 14U18322
Date: 07/18/14
Test Engineer: E. Black, T. Oeur
Configuration: EUT ONLY, Y Position
Mode: LTE 41_20MHz_16QAM

Test Equipment:
Receiving: Horn T119, and Chamber C SMA Cables
Substitution: Horn T345 Substitution, 4ft SMA Cable Warehouse

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Notes
Low Ch								
2506.00	11.90	V	0.9	5.7	16.70	33.0	-16.3	
2506.00	7.42	H	0.9	5.7	12.22	33.0	-20.8	
Mid Ch								
2593.00	10.83	V	0.9	6.0	15.93	33.0	-17.1	
2593.00	6.85	H	0.9	6.0	11.95	33.0	-21.1	
High Ch								
2680.00	7.22	V	0.9	6.6	12.92	33.0	-20.1	
2680.00	6.74	H	0.9	6.6	12.44	33.0	-20.6	

Rev. 3.17.11
Note: For Band 4 EIRP limit is 30dBm

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Band

LTE41

20MHz

QPSK

High Frequency Substitution Measurement
UL Verification Services, Inc. Chamber C

Company: Samsung
Project #: 14U18322
Date: 07/18/14
Test Engineer: E. Black, T. Oeur
Configuration: EUT ONLY, Y Position
Mode: LTE 41_20MHz_QPSK

Test Equipment:
Receiving: Horn T119, and Chamber C SMA Cables
Substitution: Horn T345 Substitution, 4ft SMA Cable Warehouse

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Notes
Low Ch								
2506.00	12.53	V	0.9	5.7	17.33	33.0	-15.7	
2506.00	8.43	H	0.9	5.7	13.23	33.0	-19.8	
Mid Ch								
2593.00	11.34	V	0.9	6.0	16.44	33.0	-16.6	
2593.00	7.34	H	0.9	6.0	12.44	33.0	-20.6	
High Ch								
2680.00	8.30	V	0.9	6.6	14.00	33.0	-19.0	
2680.00	8.16	H	0.9	6.6	13.86	33.0	-19.1	

Rev. 3.17.11
Note: For Band 4 EIRP limit is 30dBm

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Band

LTE41

15MHz

16QAM

High Frequency Substitution Measurement
UL Verification Services, Inc. Chamber C

Company: Samsung
Project #: 14U18322
Date: 07/18/14
Test Engineer: E. Black, T. Oeur
Configuration: EUT ONLY, Y Position
Mode: LTE 41_15MHz_16QAM

Test Equipment:
Receiving: Horn T119, and Chamber C SMA Cables
Substitution: Horn T345 Substitution, 4ft SMA Cable Warehouse

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Notes
Low Ch								
2503.50	11.48	V	0.9	5.7	16.28	33.0	-16.7	
2503.50	6.52	H	0.9	5.7	11.32	33.0	-21.7	
Mid Ch								
2593.00	9.59	V	0.9	6.0	14.69	33.0	-18.3	
2593.00	7.94	H	0.9	6.0	13.04	33.0	-20.0	
High Ch								
2682.50	7.92	V	0.9	6.6	13.62	33.0	-19.4	
2682.50	6.77	H	0.9	6.6	12.47	33.0	-20.5	

Rev. 3.17.11
Note: For Band 4 EIRP limit is 30dBm

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Band

LTE41

15MHz

QPSK

High Frequency Substitution Measurement
UL Verification Services, Inc. Chamber C

Company: Samsung
Project #: 14U18322
Date: 07/18/14
Test Engineer: E. Black, T. Oeur
Configuration: EUT ONLY, Y Position
Mode: LTE 41_15MHz_QPSK

Test Equipment:
Receiving: Horn T119, and Chamber C SMA Cables
Substitution: Horn T345 Substitution, 4ft SMA Cable Warehouse

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Notes
Low Ch								
2503.50	12.34	V	0.9	5.7	17.14	33.0	-15.9	
2503.50	6.83	H	0.9	5.7	11.63	33.0	-21.4	
Mid Ch								
2593.00	10.11	V	0.9	6.0	15.21	33.0	-17.8	
2593.00	7.76	H	0.9	6.0	12.86	33.0	-20.1	
High Ch								
2682.50	8.19	V	0.9	6.6	13.89	33.0	-19.1	
2682.50	7.44	H	0.9	6.6	13.14	33.0	-19.9	

Rev. 3.17.11
Note: For Band 4 EIRP limit is 30dBm

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Band

LTE41

10MHz

16QAM

High Frequency Substitution Measurement
UL Verification Services, Inc. Chamber C

Company: Samsung
Project #: 14U18322
Date: 07/18/14
Test Engineer: E. Black, T. Oeur
Configuration: EUT ONLY, Y Position
Mode: LTE 41_10MHz_16QAM

Test Equipment:
Receiving: Horn T119, and Chamber C SMA Cables
Substitution: Horn T345 Substitution, 4ft SMA Cable Warehouse

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Notes
Low Ch								
2501.00	10.24	V	0.9	5.7	15.04	33.0	-18.0	
2501.00	8.57	H	0.9	5.7	13.37	33.0	-19.6	
Mid Ch								
2593.00	10.12	V	0.9	6.0	15.22	33.0	-17.8	
2593.00	8.67	H	0.9	6.0	13.77	33.0	-19.2	
High Ch								
2685.00	9.55	V	0.9	6.6	15.25	33.0	-17.8	
2685.00	7.25	H	0.9	6.6	12.95	33.0	-20.1	

Rev. 3.17.11
Note: For Band 4 EIRP limit is 30dBm

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Band

LTE41

10MHz

QPSK

High Frequency Substitution Measurement
UL Verification Services, Inc. Chamber C

Company: Samsung
Project #: 14U18322
Date: 07/18/14
Test Engineer: E. Black, T. Oeur
Configuration: EUT ONLY, Y Position
Mode: LTE 41_10MHz_QPSK

Test Equipment:
Receiving: Horn T119, and Chamber C SMA Cables
Substitution: Horn T345 Substitution, 4ft SMA Cable Warehouse

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Notes
Low Ch								
2501.00	11.02	V	0.9	5.7	15.82	33.0	-17.2	
2501.00	9.36	H	0.9	5.7	14.16	33.0	-18.8	
Mid Ch								
2593.00	10.97	V	0.9	6.0	16.07	33.0	-16.9	
2593.00	9.61	H	0.9	6.0	14.71	33.0	-18.3	
High Ch								
2685.00	10.27	V	0.9	6.6	15.97	33.0	-17.0	
2685.00	8.01	H	0.9	6.6	13.71	33.0	-19.3	

Rev. 3.17.11
Note: For Band 4 EIRP limit is 30dBm

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Band

LTE41

5MHz

16QAM

High Frequency Substitution Measurement
UL Verification Services, Inc. Chamber C

Company: Samsung
Project #: 14u18322
Date: 07/18/14
Test Engineer: Jude Semana
Configuration: EUT only, Y-position
Mode: LTE41 5MHz 16QAM

Test Equipment:
Receiving: Horn T119, and Chamber C SMA Cables
Substitution: Horn T217 Substitution, 4ft SMA Cable Warehouse

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Note
Low Ch								
2498.50	11.16	V	0.9	5.7	15.96	33.0	-17.0	
2498.50	9.41	H	0.9	5.7	14.21	33.0	-18.8	
Mid Ch								
2593.00	11.29	V	0.9	6.0	16.39	33.0	-16.6	
2593.00	8.75	H	0.9	6.0	13.85	33.0	-19.2	
High Ch								
2687.50	9.35	V	0.9	6.6	15.05	33.0	-18.0	
2687.50	7.86	H	0.9	6.6	13.56	33.0	-19.4	

Rev. 3.17.11
Note: For Band 4 EIRP limit is 30dBm

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Band

LTE41

5MHz

QPSK

High Frequency Substitution Measurement
UL Verification Services, Inc. Chamber C

Company: Samsung
Project #: 14u18322
Date: 07/18/14
Test Engineer: Jude Semana
Configuration: EUT only, Y-position
Mode: LTE41 5MHz 1 QPSK

Test Equipment:
Receiving: Horn T119, and Chamber C SMA Cables
Substitution: Horn T217 Substitution, 4ft SMA Cable Warehouse

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Note
Low Ch								
2498.50	11.46	V	0.9	5.7	16.26	33.0	-16.7	
2498.50	10.11	H	0.9	5.7	14.91	33.0	-18.1	
Mid Ch								
2593.00	11.69	V	0.9	6.0	16.79	33.0	-16.2	
2593.00	9.85	H	0.9	6.0	14.95	33.0	-18.1	
High Ch								
2687.50	10.27	V	0.9	6.6	15.97	33.0	-17.0	
2687.50	9.16	H	0.9	6.6	14.86	33.0	-18.1	

Rev. 3.17.11
Note: For Band 4 EIRP limit is 30dBm

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Band

Band 2

HSDPA

High Frequency Substitution Measurement
Compliance Certification Services Chamber C

Company: Samsung
Project #: 14U18322
Date: 07/17/14
Test Engineer: E. Lee M. Zarin
Configuration: EUT ONLY, X Position
Mode: HSDPA 1900MHZ

Test Equipment:
Receiving: Horn T136, and Chamber A SMA Cables
Substitution:Horn T72 Substitution, 4ft SMA Cable Warehouse

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Notes
Low Ch								
1852.40	9.06	V	0.85	8.6	16.81	33.0	-16.2	
1852.40	13.74	H	0.85	8.6	21.49	33.0	-11.5	
Mid Ch								
1880.00	6.06	V	0.85	8.6	13.81	33.0	-19.2	
1880.00	12.52	H	0.85	8.6	20.27	33.0	-12.7	
High Ch								
1907.60	6.05	V	0.85	8.4	13.60	33.0	-19.4	
1907.60	14.19	H	0.85	8.4	21.74	33.0	-11.3	

Rev. 3.17.11
Note: For Band 4 EIRP limit is 30dBm

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Band

Band 2

REL99

High Frequency Substitution Measurement
Compliance Certification Services Chamber A

Company: Samsung
Project #: 14U18322
Date: 07/17/14
Test Engineer: E. Black, T. Oeur
Configuration: EUT ONLY, X Position
Mode: REL99 1900 MHz

Test Equipment:
Receiving: Horn T130, and Chamber C SMA Cables
Substitution: Dipole S/N: 00022117, 4ft SMA Cable (SN # 245200 001) Warehouse.

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Notes
Low Ch								
1852.40	11.49	V	0.85	7.89	18.53	33.0	-14.5	
1852.40	16.00	H	0.85	7.89	23.04	33.0	-10.0	
Mid Ch								
1880.00	11.51	V	0.85	7.87	18.53	33.0	-14.5	
1880.00	16.34	H	0.85	7.87	23.36	33.0	-9.6	
High Ch								
1907.60	8.01	V	0.85	7.88	15.04	33.0	-18.0	
1907.60	15.24	H	0.85	7.88	22.27	33.0	-10.7	

Rev. 3.17.11
Note: For Band 4 EIRP limit is 30dBm

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Company: Samsung
Project #: 14U18322
Date: 07/21/14
Test Engineer: K. Ros, N. Sheridan, S. Her
Configuration: EUT ONLY, X Position
Mode: HSDPA B5

Test Equipment:
Receiving: Hybrid T130, and Chamber A SMA Cables
Substitution: Dipole T416 Substitution, 4ft SMA Cable Warehouse

Band

Band 5

HSDPA

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)	Notes
Low Ch								
826.40	8.70	V	0.9	0.0	7.80	34.8	-27.0	
826.40	18.46	H	0.9	0.0	17.56	34.8	-17.2	
Mid Ch								
836.60	8.19	V	0.9	0.0	7.29	34.8	-27.5	
836.60	18.22	H	0.9	0.0	17.32	34.8	-17.5	
High Ch								
846.60	7.40	V	0.9	0.0	6.50	34.8	-28.3	
846.60	17.84	H	0.9	0.0	16.94	34.8	-17.8	

Rev. 3.17.11
Note: For Band 13/17 ERP limit is 34.77dBm; For Band 26 limit is 50dBm

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Band

Band 5

REL99

High Frequency Substitution Measurement
UL Verification Services, Inc. Chamber C

Company: Samsung
Project #: 14U18322
Date: 07/21/14
Test Engineer: K. Ros, N. Sheridan, S. Her
Configuration: EUT ONLY, X Position
Mode: REL99 850 MHz

Test Equipment:
Receiving: Hybrid T130, and Chamber A SMA Cables
Substitution: Dipole T416 Substitution, 4ft SMA Cable Warehouse

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)	Notes
Low Ch								
826.40	10.60	V	0.9	0.0	9.70	33.0	-23.3	
826.40	20.07	H	0.9	0.0	19.17	33.0	-13.8	
Mid Ch								
836.60	9.87	V	0.9	0.0	8.97	33.0	-24.0	
836.60	20.35	H	0.9	0.0	19.45	33.0	-13.5	
High Ch								
846.60	10.80	V	0.9	0.0	9.90	33.0	-23.1	
846.60	21.56	H	0.9	0.0	20.66	33.0	-12.3	

Rev. 3.17.11
Note: For Band 4 EIRP limit is 30dBm

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701I
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Band

GSM1900

EGPRS

High Frequency Substitution Measurement
UL Verification Services, Inc. Chamber C

Company: Samsung
Project #: 14U18322
Date: 7/21/2014
Test Engineer: K. Kedida
Configuration: EUT, X-position
Mode: EGPRS_1900

Test Equipment:
Receiving: Horn T119, and Chamber C SMA Cables
Substitution: Horn T217 Substitution, 4ft SMA Cable Warehouse

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Not
Low Ch								
1850.00	11.09	V	0.9	8.6	18.79	33.0	-14.2	
1850.00	17.50	H	0.9	8.6	25.20	33.0	-7.8	
Mid Ch								
1880.00	11.65	V	0.9	8.6	19.35	33.0	-13.7	
1880.00	17.37	H	0.9	8.6	25.07	33.0	-7.9	
High Ch								
1910.00	13.53	V	0.9	8.6	21.23	33.0	-11.8	
1910.00	15.90	H	0.9	8.6	23.60	33.0	-9.4	

Rev. 3.17.11
Note: For Band 4 EIRP limit is 30dBm

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Band

GSM1900

GPRS

High Frequency Substitution Measurement
UL Verification Services, Inc. Chamber C

Company: Samsung
Project #: 14U18322
Date: 07/17/14
Test Engineer: E. Lee, M. Zarin
Configuration: EUT ONLY, X Position
Mode: GPRS 1900MHZ

Test Equipment:
Receiving: Horn T119, and Chamber C SMA Cables
Substitution: Horn T72 Substitution, 4ft SMA Cable Warehouse

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Notes
Low Ch								
1850.20	16.29	V	0.9	8.6	24.04	33.0	-9.0	
1850.20	20.54	H	0.9	8.6	28.29	33.0	-4.7	
Mid Ch								
1880.00	15.56	V	0.9	8.6	23.31	33.0	-9.7	
1880.00	18.85	H	0.9	8.6	26.60	33.0	-6.4	
High Ch								
1909.80	18.29	V	0.9	8.4	25.84	33.0	-7.2	
1909.80	20.48	H	0.9	8.4	28.03	33.0	-5.0	

Rev. 3.17.11
Note: For Band 4 EIRP limit is 30dBm

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Company: Samsung
Project #: 14u18322
Date: 7/21/2014
Test Engineer: K. Ros, N. Sheridan
Configuration: EUT, X-position
Mode: EGPRS850

Test Equipment:
Receiving: Hybrid T130, and Chamber A SMA Cables
Substitution: Dipole T416 Substitution, 4ft SMA Cable Warehouse

Band

GSM850

EGPRS

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)	Not
Low Ch								
824.20	18.80	V	0.9		17.90	38.5	-20.6	
824.20	26.30	H	0.9		25.40	38.5	-13.1	
Mid Ch								
836.60	16.36	V	0.9		15.46	38.5	-23.0	
836.60	24.98	H	0.9		24.08	38.5	-14.4	
High Ch								
848.80	17.10	V	0.9		16.20	38.5	-22.3	
848.80	26.06	H	0.9		25.16	38.5	-13.3	

Rev. 3.17.11
Note: For Band 13/17 ERP limit is 34.77dBm; For Band 26 limit is 50dBm

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Company: Samsung
Project #: 14U18322
Date: 07/21/14
Test Engineer: K. Ros, N. Sheridan, D. Sblendorio
Configuration: EUT ONLY, X Position
Mode: GPRS850

Test Equipment:
Receiving: Hybrid T130, and Chamber A SMA Cables
Substitution: Dipole T416 Substitution, 4ft SMA Cable Warehouse

Band

GSM850

GPRS

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)	Notes
Low Ch								
824.20	21.80	V	0.9		20.95	38.5	-17.5	
824.20	29.73	H	0.9		28.88	38.5	-9.6	
Mid Ch								
836.60	19.86	V	0.9		19.01	38.5	-19.4	
836.60	28.71	H	0.9		27.86	38.5	-10.6	
High Ch								
848.80	19.60	V	0.9		18.75	38.5	-19.7	
848.80	28.77	H	0.9		27.92	38.5	-10.5	

Rev. 3.17.11
Note: For Band 13/17 ERP limit is 34.77dBm; For Band 26 limit is 50dBm

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11.2. FIELD STRENGTH OF SPURIOUS RADIATION

RULE PART(S)

FCC: §2.1053, §22.917, §24.238, and §27

LIMIT

§22.917 (e) and §24.238 (a): Out of band emissions. 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

TEST PROCEDURE

For Cellular equipment - Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 100 kHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

For PCS equipment - Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 MHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

RESULTS

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701I
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11.2.1. SPURIOUS RADIATION DATA

Compliance Certification Services
Above 1GHz High Frequency Substitution Measurement

Company: Samsung
Project #: 14U18322
Date: 07/21/14
Test Engineer: E. Black, T. Oeur
Configuration: EUT ONLY, Y Position
Mode: LTE 41_20MHz_16QAM

Chamber	Pre-amplifer	Filter	Limit
3m Chamber C	T34 8449B	Filter 1	Part 27

Band: LTE41 20MHz 16QAM

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, (2506 MHz)									
5.012	-4.5	V	3.0	34.8	1.0	-38.2	-25.0	-13.2	
7.518	-10.8	V	3.0	34.9	1.0	-44.7	-25.0	-19.7	
10.024	-8.7	V	3.0	35.3	1.0	-43.1	-25.0	-18.1	
5.012	-6.3	H	3.0	34.8	1.0	-40.1	-25.0	-15.1	
7.518	-8.7	H	3.0	34.9	1.0	-42.6	-25.0	-17.6	
10.024	-6.6	H	3.0	35.3	1.0	-41.0	-25.0	-16.0	
Mid Ch, (2593 MHz)									
5.186	-2.7	V	3.0	34.7	1.0	-36.4	-25.0	-11.4	
7.779	-9.9	V	3.0	35.0	1.0	-43.9	-25.0	-18.9	
10.372	-7.6	V	3.0	35.2	1.0	-41.8	-25.0	-16.8	
5.186	-3.9	H	3.0	34.7	1.0	-37.6	-25.0	-12.6	
7.779	-7.8	H	3.0	35.0	1.0	-41.7	-25.0	-16.7	
10.372	-6.6	H	3.0	35.2	1.0	-40.8	-25.0	-15.8	
High Ch, (2680 MHz)									
5.360	-5.9	V	3.0	34.7	1.0	-39.6	-25.0	-14.6	
8.040	-10.4	V	3.0	35.0	1.0	-44.4	-25.0	-19.4	
10.720	-8.4	V	3.0	35.0	1.0	-42.4	-25.0	-17.4	
5.360	-6.2	H	3.0	34.7	1.0	-39.9	-25.0	-14.9	
8.040	-8.3	H	3.0	35.0	1.0	-42.3	-25.0	-17.3	
10.720	-7.6	H	3.0	35.0	1.0	-41.6	-25.0	-16.6	

Rev. 03.03.09
Note: No other emissions were detected above the system noise floor.

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Compliance Certification Services
Above 1GHz High Frequency Substitution Measurement

Company: Samsung
Project #: 14U18322
Date: 07/21/14
Test Engineer: E. Black, T. Oeur
Configuration: EUT ONLY, Y Position
Mode: LTE 41_20MHz_QPSK

Chamber	Pre-amplifer	Filter	Limit
3m Chamber C	T34 8449B	Filter 1	Part 27

Band
LTE41
20MHz
QPSK

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, (2506 MHz)									
5.012	-3.7	V	3.0	34.8	1.0	-37.4	-25.0	-12.4	
7.518	-10.3	V	3.0	34.9	1.0	-44.2	-25.0	-19.2	
10.024	-8.5	V	3.0	35.3	1.0	-42.8	-25.0	-17.8	
5.012	-5.9	H	3.0	34.8	1.0	-39.6	-25.0	-14.6	
7.518	-8.1	H	3.0	34.9	1.0	-42.0	-25.0	-17.0	
10.024	-7.3	H	3.0	35.3	1.0	-41.7	-25.0	-16.7	
Mid Ch, (2593 MHz)									
5.186	-1.6	V	3.0	34.7	1.0	-35.3	-25.0	-10.3	
7.779	-9.4	V	3.0	35.0	1.0	-43.4	-25.0	-18.4	
10.372	-7.8	V	3.0	35.2	1.0	-41.9	-25.0	-16.9	
5.186	-2.6	H	3.0	34.7	1.0	-36.3	-25.0	-11.3	
7.779	-7.7	H	3.0	35.0	1.0	-41.6	-25.0	-16.6	
10.372	-6.0	H	3.0	35.2	1.0	-40.2	-25.0	-15.2	
High Ch, (2680 MHz)									
5.360	-5.3	V	3.0	34.7	1.0	-39.0	-25.0	-14.0	
8.040	-10.1	V	3.0	35.0	1.0	-44.1	-25.0	-19.1	
10.720	-8.2	V	3.0	35.0	1.0	-42.2	-25.0	-17.2	
5.360	-7.5	H	3.0	34.7	1.0	-41.2	-25.0	-16.2	
8.040	-8.6	H	3.0	35.0	1.0	-42.7	-25.0	-17.7	
10.720	-7.3	H	3.0	35.0	1.0	-41.3	-25.0	-16.3	

Rev. 03.03.09
Note: No other emissions were detected above the system noise floor.

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Compliance Certification Services
Above 1GHz High Frequency Substitution Measurement

Company: Samsung
Project #: 14U18322
Date: 07/21/14
Test Engineer: E. Black, T. Oeur
Configuration: EUT ONLY, Y Position
Mode: LTE 41_15MHz_16QAM

Chamber	Pre-amplifer	Filter	Limit
3m Chamber C	T34 8449B	Filter 1	Part 27

Band
LTE41
15MHz
16QAM

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, (2503.5 MHz)									
5.007	-1.6	V	3.0	34.8	1.0	-35.3	-25.0	-10.3	
7.510	-10.2	V	3.0	34.9	1.0	-44.2	-25.0	-19.2	
10.014	-8.0	V	3.0	35.4	1.0	-42.4	-25.0	-17.4	
5.007	-3.3	H	3.0	34.8	1.0	-37.0	-25.0	-12.0	
7.510	-8.8	H	3.0	34.9	1.0	-42.8	-25.0	-17.8	
10.014	-7.8	H	3.0	35.4	1.0	-42.2	-25.0	-17.2	
Mid Ch, (2593 MHz)									
5.186	-4.6	V	3.0	34.7	1.0	-38.3	-25.0	-13.3	
7.779	-15.0	V	3.0	35.0	1.0	-49.0	-25.0	-24.0	
10.372	-13.2	V	3.0	35.2	1.0	-47.4	-25.0	-22.4	
5.186	-7.6	H	3.0	34.7	1.0	-41.3	-25.0	-16.3	
7.779	-13.5	H	3.0	35.0	1.0	-47.5	-25.0	-22.5	
10.372	-12.0	H	3.0	35.2	1.0	-46.2	-25.0	-21.2	
High Ch, (2682.5 MHz)									
5.365	-4.5	V	3.0	34.7	1.0	-38.2	-25.0	-13.2	
8.047	-10.3	V	3.0	35.0	1.0	-44.3	-25.0	-19.3	
10.730	-7.6	V	3.0	35.0	1.0	-41.6	-25.0	-16.6	
5.365	-8.6	H	3.0	34.7	1.0	-42.3	-25.0	-17.3	
8.047	-8.7	H	3.0	35.0	1.0	-42.7	-25.0	-17.7	
10.730	-7.3	H	3.0	35.0	1.0	-41.3	-25.0	-16.3	

Rev. 03.03.09
Note: No other emissions were detected above the system noise floor.

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Compliance Certification Services
Above 1GHz High Frequency Substitution Measurement

Company: Samsung
Project #: 14U18322
Date: 07/21/14
Test Engineer: E. Black, T. Oeur
Configuration: EUT ONLY, Y Position
Mode: LTE 41_15MHz_QPSK

Chamber	Pre-amplifer	Filter	Limit
3m Chamber C	T34 8449B	Filter 1	Part 27

Band
LTE41
15MHz
QPSK

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, (2503.5 MHz)									
5.007	-1.7	V	3.0	34.8	1.0	-35.5	-25.0	-10.5	
7.510	-10.6	V	3.0	34.9	1.0	-44.6	-25.0	-19.6	
10.014	-7.9	V	3.0	35.4	1.0	-42.3	-25.0	-17.3	
5.007	-3.6	H	3.0	34.8	1.0	-37.3	-25.0	-12.3	
7.510	-8.7	H	3.0	34.9	1.0	-42.7	-25.0	-17.7	
10.014	-6.6	H	3.0	35.4	1.0	-40.9	-25.0	-15.9	
Mid Ch, (2593 MHz)									
5.186	-3.9	V	3.0	34.7	1.0	-37.6	-25.0	-12.6	
7.779	-14.9	V	3.0	35.0	1.0	-48.9	-25.0	-23.9	
10.372	-13.5	V	3.0	35.2	1.0	-47.7	-25.0	-22.7	
5.186	-7.4	H	3.0	34.7	1.0	-41.1	-25.0	-16.1	
7.779	-13.0	H	3.0	35.0	1.0	-47.0	-25.0	-22.0	
10.372	-12.1	H	3.0	35.2	1.0	-46.3	-25.0	-21.3	
High Ch, (2682.5 MHz)									
5.365	-4.9	V	3.0	34.7	1.0	-38.6	-25.0	-13.6	
8.047	-9.9	V	3.0	35.0	1.0	-43.9	-25.0	-18.9	
10.730	-7.2	V	3.0	35.0	1.0	-41.2	-25.0	-16.2	
5.365	-8.8	H	3.0	34.7	1.0	-42.5	-25.0	-17.5	
8.047	-8.2	H	3.0	35.0	1.0	-42.3	-25.0	-17.3	
10.730	-7.5	H	3.0	35.0	1.0	-41.5	-25.0	-16.5	

Rev. 03.03.09
Note: No other emissions were detected above the system noise floor.

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701I
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Compliance Certification Services
Above 1GHz High Frequency Substitution Measurement

Company: Samsung
Project #: 14U18322
Date: 07/18/14
Test Engineer: E. Black, T. Oeur
Configuration: EUT ONLY, Y Position
Mode: LTE 41_10MHz_16QAM

Chamber	Pre-amplifer	Filter	Limit
3m Chamber C	T34 8449B	Filter 1	Part 27

Band: LTE41 10MHz 16QAM

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, (2501 MHz)									
5.002	-4.2	V	3.0	34.8	1.0	-38.0	-25.0	-13.0	
7.503	-15.8	V	3.0	34.9	1.0	-49.7	-25.0	-24.7	
10.004	-13.3	V	3.0	35.4	1.0	-47.7	-25.0	-22.7	
5.002	-7.4	H	3.0	34.8	1.0	-41.2	-25.0	-16.2	
7.503	-13.9	H	3.0	34.9	1.0	-47.9	-25.0	-22.9	
10.004	-11.8	H	3.0	35.4	1.0	-46.1	-25.0	-21.1	
Mid Ch, (2593 MHz)									
5.186	-2.9	V	3.0	34.7	1.0	-36.6	-25.0	-11.6	
7.779	-15.4	V	3.0	35.0	1.0	-49.4	-25.0	-24.4	
10.372	-13.1	V	3.0	35.2	1.0	-47.2	-25.0	-22.2	
5.186	-7.8	H	3.0	34.7	1.0	-41.5	-25.0	-16.5	
7.779	-13.7	H	3.0	35.0	1.0	-47.6	-25.0	-22.6	
10.372	-11.7	H	3.0	35.2	1.0	-45.9	-25.0	-20.9	
High Ch, (2685 MHz)									
5.370	-7.5	V	3.0	34.7	1.0	-41.2	-25.0	-16.2	
8.055	-15.5	V	3.0	35.0	1.0	-49.5	-25.0	-24.5	
10.740	-13.6	V	3.0	35.0	1.0	-47.6	-25.0	-22.6	
5.370	-10.9	H	3.0	34.7	1.0	-44.6	-25.0	-19.6	
8.055	-14.0	H	3.0	35.0	1.0	-48.1	-25.0	-23.1	
10.740	-13.1	H	3.0	35.0	1.0	-47.1	-25.0	-22.1	

Rev. 03.03.09
Note: No other emissions were detected above the system noise floor.

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701I
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888

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Compliance Certification Services
Above 1GHz High Frequency Substitution Measurement

Company: Samsung
Project #: 14U18322
Date: 07/18/14
Test Engineer: E. Black, T. Oeur
Configuration: EUT ONLY, Y Position
Mode: LTE 41_10MHz_QPSK

Chamber	Pre-amplifer	Filter	Limit
3m Chamber C	T34 8449B	Filter 1	Part 27

Band: LTE41 10MHz QPSK

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, (2501 MHz)									
5.002	-3.3	V	3.0	34.8	1.0	-37.1	-25.0	-12.1	
7.503	-16.0	V	3.0	34.9	1.0	-50.0	-25.0	-25.0	
10.004	-11.6	V	3.0	35.4	1.0	-45.9	-25.0	-20.9	
5.002	-6.9	H	3.0	34.8	1.0	-40.7	-25.0	-15.7	
7.503	-14.3	H	3.0	34.9	1.0	-48.2	-25.0	-23.2	
10.004	-10.5	H	3.0	35.4	1.0	-44.8	-25.0	-19.8	
Mid Ch, (2593 MHz)									
5.186	-0.9	V	3.0	34.7	1.0	-34.6	-25.0	-9.6	
7.779	-14.2	V	3.0	35.0	1.0	-48.2	-25.0	-23.2	
10.372	-12.4	V	3.0	35.2	1.0	-46.6	-25.0	-21.6	
5.186	-5.9	H	3.0	34.7	1.0	-39.6	-25.0	-14.6	
7.779	-12.7	H	3.0	35.0	1.0	-46.7	-25.0	-21.7	
10.372	-11.2	H	3.0	35.2	1.0	-45.3	-25.0	-20.3	
High Ch, (2685 MHz)									
5.370	-7.0	V	3.0	34.7	1.0	-40.8	-25.0	-15.8	
8.055	-15.2	V	3.0	35.0	1.0	-49.2	-25.0	-24.2	
10.740	-13.2	V	3.0	35.0	1.0	-47.2	-25.0	-22.2	
5.370	-10.6	H	3.0	34.7	1.0	-44.3	-25.0	-19.3	
8.055	-13.3	H	3.0	35.0	1.0	-47.3	-25.0	-22.3	
10.740	-12.2	H	3.0	35.0	1.0	-46.2	-25.0	-21.2	

Rev. 03.03.09
Note: No other emissions were detected above the system noise floor.

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701I
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Compliance Certification Services
Above 1GHz High Frequency Substitution Measurement

Company: Samsung
Project #: 14U18322
Date: 07/18/14
Test Engineer: E. Black, T. Oeur
Configuration: EUT ONLY, Y Position
Mode: LTE 41_10MHz_16QAM

Chamber	Pre-amplifer	Filter	Limit
3m Chamber C	T34 8449B	Filter 1	Part 27

Band: LTE41 5MHz 16QAM

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, (2501 MHz)									
5.002	1.0	V	3.0	34.8	1.0	-32.7	-25.0	-7.7	
7.503	-16.4	V	3.0	34.9	1.0	-50.3	-25.0	-25.3	
10.004	-14.0	V	3.0	35.4	1.0	-48.3	-25.0	-23.3	
5.002	-3.2	H	3.0	34.8	1.0	-37.0	-25.0	-12.0	
7.503	-15.2	H	3.0	34.9	1.0	-49.2	-25.0	-24.2	
10.004	-13.0	H	3.0	35.4	1.0	-47.3	-25.0	-22.3	
Mid Ch, (2593 MHz)									
5.186	0.4	V	3.0	34.7	1.0	-33.3	-25.0	-8.3	
7.779	-15.2	V	3.0	35.0	1.0	-49.2	-25.0	-24.2	
10.372	-12.8	V	3.0	35.2	1.0	-47.0	-25.0	-22.0	
5.186	-1.6	H	3.0	34.7	1.0	-35.3	-25.0	-10.3	
7.779	-13.6	H	3.0	35.0	1.0	-47.6	-25.0	-22.6	
10.372	-11.7	H	3.0	35.2	1.0	-45.8	-25.0	-20.8	
High Ch, (2685 MHz)									
5.370	-3.7	V	3.0	34.7	1.0	-37.4	-25.0	-12.4	
8.055	-14.7	V	3.0	35.0	1.0	-48.8	-25.0	-23.8	
10.740	-13.5	V	3.0	35.0	1.0	-47.5	-25.0	-22.5	
5.370	-3.8	H	3.0	34.7	1.0	-37.5	-25.0	-12.5	
8.055	-14.2	H	3.0	35.0	1.0	-48.2	-25.0	-23.2	
10.740	-12.9	H	3.0	35.0	1.0	-46.9	-25.0	-21.9	

Rev. 03.03.09
Note: No other emissions were detected above the system noise floor.

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701I
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Compliance Certification Services
Above 1GHz High Frequency Substitution Measurement

Company: Samsung
Project #: 14U18322
Date: 07/18/14
Test Engineer: E. Black, T. Oeur
Configuration: EUT ONLY, Y Position
Mode: LTE 41_5MHz_QPSK

Chamber	Pre-amplifer	Filter	Limit
3m Chamber C	T34 8449B	Filter 1	Part 27

Band: LTE41 5MHz QPSK

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, (2498.5 MHz)									
4.979	1.5	V	3.0	34.8	1.0	-32.3	-25.0	-7.3	
7.469	-16.2	V	3.0	34.9	1.0	-50.1	-25.0	-25.1	
9.958	-14.9	V	3.0	35.4	1.0	-49.3	-25.0	-24.3	
4.979	-3.4	H	3.0	34.8	1.0	-37.2	-25.0	-12.2	
7.469	-15.0	H	3.0	34.9	1.0	-48.9	-25.0	-23.9	
9.958	-13.0	H	3.0	35.4	1.0	-47.4	-25.0	-22.4	
Mid Ch, (2593 MHz)									
5.186	1.0	V	3.0	34.7	1.0	-32.7	-25.0	-7.7	
7.779	-15.0	V	3.0	35.0	1.0	-49.0	-25.0	-24.0	
10.372	-13.2	V	3.0	35.2	1.0	-47.4	-25.0	-22.4	
5.186	-1.6	H	3.0	34.7	1.0	-35.3	-25.0	-10.3	
7.779	-13.0	H	3.0	35.0	1.0	-47.0	-25.0	-22.0	
10.372	-11.7	H	3.0	35.2	1.0	-45.9	-25.0	-20.9	
High Ch, (2687.5 MHz)									
5.375	-5.1	V	3.0	34.7	1.0	-38.8	-25.0	-13.8	
8.063	-15.7	V	3.0	35.0	1.0	-49.8	-25.0	-24.8	
10.750	-13.0	V	3.0	35.0	1.0	-47.0	-25.0	-22.0	
5.375	-4.8	H	3.0	34.7	1.0	-38.5	-25.0	-13.5	
8.063	-14.1	H	3.0	35.0	1.0	-48.1	-25.0	-23.1	
10.750	-13.1	H	3.0	35.0	1.0	-47.1	-25.0	-22.1	

Rev. 03.03.09
Note: No other emissions were detected above the system noise floor.

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701I
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Compliance Certification Services
Above 1GHz High Frequency Substitution Measurement

Company: Samsung
Project #: 14U18322
Date: 07/22/14
Test Engineer: S. Her, R. Yu, L. Lara
Configuration: X-Pos EUT w/ AC Charger + HS
Mode: HSDPA_B2

Chamber	Pre-amplifer	Filter	Limit
3m Chamber	T34 8449B	Filter 1	Part 24

Band

Band 2

HSDPA

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 1852.4MHz									
3.705	-11.6	V	3.0	35.4	1.0	-46.0	-13.0	-33.0	
5.557	-8.6	V	3.0	34.7	1.0	-42.3	-13.0	-29.3	
7.410	-8.5	V	3.0	34.9	1.0	-42.4	-13.0	-29.4	
3.705	-6.3	H	3.0	35.4	1.0	-40.7	-13.0	-27.7	
5.557	2.2	H	3.0	34.7	1.0	-31.6	-13.0	-18.6	
7.410	-8.3	H	3.0	34.9	1.0	-42.2	-13.0	-29.2	
Mid Ch, 1880MHz									
3.760	-9.2	V	3.0	35.3	1.0	-43.6	-13.0	-30.6	
5.640	-7.7	V	3.0	34.7	1.0	-41.4	-13.0	-28.4	
7.520	-8.4	V	3.0	34.9	1.0	-42.3	-13.0	-29.3	
3.760	-7.8	H	3.0	35.3	1.0	-42.1	-13.0	-29.1	
5.640	-2.7	H	3.0	34.7	1.0	-36.4	-13.0	-23.4	
7.520	-8.1	H	3.0	34.9	1.0	-42.0	-13.0	-29.0	
High Ch, 1907.6MHz									
3.815	-14.0	V	3.0	35.3	1.0	-48.3	-13.0	-35.3	
5.723	-8.2	V	3.0	34.7	1.0	-41.9	-13.0	-28.9	
7.630	-9.2	V	3.0	34.9	1.0	-43.2	-13.0	-30.2	
3.815	-10.0	H	3.0	35.3	1.0	-44.3	-13.0	-31.3	
5.723	-1.5	H	3.0	34.7	1.0	-35.2	-13.0	-22.2	
7.630	-7.7	H	3.0	34.9	1.0	-41.7	-13.0	-28.7	

Rev. 03.03.09
Note: No other emissions were detected above the system noise floor.

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701I
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Compliance Certification Services
Above 1GHz High Frequency Substitution Measurement

Company: Samsung
Project #: 14U18322
Date: 07/22/14
Test Engineer: S. Her, R. Yu, L. Lara
Configuration: X-Pos EUT w/ AC Charger + HS
Mode: REL99_B2

Chamber	Pre-amplifer	Filter	Limit
3m Chamber	T34 8449B	Filter 1	Part 24

Band

Band 2

REL99

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 1852.4MHz									
3.705	-11.6	V	3.0	35.4	1.0	-46.0	-13.0	-33.0	
5.557	-8.6	V	3.0	34.7	1.0	-42.3	-13.0	-29.3	
7.410	-8.5	V	3.0	34.9	1.0	-42.4	-13.0	-29.4	
3.705	-6.3	H	3.0	35.4	1.0	-40.7	-13.0	-27.7	
5.557	2.2	H	3.0	34.7	1.0	-31.6	-13.0	-18.6	
7.410	-8.3	H	3.0	34.9	1.0	-42.2	-13.0	-29.2	
Mid Ch, 1880MHz									
3.760	-9.2	V	3.0	35.3	1.0	-43.6	-13.0	-30.6	
5.640	-7.7	V	3.0	34.7	1.0	-41.4	-13.0	-28.4	
7.520	-8.4	V	3.0	34.9	1.0	-42.3	-13.0	-29.3	
3.760	-7.8	H	3.0	35.3	1.0	-42.1	-13.0	-29.1	
5.640	-2.7	H	3.0	34.7	1.0	-36.4	-13.0	-23.4	
7.520	-8.1	H	3.0	34.9	1.0	-42.0	-13.0	-29.0	
High Ch, 1907.6MHz									
3.815	-14.0	V	3.0	35.3	1.0	-48.3	-13.0	-35.3	
5.723	-8.2	V	3.0	34.7	1.0	-41.9	-13.0	-28.9	
7.630	-9.2	V	3.0	34.9	1.0	-43.2	-13.0	-30.2	
3.815	-10.0	H	3.0	35.3	1.0	-44.3	-13.0	-31.3	
5.723	-1.5	H	3.0	34.7	1.0	-35.2	-13.0	-22.2	
7.630	-7.7	H	3.0	34.9	1.0	-41.7	-13.0	-28.7	

Rev. 03.03.09
Note: No other emissions were detected above the system noise floor.

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701I
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Compliance Certification Services
Above 1GHz High Frequency Substitution Measurement

Company: Samsung
Project #: 14U18322
Date: 07/21/14
Test Engineer: S. Her, R. Yu, L. Lara
Configuration: X-Pos EUT w/ AC Charger + HS
Mode: HSDPA_B5

Chamber	Pre-amplifer	Filter	Limit
3m Chamber	T34 8449B	Filter 1	Part 22

Band

Band 5

HSDPA

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 826.4MHz									
1.653	-19.6	V	3.0	37.4	1.0	-56.0	-13.0	-43.0	
2.479	-16.1	V	3.0	36.4	1.0	-51.5	-13.0	-38.5	
3.306	-16.9	V	3.0	35.8	1.0	-51.7	-13.0	-38.7	
1.653	-14.3	H	3.0	37.4	1.0	-50.7	-13.0	-37.7	
2.479	-7.5	H	3.0	36.4	1.0	-42.9	-13.0	-29.9	
3.306	-18.0	H	3.0	35.8	1.0	-52.8	-13.0	-39.8	
Mid Ch, 836.6MHz									
1.673	-17.2	V	3.0	37.3	1.0	-53.5	-13.0	-40.5	
2.510	-15.2	V	3.0	36.4	1.0	-50.6	-13.0	-37.6	
3.346	-16.9	V	3.0	35.8	1.0	-51.6	-13.0	-38.6	
1.673	-15.8	H	3.0	37.3	1.0	-52.1	-13.0	-39.1	
2.510	-12.4	H	3.0	36.4	1.0	-47.7	-13.0	-34.7	
3.346	-17.7	H	3.0	35.8	1.0	-52.5	-13.0	-39.5	
High Ch, 846.6MHz									
1.693	-21.9	V	3.0	37.3	1.0	-58.2	-13.0	-45.2	
2.540	-15.8	V	3.0	36.3	1.0	-51.1	-13.0	-38.1	
3.386	-17.7	V	3.0	35.7	1.0	-52.4	-13.0	-39.4	
1.693	-17.9	H	3.0	37.3	1.0	-54.2	-13.0	-41.2	
2.540	-11.2	H	3.0	36.3	1.0	-46.6	-13.0	-33.6	
3.386	-17.4	H	3.0	35.7	1.0	-52.1	-13.0	-39.1	

Rev. 03.03.09
Note: No other emissions were detected above the system noise floor.

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701I
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Compliance Certification Services
Above 1GHz High Frequency Substitution Measurement

Company: Samsung
Project #: 14U18322
Date: 07/21/14
Test Engineer: S. Her, R. Yu, L. Lara
Configuration: X-Pos EUT w/ AC Charger + HS
Mode: REL99_B5

Chamber	Pre-amplifer	Filter	Limit
3m Chamber	T34 8449B	Filter 1	Part 22

Band

Band 5

REL99

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 826.4MHz									
1.653	-18.5	V	3.0	37.4	1.0	-54.9	-13.0	-41.9	
2.479	-16.0	V	3.0	36.4	1.0	-51.4	-13.0	-38.4	
3.306	-18.1	V	3.0	35.8	1.0	-52.9	-13.0	-39.9	
1.653	-13.5	H	3.0	37.4	1.0	-49.9	-13.0	-36.9	
2.479	-8.4	H	3.0	36.4	1.0	-43.8	-13.0	-30.8	
3.306	-18.6	H	3.0	35.8	1.0	-53.4	-13.0	-40.4	
Mid Ch, 836.6MHz									
1.673	-14.0	V	3.0	37.3	1.0	-50.4	-13.0	-37.4	
2.510	-18.0	V	3.0	36.4	1.0	-53.3	-13.0	-40.3	
3.346	-15.6	V	3.0	35.8	1.0	-50.4	-13.0	-37.4	
1.673	-13.4	H	3.0	37.3	1.0	-49.8	-13.0	-36.8	
2.510	-12.5	H	3.0	36.4	1.0	-47.9	-13.0	-34.9	
3.346	-18.2	H	3.0	35.8	1.0	-53.0	-13.0	-40.0	
High Ch, 846.6MHz									
1.693	-21.0	V	3.0	37.3	1.0	-57.3	-13.0	-44.3	
2.540	-14.9	V	3.0	36.3	1.0	-50.2	-13.0	-37.2	
3.386	-17.3	V	3.0	35.7	1.0	-52.0	-13.0	-39.0	
1.693	-18.9	H	3.0	37.3	1.0	-55.2	-13.0	-42.2	
2.540	-9.3	H	3.0	36.3	1.0	-44.7	-13.0	-31.7	
3.386	-17.5	H	3.0	35.7	1.0	-52.2	-13.0	-39.2	

Rev. 03.03.09
Note: No other emissions were detected above the system noise floor.

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701I
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888

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Compliance Certification Services
Above 1GHz High Frequency Substitution Measurement

Company: Samsung
Project #: 14U18322
Date: 07/21/14
Test Engineer: K. Revis, T.Oeur
Configuration: X-Pos EUT w/ AC Charger + HS
Mode: EGPRS 1900

Chamber	Pre-amplifer	Filter	Limit
3m Chamber	T34 8449B	Filter 1	Part 24

Band

GSM1900

EGPRS

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 1850.2MHz									
3.700	-5.3	V	3.0	35.4	1.0	-39.7	-13.0	-26.7	
5.551	-11.8	V	3.0	34.7	1.0	-45.5	-13.0	-32.5	
7.401	-9.1	V	3.0	34.9	1.0	-43.0	-13.0	-30.0	
3.700	0.4	H	3.0	35.4	1.0	-34.0	-13.0	-21.0	
5.551	-12.6	H	3.0	34.7	1.0	-46.4	-13.0	-33.4	
7.401	-8.0	H	3.0	34.9	1.0	-41.9	-13.0	-28.9	
Mid Ch, 1880.0MHz									
3.760	-0.6	V	3.0	35.3	1.0	-35.0	-13.0	-22.0	
5.640	-10.3	V	3.0	34.7	1.0	-44.0	-13.0	-31.0	
7.520	-8.4	V	3.0	34.9	1.0	-42.3	-13.0	-29.3	
3.760	2.0	H	3.0	35.3	1.0	-32.3	-13.0	-19.3	
5.640	-13.4	H	3.0	34.7	1.0	-47.2	-13.0	-34.2	
7.520	-9.2	H	3.0	34.9	1.0	-43.2	-13.0	-30.2	
High Ch, 1909.8MHz									
3.820	-6.3	V	3.0	35.3	1.0	-40.6	-13.0	-27.6	
5.729	-11.6	V	3.0	34.7	1.0	-45.3	-13.0	-32.3	
7.639	-8.0	V	3.0	35.0	1.0	-41.9	-13.0	-28.9	
3.820	-3.6	H	3.0	35.3	1.0	-37.9	-13.0	-24.9	
5.729	-8.9	H	3.0	34.7	1.0	-42.6	-13.0	-29.6	
7.639	-7.9	H	3.0	35.0	1.0	-41.8	-13.0	-28.8	

Rev. 03.03.09
Note: No other emissions were detected above the system noise floor.

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701I
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888

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Compliance Certification Services
Above 1GHz High Frequency Substitution Measurement

Company: Samsung
Project #: 14U18322
Date: 07/21/14
Test Engineer: G. Chan, L. Lee
Configuration: X-Pos EUT w/ AC Charger + HS
Mode: GPRS 1900

Chamber	Pre-amplifer	Filter	Limit
3m Chamber	T34 8449B	Filter 1	Part 24

Band

GSM1900

GPRS

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 1850.2MHz									
3.700	-14.3	V	3.0	35.4	1.0	-48.7	-13.0	-35.7	
5.551	-9.0	V	3.0	34.7	1.0	-42.8	-13.0	-29.8	
7.401	-16.5	V	3.0	34.9	1.0	-50.4	-13.0	-37.4	
3.700	-12.9	H	3.0	35.4	1.0	-47.3	-13.0	-34.3	
5.551	-3.9	H	3.0	34.7	1.0	-37.7	-13.0	-24.7	
7.401	-15.8	H	3.0	34.9	1.0	-49.7	-13.0	-36.7	
Mid Ch, 1880.0MHz									
3.760	-12.0	V	3.0	35.3	1.0	-46.3	-13.0	-33.3	
5.640	-5.4	V	3.0	34.7	1.0	-39.2	-13.0	-26.2	
7.520	-15.1	V	3.0	34.9	1.0	-49.0	-13.0	-36.0	
3.760	-10.1	H	3.0	35.3	1.0	-44.5	-13.0	-31.5	
5.640	-5.0	H	3.0	34.7	1.0	-38.7	-13.0	-25.7	
7.520	-15.8	H	3.0	34.9	1.0	-49.7	-13.0	-36.7	
High Ch, 1909.8MHz									
3.820	-12.0	V	3.0	35.3	1.0	-46.3	-13.0	-33.3	
5.729	-6.0	V	3.0	34.7	1.0	-39.7	-13.0	-26.7	
7.639	-16.9	V	3.0	35.0	1.0	-50.9	-13.0	-37.9	
3.820	-14.0	H	3.0	35.3	1.0	-48.2	-13.0	-35.2	
5.729	-6.2	H	3.0	34.7	1.0	-39.9	-13.0	-26.9	
7.639	-15.0	H	3.0	35.0	1.0	-49.0	-13.0	-36.0	

Rev. 03.03.09
Note: No other emissions were detected above the system noise floor.

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Compliance Certification Services
Above 1GHz High Frequency Substitution Measurement

Company: Samsung
Project #: 14U18322
Date: 07/21/14
Test Engineer: K. Revis, T.Oeur
Configuration: X-Pos EUT w/ AC Charger + HS
Mode: EGPRS 850

Chamber	Pre-amplifer	Filter	Limit
3m Chamber	T34 8449B	Filter 1	Part 22

Band

GSM850

EGPRS

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 824.2MHz									
1.648	-18.9	V	3.0	37.4	1.0	-55.2	-13.0	-42.2	
2.473	-17.2	V	3.0	36.4	1.0	-52.5	-13.0	-39.5	
3.297	-17.2	V	3.0	35.8	1.0	-52.0	-13.0	-39.0	
1.648	-19.5	H	3.0	37.4	1.0	-55.9	-13.0	-42.9	
2.473	-16.9	H	3.0	36.4	1.0	-52.3	-13.0	-39.3	
3.297	-17.4	H	3.0	35.8	1.0	-52.2	-13.0	-39.2	
Mid Ch, 836.6MHz									
1.673	-21.1	V	3.0	37.3	1.0	-57.4	-13.0	-44.4	
2.510	-18.2	V	3.0	36.4	1.0	-53.5	-13.0	-40.5	
3.346	-16.3	V	3.0	35.8	1.0	-51.0	-13.0	-38.0	
1.673	-16.9	H	3.0	37.3	1.0	-53.2	-13.0	-40.2	
2.510	-13.1	H	3.0	36.4	1.0	-48.5	-13.0	-35.5	
3.346	-17.9	H	3.0	35.8	1.0	-52.6	-13.0	-39.6	
High Ch, 848.8MHz									
1.698	-21.7	V	3.0	37.3	1.0	-58.0	-13.0	-45.0	
2.547	-18.9	V	3.0	36.3	1.0	-54.2	-13.0	-41.2	
3.395	-17.2	V	3.0	35.7	1.0	-51.9	-13.0	-38.9	
1.698	-18.1	H	3.0	37.3	1.0	-54.4	-13.0	-41.4	
2.547	-10.9	H	3.0	36.3	1.0	-46.2	-13.0	-33.2	
3.395	-17.3	H	3.0	35.7	1.0	-52.0	-13.0	-39.0	

Rev. 03.03.09
Note: No other emissions were detected above the system noise floor.

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Compliance Certification Services
Above 1GHz High Frequency Substitution Measurement

Company: Samsung
Project #: 14U18322
Date: 07/21/14
Test Engineer: K. Revis, T.Oeur
Configuration: X-Pos EUT w/ AC Charger + HS
Mode: GPRS 8250

Chamber	Pre-amplifer	Filter	Limit
3m Chamber	T34 8449B	Filter 1	Part 22

Band

GSM850

GPRS

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 824.2MHz									
1.648	-19.7	V	3.0	37.4	1.0	-56.1	-13.0	-43.1	
2.473	-16.1	V	3.0	36.4	1.0	-51.5	-13.0	-38.5	
3.297	-17.0	V	3.0	35.8	1.0	-51.8	-13.0	-38.8	
1.648	-14.3	H	3.0	37.4	1.0	-50.7	-13.0	-37.7	
2.473	-7.5	H	3.0	36.4	1.0	-42.9	-13.0	-29.9	
3.297	-18.0	H	3.0	35.8	1.0	-52.8	-13.0	-39.8	
Mid Ch, 836.6MHz									
1.673	-17.2	V	3.0	37.3	1.0	-53.5	-13.0	-40.5	
2.510	-15.2	V	3.0	36.4	1.0	-50.6	-13.0	-37.6	
3.346	-16.9	V	3.0	35.8	1.0	-51.6	-13.0	-38.6	
1.673	-15.8	H	3.0	37.3	1.0	-52.1	-13.0	-39.1	
2.510	-12.4	H	3.0	36.4	1.0	-47.7	-13.0	-34.7	
3.346	-17.7	H	3.0	35.8	1.0	-52.5	-13.0	-39.5	
High Ch, 848.8MHz									
1.698	-21.9	V	3.0	37.3	1.0	-58.2	-13.0	-45.2	
2.547	-15.8	V	3.0	36.3	1.0	-51.1	-13.0	-38.1	
3.395	-17.7	V	3.0	35.7	1.0	-52.4	-13.0	-39.4	
1.698	-17.9	H	3.0	37.3	1.0	-54.2	-13.0	-41.2	
2.547	-11.2	H	3.0	36.3	1.0	-46.5	-13.0	-33.5	
3.395	-17.4	H	3.0	35.7	1.0	-52.1	-13.0	-39.1	

Rev. 03.03.09
Note: No other emissions were detected above the system noise floor.

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