



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

WWAN

CERTIFICATION TEST REPORT

FOR

Multi Path Blue Force Tracker

MODEL NUMBER : mBFT17

FCC ID: 2AL3AHDJC-1701

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Revision History

Rev.	Issue Date	Revisions	Revised By
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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: HYUNDAI J-COMM. CO., LTD.
EUT DESCRIPTION: Multi Path Blue Force Tracker
MODEL NUMBER: mBFT17
SERIAL NUMBER: 0001, 0002 (RADIATED);
0001 (CONDUCTED)
DATE TESTED: MAR 28, 2017 – APR 26, 2017

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 22H, 24E and 27L	Pass

UL Korea, Ltd. 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 Korea, Ltd. 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 Korea, Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Korea, Ltd. 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 IAS, any agency of the Federal Government, or any agency of any government.

Approved & Released For
UL Korea, Ltd. By:



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Tested By:



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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with following methods.

1. FCC CFR 47 Part 2.
2. FCC CFR 47 Part 22.
3. FCC CFR 47 Part 24.
4. FCC CFR 47 Part 27.
5. ANSI TIA-603-D
6. KDB 971168 D01 Power Meas License Digital Systems v02r02

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea. Line conducted emissions are measured only at the 218 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.

218 Maeyeong-ro	
☐	Chamber 1
☒	Chamber 2

UL Korea, Ltd. is accredited by IAS, Laboratory Code TL-637. The full scope of accreditation can be viewed at <http://www.iasonline.org/PDF/TL/TL-637.pdf>.

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.

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	2.32 dB
Radiated Disturbance, Below 1GHz	4.14 dB
Radiated Disturbance, Above 1 GHz	5.97 dB

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a Multi Path Blue Force Tracker.
This test report addresses the WWAN operational mode.

5.2. MAXIMUM OUTPUT POWER(WCDMA)

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

Note : Conducted output power results were excerpted from RF exposure test report.(4787927807-S1V1 FCC Report SAR)

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

FCC Part 22/24/27						
Band	Frequency Range	Modulation	Conducted		Radiated	
	[MHz]		Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 5	824~849	REL99	22.70	186.21	21.29	134.59
		HSDPA	22.25	167.88	21.21	132.13
		HSUPA	21.44	139.32		
Band 4	1710~1755	REL99	22.35	171.79	25.24	334.20
		HSDPA	21.97	157.40	25.20	331.13
		HSUPA	21.08	128.23		
Band 2	1850~1910	REL99	21.75	149.62	23.34	215.77
		HSDPA	21.35	136.46	23.14	206.06
		HSUPA	20.51	112.46		

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

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

Frequency (MHz)	Peak Gain (dBi)
WCDMA Band 5 824 ~ 849 MHz	2.92
WCDMA Band 2 1850 ~ 1910 MHz	4.90
WCDMA Band 4 1710 ~ 1755 MHz	2.71

5.4. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Charger	SHENZHEN LIANYUNDA ELECTRONIC CO., LTD	LYD0505000	N.A	N/A

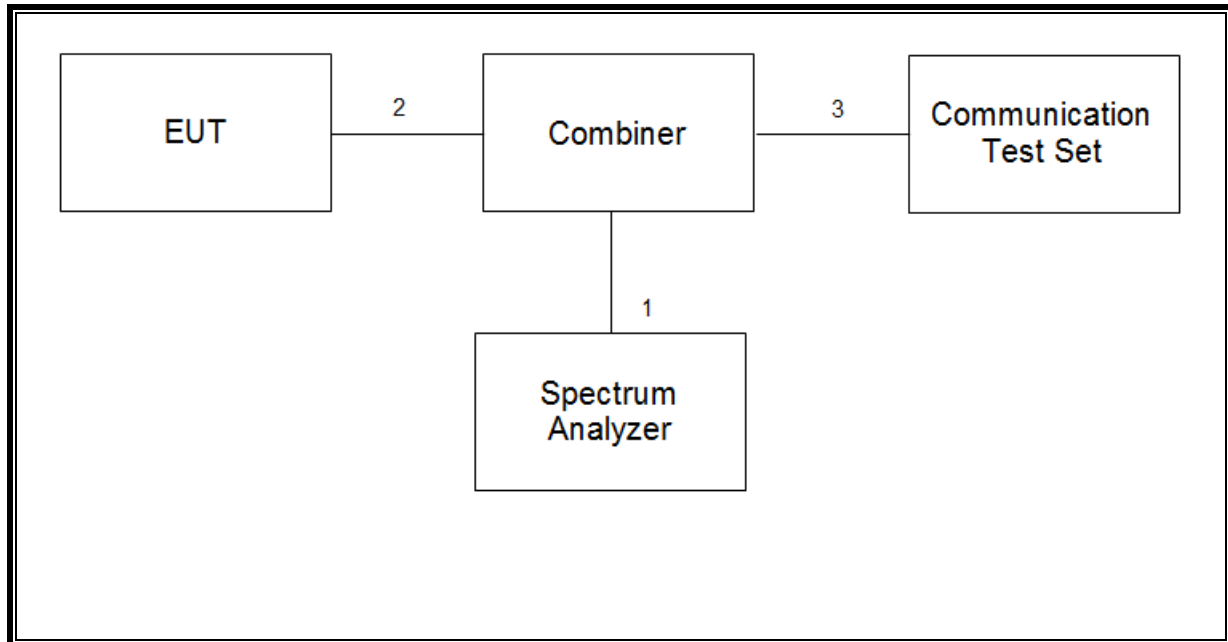
I/O CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	DC Power	1	2-PIN	Shielded	1 m	N/A
2	AC Power	2	AC	Shielded	1.1 m	N/A

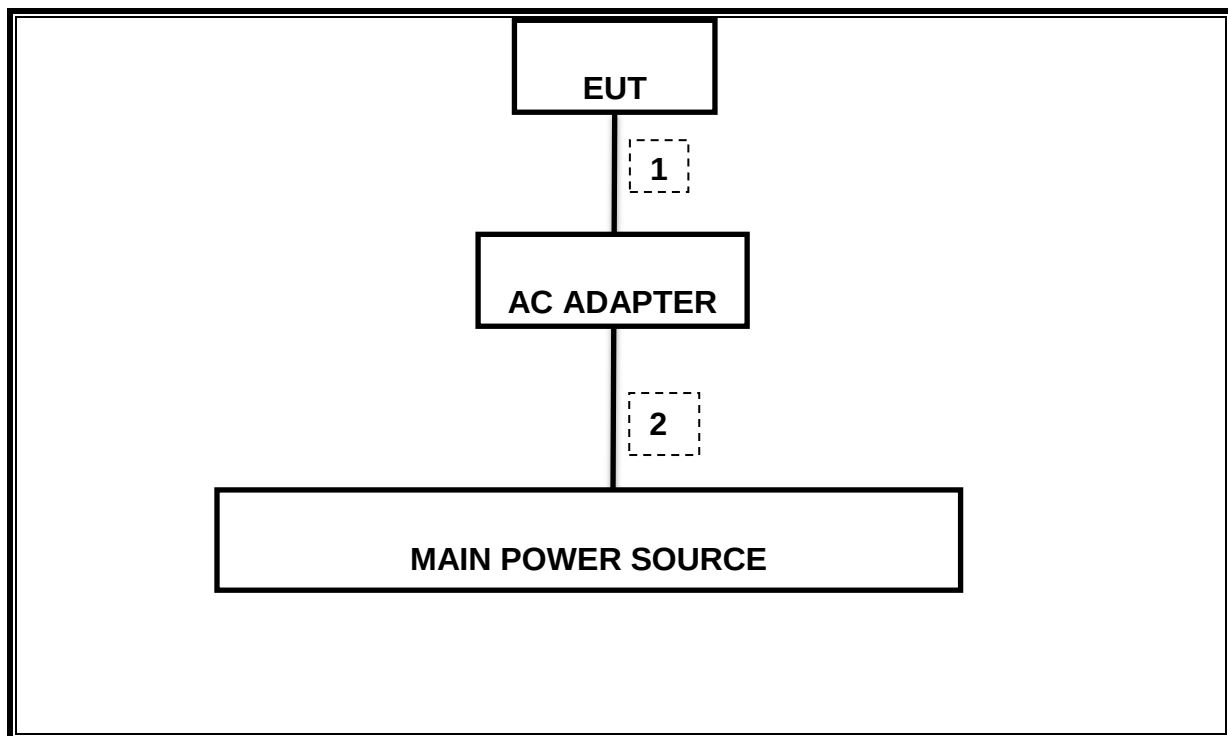
TEST SETUP

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

SETUP DIAGRAM FOR TESTS (CONDUCTED TEST SETUP)



SETUP DIAGRAM FOR TESTS (RADIATED TEST SETUP)



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	S/N	Cal Due
Antenna, Tuned Dipole 400~1000 MHz	ETS	3121D DB4	00164753	07-28-17
Antenna, Horn, 40 GHz	ETS	3116C	00166155	11-30-17
Antenna, Horn, 40 GHz	ETS	3116C-PA	00168841	12-15-17
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	750	10-14-18
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	845	11-24-17
Antenna, Horn, 18 GHz	ETS	3115	00167211	10-14-18
Antenna, Horn, 18 GHz	ETS	3117	00168724	06-17-17
Antenna, Horn, 18 GHz	ETS	3117	00168717	06-17-17
Combiner	WEINSCHTEL	1575	2154	08-17-17
Communications Test Set	R&S	CMW500	150312	08-17-17
Communications Test Set	R&S	CMW500	115331	08-17-17
DC Power Supply	Agilent / HP	E3640A	MY54226395	08-16-17
Preamplifier, 1000 MHz	Sonoma	310N	341282	08-17-17
Preamplifier, 1000 MHz	Sonoma	310N	351741	08-16-17
Preamplifier	ETS	3115-PA	00167475	08-17-17
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	08-16-17
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54170614	08-17-17
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54490312	03-09-18
EMI Test Receive, 40 GHz	R&S	ESU40	100439	08-17-17
EMI Test Receive, 40 GHz	R&S	ESU40	100457	08-16-17
High Pass Filter 1.2GHz	Micro-Tronics	HPM50108-02	G005	08-17-17
High Pass Filter 1.2GHz	Micro-Tronics	HPM50108-02	G006	08-17-17
High Pass Filter 2.8GHz	Micro-Tronics	HPM50111-02	010	08-17-17
High Pass Filter 2.8GHz	Micro-Tronics	HPM50111-02	011	08-17-17
High Pass Filter 4GHz	Micro-Tronics	HPM50118-02	G001	08-17-17
High Pass Filter 4GHz	Micro-Tronics	HPM50118-02	G002	08-17-17
Attenuator	PASTERNAK	PE7087-10	A009	08-16-17
Temperature Chamber	ESPEC	SH-642	93001109	08-17-17
UL Software				
Description	Manufacturer	Model	Version	
Antenna port test software	UL	CLT	Ver 1.6	

7. Summary Table

FCC Part Section	Test Description	Test Limit	Test Condition	Test Result	Note
2.1049	Occupied Band width (99%)	N/A	Conducted	Pass	4.0689 MHz
22.917(a) 24.238(a) 27.53(g)	Band Edge / Conducted Spurious Emission	-13dBm		Pass	-28.418dBm
2.1046	Conducted output power	N/A		Pass	22.7 dBm
22.355 24.235 27.54	Frequency Stability	2.5PPM		Pass	-0.003 ppm
22.913(a)(2)	Effective Radiated Power	38 dBm	Radiated	Pass	21.29 dBm
24.232(c)	Equivalent Isotropic Radiated Power	33dBm		Pass	23.34 dBm
27.50(d)(4)		30dBm		Pass	25.24 dBm
22.917(a) 24.238(a) 27.53(g)	Radiated Spurious Emission	-13dBm		Pass	-35.9 dBm

FCC Rule Part	Frequency Range [MHz]	Output Power [W]	Frequency Tolerance	Emission Designator	Emission Bandwidth [MHz]	Communication Type
WCDMA						
22H	826.4 - 846.6	0.135	2.5 ppm	4M06F9W		WCDMA B5
27L	1712.4 - 1752.6	0.334	2.5 ppm	4M07F9W		WCDMA B4
24E	1852.4 - 1907.6	0.216	2.5 ppm	4M06F9W		WCDMA B2

8. PEAK TO AVERAGE RATIO

Test Procedure

Per KDB 971168 D01 Power Meas License Digital Systems v02r02;

The transmitter output was connected to a CMW500 Test Set and configured to operate at maximum power. The PAR were measured on the Spectrum Analyzer.

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.

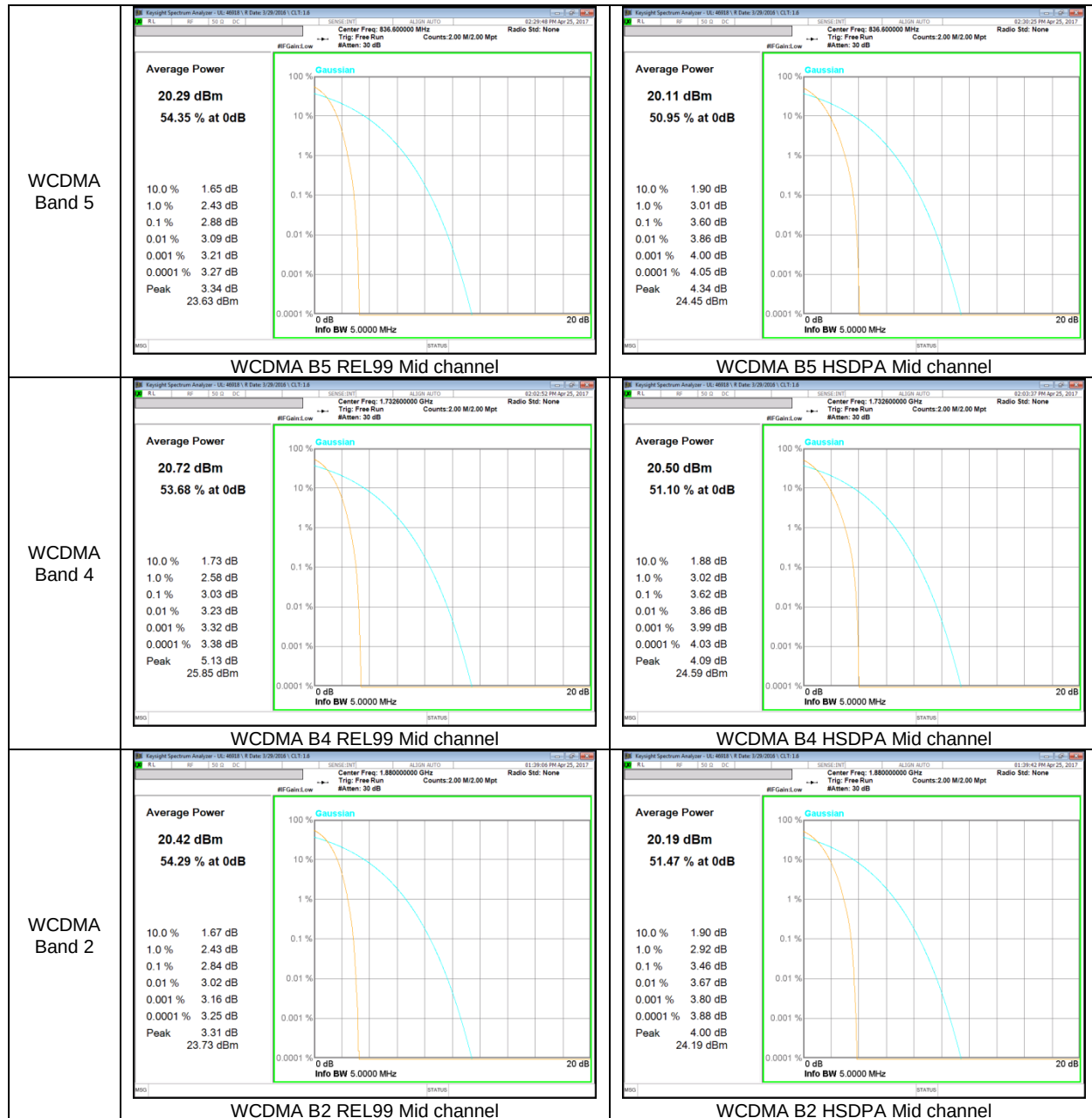
8.1. CONDUCTED PEAK TO AVERAGE RESULT

WCDMA

Band	Channel	f [MHz]	Mode	Ratio [dB]	Limit [dB]
Band 5	4183	836.6	REL99	2.88	13.00
			HSDPA	3.60	
Band 4	1413	1732.6	REL99	3.03	
			HSDPA	3.62	
Band 2	9400	1880.0	REL99	2.84	
			HSDPA	3.46	

8.2. CONDUCTED PEAK TO AVERAGE PLOTS

WCDMA



9. LIMITS AND CONDUCTED RESULTS

9.1. OCCUPIED BANDWIDTH

RULE PART(S)

FCC: §2.1049

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 v02r02)

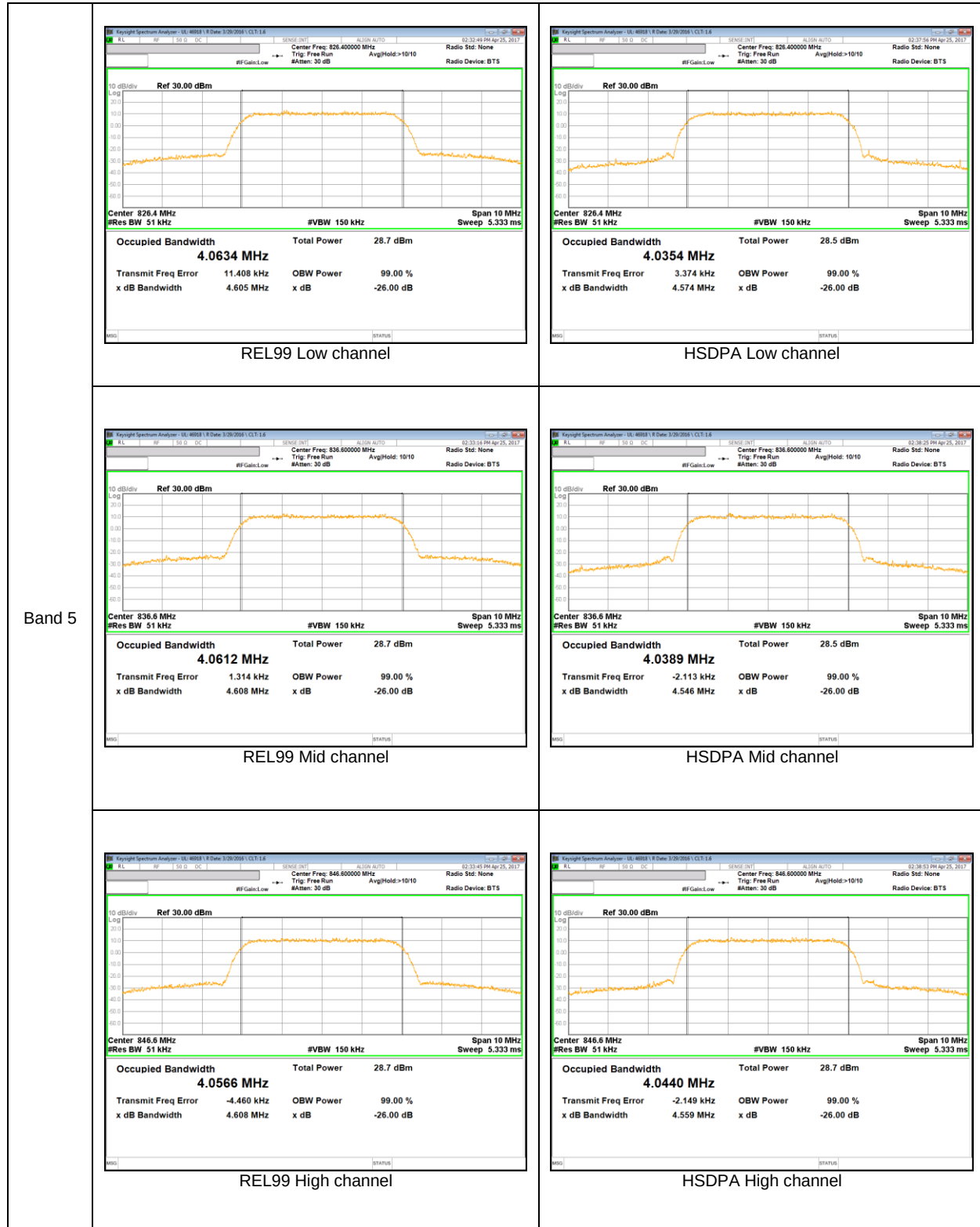
9.1.1. OCCUPIED BANDWIDTH RESULTS

WCDMA

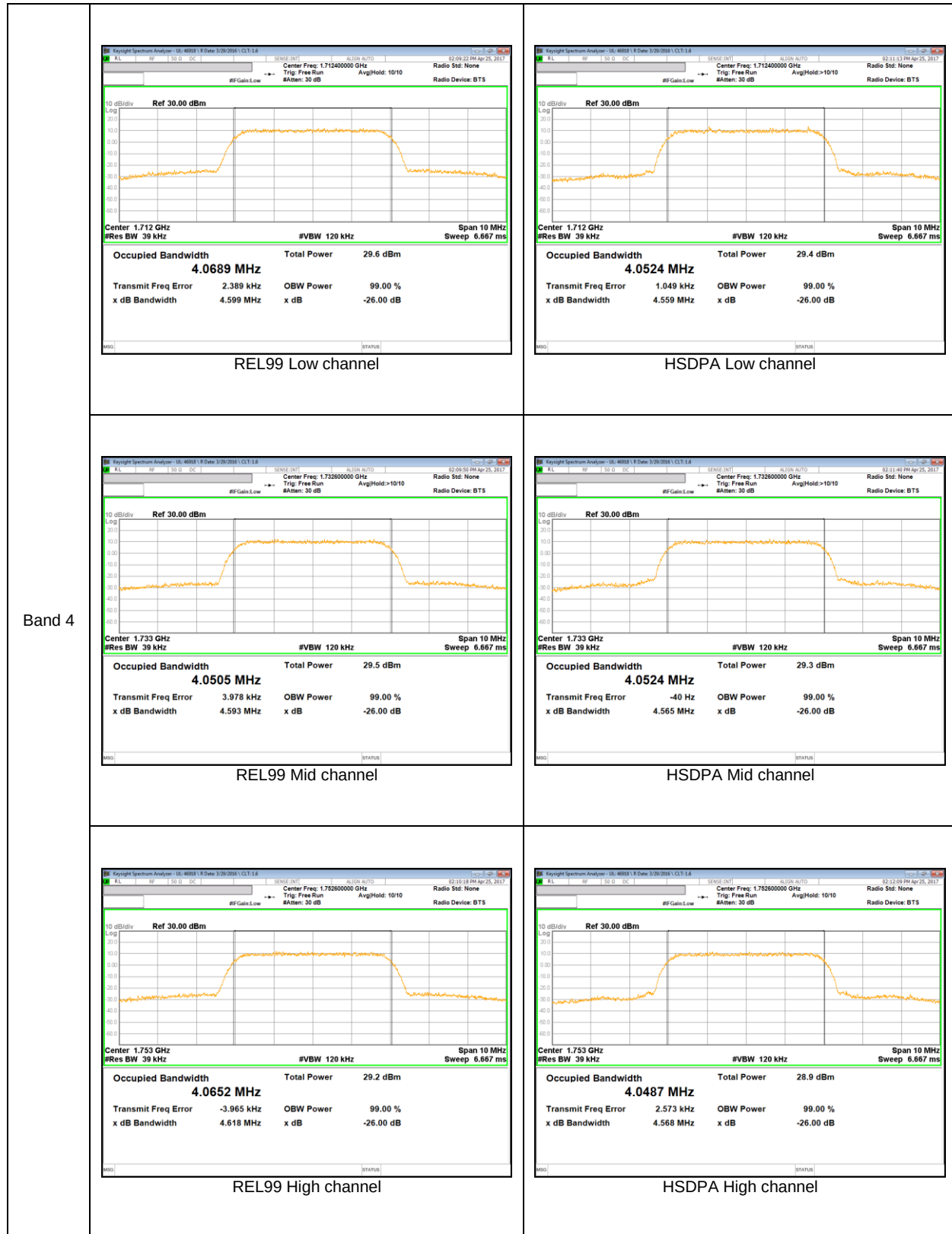
Band	Mode	Channel	f [MHz]	99% BW [MHz]	26dB BW [MHz]
Band 5	REL99	4132	826.4	4.0634	4.605
		4183	836.6	4.0612	4.608
		4233	846.6	4.0566	4.608
	HSDPA	4132	826.4	4.0354	4.574
		4183	836.6	4.0389	4.546
		4233	846.6	4.0440	4.559
Band 4	REL99	1312	1712.4	4.0689	4.599
		1413	1732.6	4.0505	4.593
		1513	1752.6	4.0652	4.618
	HSDPA	1312	1712.4	4.0524	4.559
		1413	1732.6	4.0524	4.565
		1513	1752.6	4.0487	4.568
Band 2	REL99	9262	1852.4	4.0608	4.617
		9400	1880.0	4.0614	4.597
		9538	1907.6	4.0583	4.615
	HSDPA	9262	1852.4	4.0517	4.536
		9400	1880.0	4.0521	4.559
		9538	1907.6	4.0455	4.557

9.1.2. OCCUPIED BANDWIDTH PLOTS

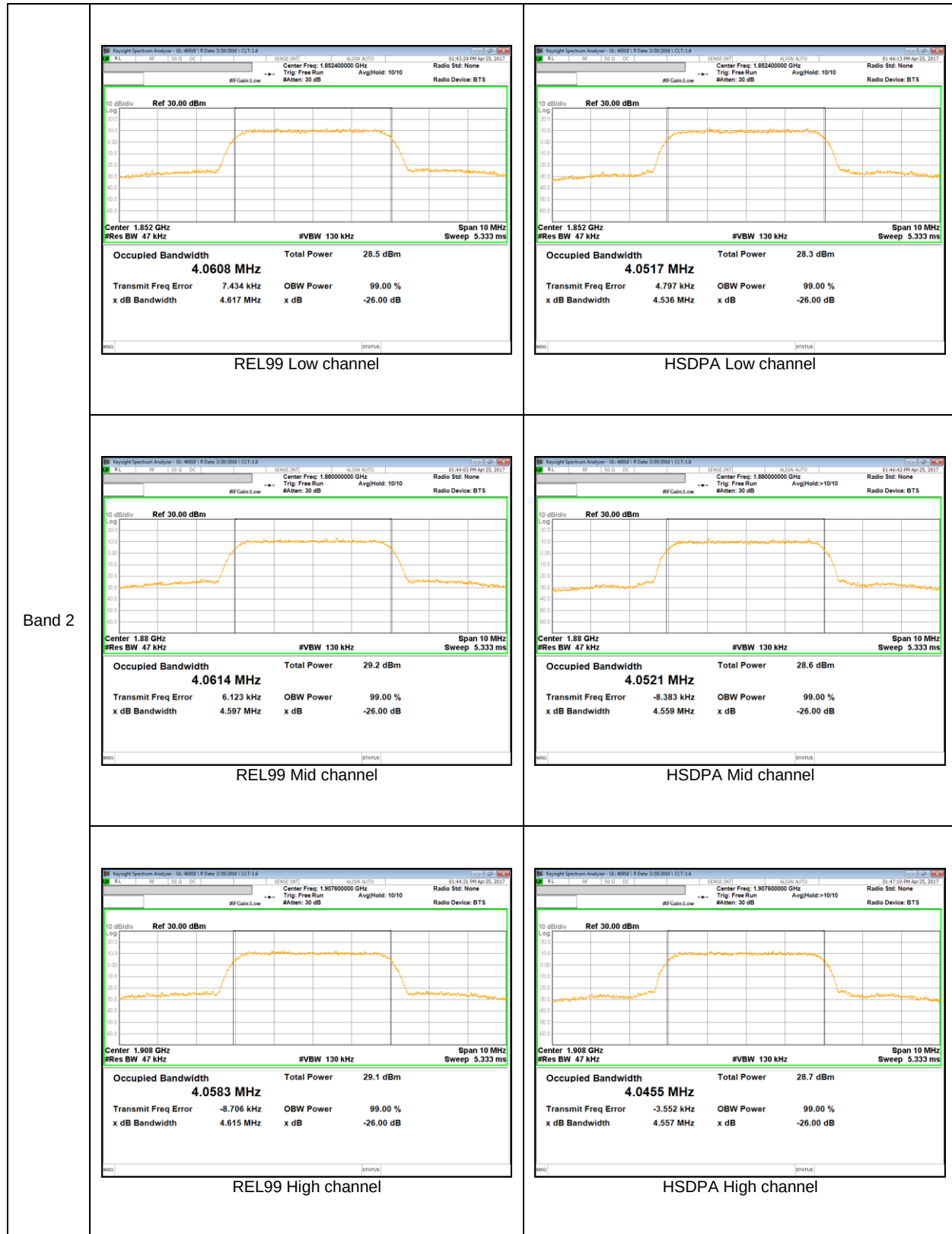
WCDMA Band 5



WCDMA Band 4



WCDMA Band 2



9.2. BAND EDGE EMISSIONS

RULE PART(S)

§22.359, §24.238 and §27.53 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 v02r02

The transmitter output was connected to 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.

WCDMA

- a) Set the RBW = 1 ~ 1.5 % of OBW (Typically limited to a minimum RBW of 1% of the OBW)
- b) Set VBW $\geq 3 \times$ RBW;
- c) Set span ≥ 1.5 times the OBW;
- d) Sweep time = Auto;
- e) Detector = RMS;
- f) Ensure that the number of measurement points $\geq 2 \times \text{Span} / \text{RBW}$;
- g) Trace mode = Average (100);

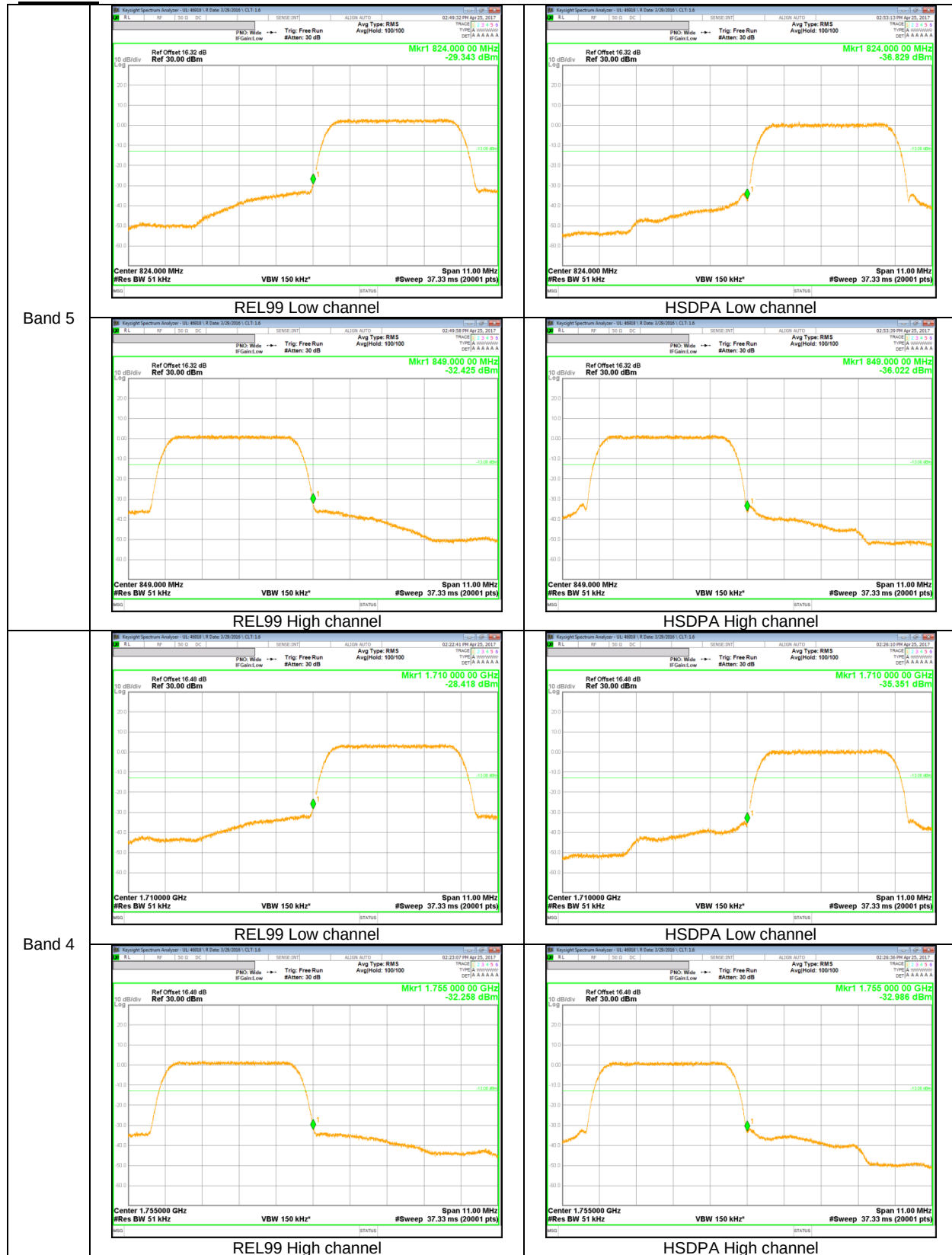
RESULTS

WCDMA

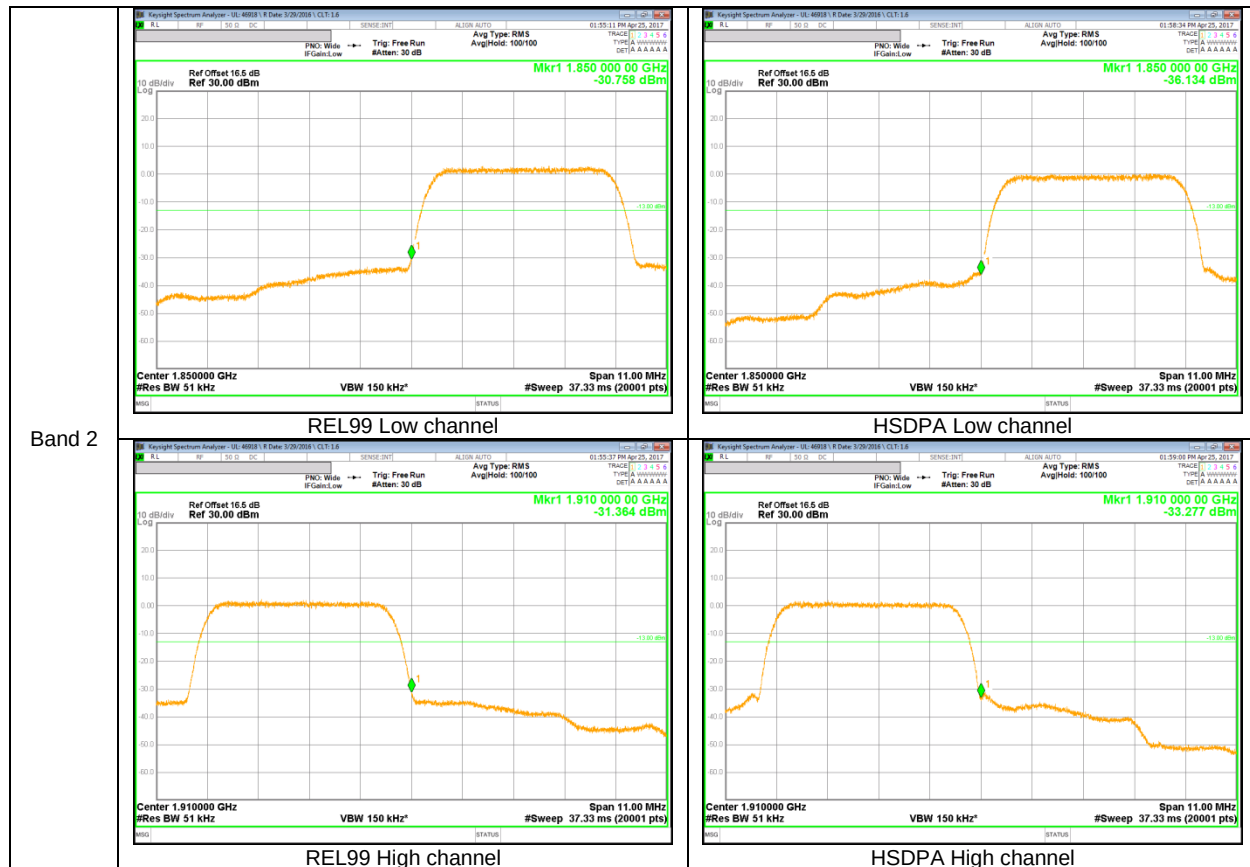
Band	Mode	Side	f [MHz]	Level [dBm]	Limit [dBm]
Band 5	REL99	Lower	824.000	-29.343	-13.00
		Upper	849.000	-32.425	
	HSDPA	Lower	824.000	-36.829	
		Upper	849.000	-36.022	
Band 4	REL99	Lower	1710.000	-28.418	
		Upper	1755.000	-32.258	
	HSDPA	Lower	1710.000	-35.351	
		Upper	1755.000	-32.986	
Band 2	REL99	Lower	1850.000	-30.758	
		Upper	1910.000	-31.364	
	HSDPA	Lower	1850.000	-36.134	
		Upper	1910.000	-33.277	

9.2.1. BAND EDGE PLOTS

WCDMA



WCDMA



10.3 OUT OF BAND EMISSIONS

RULE PART(S)

FCC: §2.1051, §22.901, §22.917, §24.238 and §27. 53

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 v02r02

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.

- a) Set the RBW = 100KHz for emission below 1GHz and 1MHz for emissions above 1GHz
(Tests were performed 1MHz [Worst case], to sweep 1 time for all frequency range)
- b) Set VBW $\geq 3 \times$ RBW;
- c) Set span ≥ 1.5 times the OBW;
- d) Sweep time = auto couple;
- e) Detector = peak;
- f) Ensure that the number of measurement points = Max (40001);
- g) Trace mode = max hold;

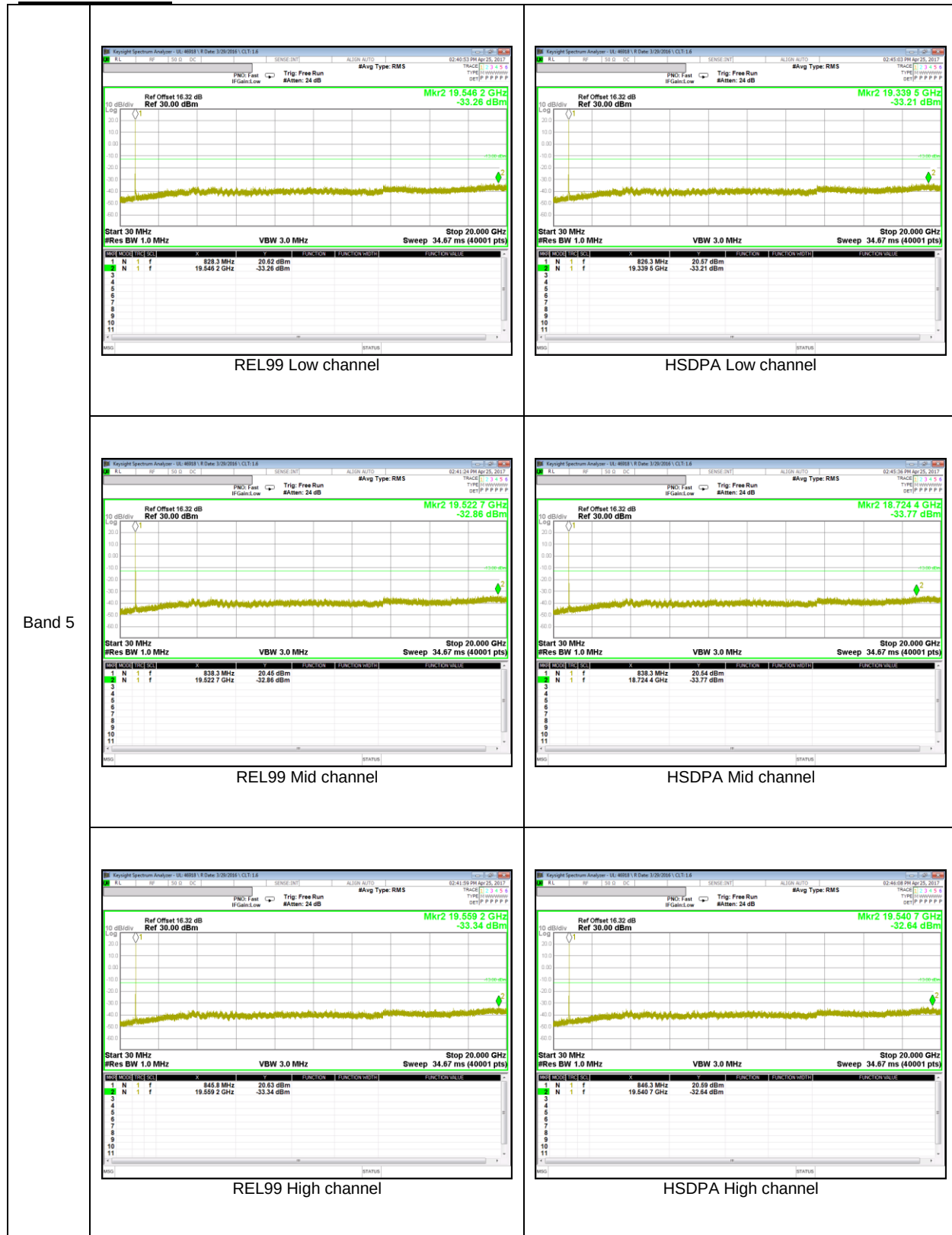
RESULTS

WCDMA

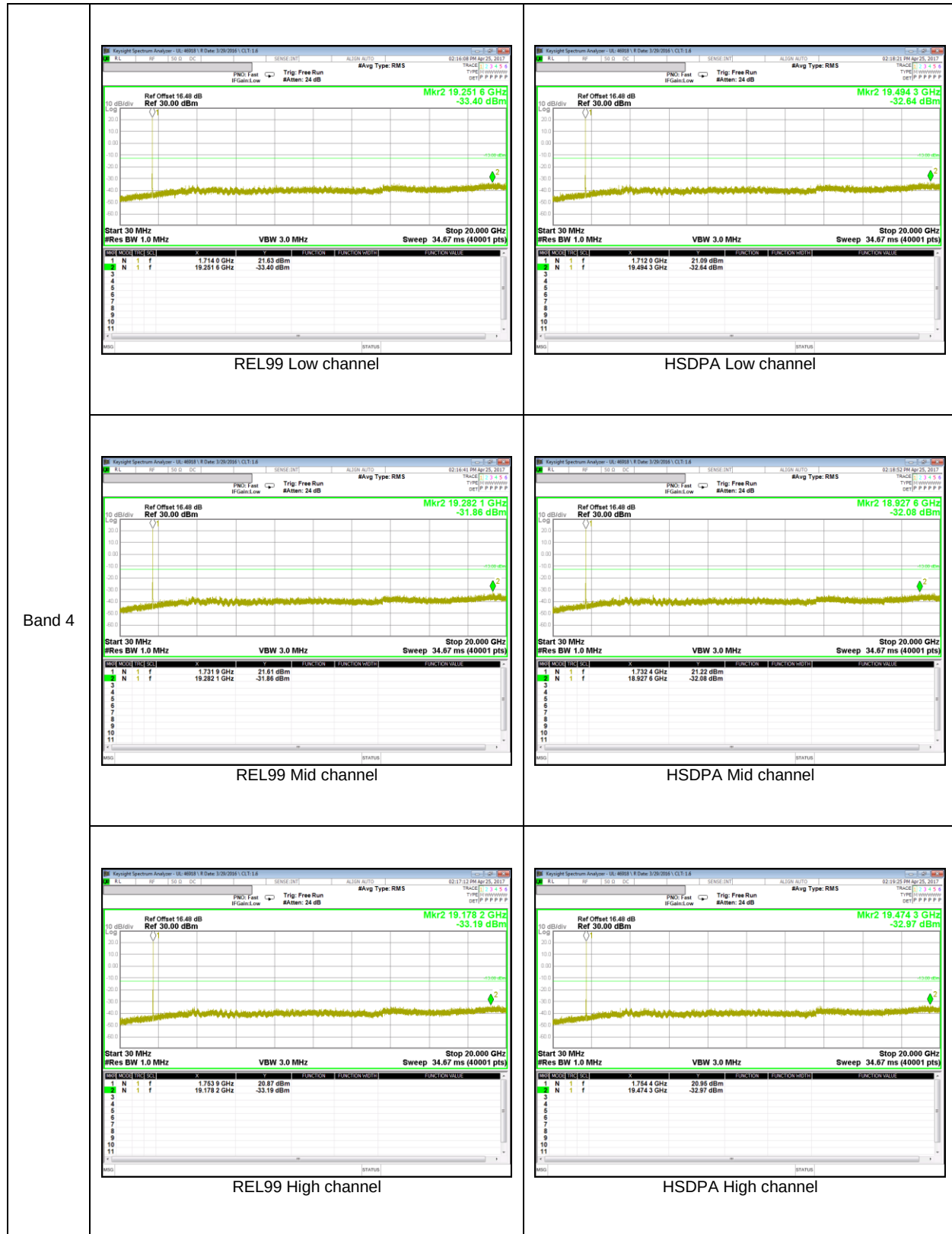
Band	Mode	f [MHz]	Spurious [dBm]	Limit [dBm]
Band 5	REL99	826.4	-33.26	-13.00
		836.6	-32.86	
		846.6	-33.34	
	HSDPA	826.4	-33.21	
		836.6	-33.77	
		846.6	-32.64	
Band 4	REL99	1712.4	-33.40	
		1732.6	-31.86	
		1752.6	-33.19	
	HSDPA	1712.4	-32.64	
		1732.6	-32.08	
		1752.6	-32.97	
Band 2	REL99	1852.4	-32.67	
		1880.0	-33.30	
		1907.6	-32.63	
	HSDPA	1852.4	-32.57	
		1880.0	-33.20	
		1907.6	-33.23	

9.2.2. OUT OF BAND EMISSIONS PLOTS

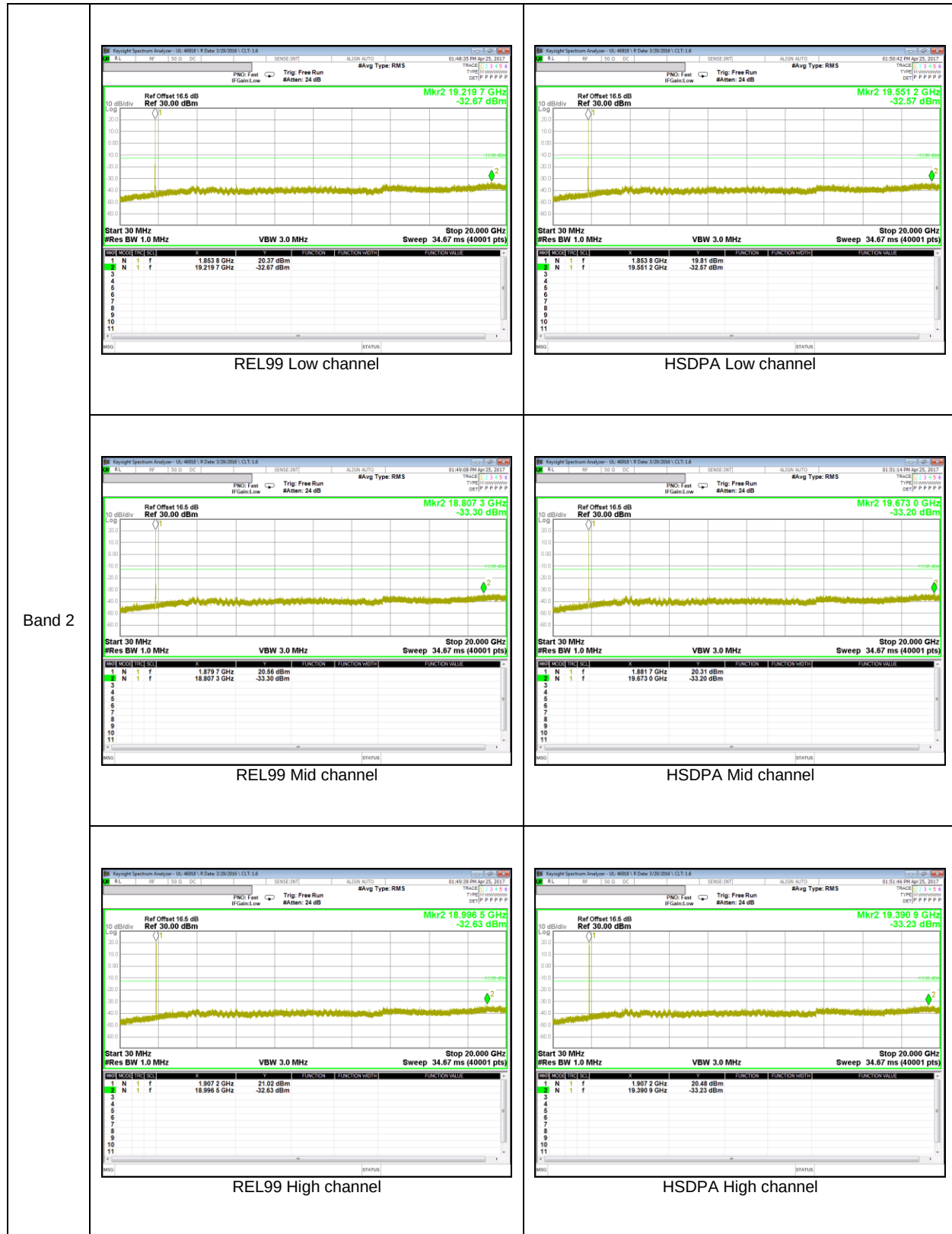
WCDMA Band 5



WCDMA Band 4



WCDMA Band 2



9.3. 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 v02r02

RESULTS

See the following pages.

9.3.1. FREQUENCY STABILITY RESULTS

WCDMA Band 5, Channel 4183, Frequency 836.6 MHz

Reference Frequency: WCDMA Band 5 Mid Channel 836.6 MHz @ 20°C				
Limit: +- 2.5 ppm = 2091.500 Hz				
Power Supply [Vdc]	Environment Temperature [°C]	Frequency Deviation Measured with Time Elapse		
		[MHz]	Delta [ppm]	Limit [ppm]
3.70	50	836.60000792	-0.002	2.5
3.70	40	836.60000598	0.000	2.5
3.70	30	836.60000742	-0.001	2.5
3.70	20	836.60000631	0	2.5
3.70	10	836.60000859	-0.003	2.5
3.70	0	836.60000668	0.000	2.5
3.70	-10	836.60000570	0.001	2.5
3.70	-20	836.60000697	-0.001	2.5
3.70	-30	836.60000615	0.000	2.5

Reference Frequency: WCDMA Band 5 Mid Channel 836.6 MHz @ 20°C				
Limit: +- 2.5 ppm = 2091.500 Hz				
Power Supply [Vdc]	Environment Temperature [°C]	Frequency Deviation Measured with Time Elapse		
		[MHz]	Delta [ppm]	Limit [ppm]
3.70	20	836.60000631	0	2.5
4.20	20	836.60000738	-0.001	2.5
3.50	20	836.60000572	0.001	2.5

WCDMA Band 4, Channel 1413, Frequency 1732.6 MHz

Reference Frequency: WCDMA Band 4 Mid Channel 1732.6 MHz @ 20°C				
Limit: +- 2.5 ppm = 4331.500 Hz				
Power Supply [Vdc]	Environment Temperature [°C]	Frequency Deviation Measured with Time Elapse		
		[MHz]	Delta [ppm]	Limit [ppm]
3.70	50	1732.60001043	0.001	2.5
3.70	40	1732.60001423	-0.001	2.5
3.70	30	1732.60001225	0.000	2.5
3.70	20	1732.60001272	0	2.5
3.70	10	1732.60001167	0.001	2.5
3.70	0	1732.60001579	-0.002	2.5
3.70	-10	1732.60001164	0.001	2.5
3.70	-20	1732.60001359	-0.001	2.5
3.70	-30	1732.60001428	-0.001	2.5

Reference Frequency: WCDMA Band 4 Mid Channel 1732.6 MHz @ 20°C				
Limit: +- 2.5 ppm = 4331.500 Hz				
Power Supply [Vdc]	Environment Temperature [°C]	Frequency Deviation Measured with Time Elapse		
		[MHz]	Delta [ppm]	Limit [ppm]
3.70	20	1732.60001272	0	2.5
4.20	20	1732.60001321	0.000	2.5
3.50	20	1732.60001258	0.000	2.5

WCDMA Band 2, Channel 9400, Frequency 1880.0 MHz

Reference Frequency: WCDMA Band 2 Mid Channel 1880.0 MHz @ 20°C				
Limit: +- 2.5 ppm = 4700.000 Hz				
Power Supply [Vdc]	Environment Temperature [°C]	Frequency Deviation Measured with Time Elapse		
		[MHz]	Delta [ppm]	Limit [ppm]
3.70	50	1879.99998278	0.000	2.5
3.70	40	1879.99998502	-0.001	2.5
3.70	30	1879.99998558	-0.001	2.5
3.70	20	1879.99998302	0	2.5
3.70	10	1879.99998411	-0.001	2.5
3.70	0	1879.99998326	0.000	2.5
3.70	-10	1879.99998239	0.000	2.5
3.70	-20	1879.99998271	0.000	2.5
3.70	-30	1879.99998419	-0.001	2.5

Reference Frequency: WCDMA Band 2 Mid Channel 1880.0 MHz @ 20°C				
Limit: +- 2.5 ppm = 4700.000 Hz				
Power Supply [Vdc]	Environment Temperature [°C]	Frequency Deviation Measured with Time Elapse		
		[MHz]	Delta [ppm]	Limit [ppm]
3.70	20	1879.99998302	0	2.5
4.20	20	1879.99998345	0.000	2.5
3.50	20	1879.99998290	0.000	2.5

10. RADIATED TEST RESULTS

10.1. RADIATED POWER (ERP & EIRP)

RULE PART(S)

FCC: §2.1046, §22.913, §24.232 and §27.50

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.

27.50(d) - (4) Fixed, mobile, and portable (hand-held) stations operating in the 1710-1755 MHz band and mobile and portable stations operating in the 1695-1710 MHz and 1755-1780 MHz bands are limited to 1 watt EIRP.(Band 4)

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 603D Clause 2.2.17; ESU40 setting reference to 971168 D01 v02r02

For peak power measurement with a ESU40:

a) Set the RBW $\geq$ OBW; b) Set VBW $\geq 3 \times$ RBW; c) Set span $\geq 2 \times$ RBW; d) Sweep time = auto couple; e) Detector = peak; f) Ensure that the number of measurement points $\geq$ span/RBW; g) Trace mode = max hold;

For average power measurement with a ESU40:

a) Set span to at least 1.5 times the OBW; b) Set RBW = 1-5% of the OBW, not to exceed 1 MHz; c) Set VBW $\geq 3 \times$ RBW; d) Set number of points in sweep $\geq 2 \times$ span / RBW; e) Sweep time = auto-couple; f) Detector = RMS (power averaging); g) Use free run trigger If burst duty cycle ≥ 98 ; h) Use trigger to capture bursts If burst duty cycle < 98 ; i) Trace average at least 100 traces in power averaging (i.e., RMS) mode. j) Compute the power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function.

TEST RESULTS

10.1.1. ERP/EIRP Results

WCDMA

Band	Mode	Channel	f [MHz]	ERP / EIRP	
				[dBm]	[mW]
Band 5	REL99	4132	826.4	20.24	105.68
		4183	836.6	21.25	133.35
		4233	846.6	21.29	134.59
	HSDPA	4132	826.4	20.24	105.68
		4183	836.6	21.13	129.72
		4233	846.6	21.21	132.13
Band 4	REL99	1312	1712.4	23.93	247.17
		1413	1732.6	24.33	271.02
		1513	1752.6	25.24	334.20
	HSDPA	1312	1712.4	23.84	242.10
		1413	1732.6	24.14	259.42
		1513	1752.6	25.20	331.13
Band 2	REL99	9262	1852.4	22.64	183.65
		9400	1880.0	23.34	215.77
		9538	1907.6	22.75	188.36
	HSDPA	9262	1852.4	22.42	174.58
		9400	1880.0	23.14	206.06
		9538	1907.6	22.66	184.50

10.1.2. ERP/EIRP DATA

WCDMA Band 5

WCDMA Band 5 REL99		High Frequency Substitution Measurement UL Korea, Ltd. Suwon Laboratory Chamber 2							
		Company: Hyundai Project #: 4787927807 Date: 04-07-17 Test Engineer: Chan Park Configuration: EUT ONLY, Z Position Mode: Rel 99_850 MHz							
		Test Equipment: Receiving: VULB9163-749, and 3m Chamber N-type Cable (Setup this one for testing EUT) Substitution: Dipole S/N: 00164753, 3m SMA Cable Warehouse.							
		f	SG reading	Ant. Pol.	Cable Loss	Antenna Gain	ERP	Limit	Notes
		MHz	(dBm)	(H/V)	(dB)	(dBd)	(dBm)	(dBm)	(dB)
		Low Ch							
		826.40	22.85	V	1.1	-1.5	20.24	38.5	-18.2
		826.40	14.33	H	1.1	-1.5	11.72	38.5	-26.7
		Mid Ch							
		836.60	23.74	V	1.1	-1.4	21.25	38.5	-17.2
		836.60	15.51	H	1.1	-1.4	13.02	38.5	-25.4
		High Ch							
		846.60	23.67	V	1.1	-1.3	21.29	38.5	-17.2
		846.60	15.75	H	1.1	-1.3	13.37	38.5	-25.1
		Rev. 3.17.11							

WCDMA Band 5 HSDPA		High Frequency Substitution Measurement UL Korea, Ltd. Suwon Laboratory Chamber 2							
		Company: Hyundai Project #: 4787927807 Date: 04-07-17 Test Engineer: Chan Park Configuration: EUT ONLY, Z Position Mode: HSDPA_850 MHz							
		Test Equipment: Receiving: VULB9163-749, and 3m Chamber N-type Cable (Setup this one for testing EUT) Substitution: Dipole S/N: 00164753, 3m SMA Cable Warehouse.							
		f	SG reading	Ant. Pol.	Cable Loss	Antenna Gain	ERP	Limit	Notes
		MHz	(dBm)	(H/V)	(dB)	(dBd)	(dBm)	(dBm)	(dB)
		Low Ch							
		826.40	22.85	V	1.1	-1.5	20.24	38.5	-18.2
		826.40	14.27	H	1.1	-1.5	11.66	38.5	-26.8
		Mid Ch							
		836.60	23.62	V	1.1	-1.4	21.13	38.5	-17.3
		836.60	15.19	H	1.1	-1.4	12.70	38.5	-25.8
		High Ch							
		846.60	23.59	V	1.1	-1.3	21.21	38.5	-17.2
		846.60	15.64	H	1.1	-1.3	13.26	38.5	-25.2
		Rev. 3.17.11							

WCDMA Band 4

WCDMA Band 4 REL99	High Frequency Substitution Measurement UL Korea, Ltd. Suwon Laboratory Chamber 2								
	Company: Hyundai Project #: 4787927807 Date: 04-07-17 Test Engineer: Chan Park Configuration: EUT ONLY, Y Position Mode: Rel 99_1700 MHz								
	Test Equipment: Receiving: 3117[00168724] and Chamber 1 SMA Cables Substitution: 3115[00161451] Substitution, 3m SMA Cable Warehouse								
	f	SG reading	Ant. Pol.	Cable Loss	Antenna Gain	EIRP	Limit	Margin	Notes
	MHz	(dBm)	(H/V)	(dB)	(dBi)	(dBm)	(dBm)	(dB)	
	Low Ch								
	1712.40	12.21	V	1.54	9.20	19.87	30.0	-10.1	
	1712.40	16.27	H	1.54	9.20	23.93	30.0	-6.1	
	Mid Ch								
	1732.60	12.23	V	1.55	9.31	19.99	30.0	-10.0	
	1732.60	16.57	H	1.55	9.31	24.33	30.0	-5.7	
	High Ch								
	1752.60	13.90	V	1.56	9.38	21.72	30.0	-8.3	
	1752.60	17.42	H	1.56	9.38	25.24	30.0	-4.8	
	Rev. 3.17.11 Note: For Band 4 EIRP limit is 30dBm								
WCDMA Band 4 HSDPA	High Frequency Substitution Measurement UL Korea, Ltd. Suwon Laboratory Chamber 2								
	Company: Hyundai Project #: 4787927807 Date: 04-07-17 Test Engineer: Chan Park Configuration: EUT ONLY, Y Position Mode: HSDPA_1700 MHz								
	Test Equipment: Receiving: 3117[00168724] and Chamber 1 SMA Cables Substitution: 3115[00161451] Substitution, 3m SMA Cable Warehouse								
	f	SG reading	Ant. Pol.	Cable Loss	Antenna Gain	EIRP	Limit	Margin	Notes
	MHz	(dBm)	(H/V)	(dB)	(dBi)	(dBm)	(dBm)	(dB)	
	Low Ch								
	1712.40	12.42	V	1.54	9.20	20.08	30.0	-9.9	
	1712.40	16.18	H	1.54	9.20	23.84	30.0	-6.2	
	Mid Ch								
	1732.60	12.29	V	1.55	9.31	20.05	30.0	-10.0	
	1732.60	16.38	H	1.55	9.31	24.14	30.0	-5.9	
	High Ch								
	1752.60	13.88	V	1.56	9.38	21.70	30.0	-8.3	
	1752.60	17.38	H	1.56	9.38	25.20	30.0	-4.8	
	Rev. 3.17.11 Note: For Band 4 EIRP limit is 30dBm								

WCDMA Band 2

WCDMA Band 2 REL99	High Frequency Substitution Measurement UL Korea, Ltd. Suwon Laboratory Chamber 2 Company: Hyundai Project #: 4787927807 Date: 04-07-17 Test Engineer: Chan Park Configuration: EUT ONLY, Z Position Mode: REL99_1900 MHz Test Equipment: Receiving: 3117[00168724] and Chamber 1 SMA Cables Substitution: 3115[00161451] Substitution, 3m SMA Cable Warehouse								
	f	SG reading	Ant. Pol.	Cable Loss	Antenna Gain	EIRP	Limit	Margin	Notes
	MHz	(dBm)	(H/V)	(dB)	(dBi)	(dBm)	(dBm)	(dB)	
	Low Ch								
	1852.40	15.45	V	1.60	8.79	22.64	33.0	-10.4	
	1852.40	14.14	H	1.60	8.79	21.33	33.0	-11.7	
	Mid Ch								
	1880.00	16.34	V	1.62	8.62	23.34	33.0	-9.7	
	1880.00	13.31	H	1.62	8.62	20.31	33.0	-12.7	
	High Ch								
	1907.60	15.93	V	1.63	8.45	22.75	33.0	-10.2	
	1907.60	11.64	H	1.63	8.45	18.46	33.0	-14.5	
Rev. 3.17.11 Note: For Band 4 EIRP limit is 30dBm									
WCDMA Band 2 HSDPA	High Frequency Substitution Measurement UL Korea, Ltd. Suwon Laboratory Chamber 2 Company: Hyundai Project #: 4787927807 Date: 04-07-17 Test Engineer: Chan Park Configuration: EUT ONLY, Z Position Mode: HSDPA_1900 MHz Test Equipment: Receiving: 3117[00168724] and Chamber 1 SMA Cables Substitution: 3115[00161451] Substitution, 3m SMA Cable Warehouse								
	f	SG reading	Ant. Pol.	Cable Loss	Antenna Gain	EIRP	Limit	Margin	Notes
	MHz	(dBm)	(H/V)	(dB)	(dBi)	(dBm)	(dBm)	(dB)	
	Low Ch								
	1852.40	15.23	V	1.60	8.79	22.42	33.0	-10.6	
	1852.40	13.55	H	1.60	8.79	20.74	33.0	-12.3	
	Mid Ch								
	1880.00	16.14	V	1.62	8.62	23.14	33.0	-9.9	
	1880.00	13.14	H	1.62	8.62	20.14	33.0	-12.9	
	High Ch								
	1907.60	15.84	V	1.63	8.45	22.66	33.0	-10.3	
	1907.60	11.16	H	1.63	8.45	17.98	33.0	-15.0	
Rev. 3.17.11 Note: For Band 4 EIRP limit is 30dBm									

10.2. FIELD STRENGTH OF SPURIOUS RADIATION

RULE PART(S)

FCC: §2.1053, §22.917, §24.238 and §27. 53

LIMIT

Part 22.917(a) & Part 24.238(a) 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

ANSI / TIA / EIA 603D Clause 2.2.12; ESU40 setting reference to 971168 D01 v02r02

For peak power measurement with a ESU40:

- a) Set the RBW = 100 KHz for emission below 1GHz and 1MHz for emissions above 1GHz
- b) Set VBW $\geq 3 \times$ RBW;
- c) Set span ≥ 1.5 times the OBW;
- d) Sweep time = auto couple;
- e) Detector = peak (RMS for average measurement);
- f) Ensure that the number of measurement points $\geq$ span/RBW;
- g) Trace mode = max hold;

RESULTS

10.2.1. SPURIOUS RADIATION PLOTS

WCDMA Band 5

UL Korea, Ltd Suwon Laboratory Above 1GHz High Frequency Substitution Measurement									
Company:		Hyundai							
Project #:		4787927807							
Date:		04-10-17							
Test Engineer:		Chan Park							
Configuration:		EUT / AC Adapter / Earphone / X Position							
Mode:		Tx, REL99,850MHz							
Chamber		Pre-amplifier		Filter		Limit			
Chamber 2		AFS42		Filter 1		Part 22			
f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 826.40MHz									
1.6520	-16.3	V	3.0	38.2	1.0	-53.5	-13.0	-40.5	
2.4790	-12.6	V	3.0	38.8	1.0	-50.4	-13.0	-37.4	
3.3056	-14.7	V	3.0	39.4	1.0	-53.1	-13.0	-40.1	
1.6520	-15.2	H	3.0	38.2	1.0	-52.5	-13.0	-39.5	
2.4790	-13.7	H	3.0	38.8	1.0	-51.5	-13.0	-38.5	
3.3056	-14.6	H	3.0	39.4	1.0	-53.0	-13.0	-40.0	
Mid Ch, 836.6MHz									
1.6732	-13.8	V	3.0	38.2	1.0	-51.1	-13.0	-38.1	
2.5098	-13.6	V	3.0	38.8	1.0	-51.4	-13.0	-38.4	
3.3464	-15.0	V	3.0	39.5	1.0	-53.4	-13.0	-40.4	
1.6732	-15.8	H	3.0	38.2	1.0	-53.0	-13.0	-40.0	
2.5098	-14.8	H	3.0	38.8	1.0	-52.7	-13.0	-39.7	
3.3464	-14.8	H	3.0	39.5	1.0	-53.2	-13.0	-40.2	
High Ch, 846.6MHz									
1.6932	-12.5	V	3.0	38.2	1.0	-49.8	-13.0	-36.8	
2.5390	-15.1	V	3.0	38.9	1.0	-53.0	-13.0	-40.0	
3.3860	-14.3	V	3.0	39.5	1.0	-52.8	-13.0	-39.8	
1.6932	-14.4	H	3.0	38.2	1.0	-51.6	-13.0	-38.6	
2.5390	-15.5	H	3.0	38.9	1.0	-53.4	-13.0	-40.4	
3.3860	-14.7	H	3.0	39.5	1.0	-53.2	-13.0	-40.2	
Rev. 03.03.09 Note: No other emissions were detected above the system noise floor.									

UL Korea, Ltd Suwon Laboratory Above 1GHz High Frequency Substitution Measurement									
Company:		Hyundai							
Project #:		4787927807							
Date:		04-10-17							
Test Engineer:		Chan Park							
Configuration:		EUT / AC Adapter / Earphone / X Position							
Mode:		Tx, HSDPA,850MHz							
Chamber		Pre-amplifier		Filter		Limit			
Chamber 2		AFS42		Filter 1		Part 22			
f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 826.40MHz									
1.6520	-14.1	V	3.0	38.2	1.0	-51.3	-13.0	-38.3	
2.4790	-13.3	V	3.0	38.8	1.0	-51.1	-13.0	-38.1	
3.3056	-14.4	V	3.0	39.4	1.0	-52.8	-13.0	-39.8	
1.6520	-14.4	H	3.0	38.2	1.0	-51.6	-13.0	-38.6	
2.4790	-14.0	H	3.0	38.8	1.0	-51.8	-13.0	-38.8	
3.3056	-14.7	H	3.0	39.4	1.0	-53.1	-13.0	-40.1	
Mid Ch, 836.6MHz									
1.6732	-12.5	V	3.0	38.2	1.0	-49.8	-13.0	-36.8	
2.5098	-14.2	V	3.0	38.8	1.0	-52.1	-13.0	-39.1	
3.3464	-15.1	V	3.0	39.5	1.0	-53.5	-13.0	-40.5	
1.6732	-13.9	H	3.0	38.2	1.0	-51.1	-13.0	-38.1	
2.5098	-15.4	H	3.0	38.8	1.0	-53.3	-13.0	-40.3	
3.3464	-14.9	H	3.0	39.5	1.0	-53.4	-13.0	-40.4	
High Ch, 846.6MHz									
1.6932	-10.6	V	3.0	38.2	1.0	-47.8	-13.0	-34.8	
2.5390	-14.8	V	3.0	38.9	1.0	-52.7	-13.0	-39.7	
3.3860	-14.4	V	3.0	39.5	1.0	-52.9	-13.0	-39.9	
1.6932	-13.0	H	3.0	38.2	1.0	-50.2	-13.0	-37.2	
2.5390	-16.3	H	3.0	38.9	1.0	-54.2	-13.0	-41.2	
3.3860	-14.6	H	3.0	39.5	1.0	-53.1	-13.0	-40.1	
Rev. 03.03.09 Note: No other emissions were detected above the system noise floor.									

WCDMA Band 4

WCDMA
Band 4
REL99

UL Korea, Ltd Suwon Laboratory
Above 1GHz High Frequency Substitution Measurement

Company: Hyundai
Project #: 4787927807
Date: 04-10-17
Test Engineer: Chan Park
Configuration: EUT / AC Adapter / Y Position
Mode: Tx, REL99,1700MHz

Chamber

Pre-amplifier

Filter

Limit

Chamber 2

AFS42

Filter 1

Part27

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 1712.4MHz									
3.4248	1.7	V	3.0	39.5	1.0	-36.8	-13.0	-23.8	
5.1372	-12.3	V	3.0	39.8	1.0	-51.1	-13.0	-38.1	
6.8496	-11.1	V	3.0	39.7	1.0	-49.8	-13.0	-36.8	
3.4248	-7.2	H	3.0	39.5	1.0	-45.7	-13.0	-32.7	
5.1372	-12.5	H	3.0	39.8	1.0	-51.3	-13.0	-38.3	
6.8496	-10.7	H	3.0	39.7	1.0	-49.4	-13.0	-36.4	
Mid Ch, 1732.6MHz									
3.4652	0.9	V	3.0	39.5	1.0	-37.6	-13.0	-24.6	
5.1978	-12.6	V	3.0	39.8	1.0	-51.4	-13.0	-38.4	
6.9304	-10.9	V	3.0	39.7	1.0	-49.5	-13.0	-36.5	
3.4652	-7.6	H	3.0	39.5	1.0	-46.1	-13.0	-33.1	
5.1978	-12.8	H	3.0	39.8	1.0	-51.7	-13.0	-38.7	
6.9304	-10.5	H	3.0	39.7	1.0	-49.2	-13.0	-36.2	
High Ch, 1752.6MHz									
3.5052	-0.8	V	3.0	39.5	1.0	-39.4	-13.0	-26.4	
5.2578	-12.8	V	3.0	39.8	1.0	-51.6	-13.0	-38.6	
7.0104	-11.5	V	3.0	39.6	1.0	-50.1	-13.0	-37.1	
3.5052	-8.1	H	3.0	39.5	1.0	-46.6	-13.0	-33.6	
5.2578	-12.2	H	3.0	39.8	1.0	-51.0	-13.0	-38.0	
7.0104	-11.0	H	3.0	39.6	1.0	-49.6	-13.0	-36.6	

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

WCDMA
Band 4
HSDPA

UL Korea, Ltd Suwon Laboratory
Above 1GHz High Frequency Substitution Measurement

Company: Hyundai
Project #: 4787927807
Date: 04-10-17
Test Engineer: Chan Park
Configuration: EUT / AC Adapter / Y Position
Mode: Tx, HSDPA,1700MHz

Chamber

Pre-amplifier

Filter

Limit

Chamber 2

AFS42

Filter 1

Part27

f GHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 1712.4MHz									
3.4248	2.6	V	3.0	39.5	1.0	-35.9	-13.0	-22.9	
5.1372	-12.4	V	3.0	39.8	1.0	-51.2	-13.0	-38.2	
6.8496	-10.5	V	3.0	39.7	1.0	-49.2	-13.0	-36.2	
3.4248	-6.8	H	3.0	39.5	1.0	-45.3	-13.0	-32.3	
5.1372	-12.5	H	3.0	39.8	1.0	-51.3	-13.0	-38.3	
6.8496	-10.9	H	3.0	39.7	1.0	-49.6	-13.0	-36.6	
Mid Ch, 1732.6MHz									
3.4652	1.3	V	3.0	39.5	1.0	-37.2	-13.0	-24.2	
5.1978	-12.5	V	3.0	39.8	1.0	-51.3	-13.0	-38.3	
6.9304	-10.8	V	3.0	39.7	1.0	-49.4	-13.0	-36.4	
3.4652	-7.9	H	3.0	39.5	1.0	-46.4	-13.0	-33.4	
5.1978	-12.7	H	3.0	39.8	1.0	-51.5	-13.0	-38.5	
6.9304	-10.3	H	3.0	39.7	1.0	-49.0	-13.0	-36.0	
High Ch, 1752.6MHz									
3.5052	-0.4	V	3.0	39.5	1.0	-38.9	-13.0	-25.9	
5.2578	-12.2	V	3.0	39.8	1.0	-51.1	-13.0	-38.1	
7.0104	-11.4	V	3.0	39.6	1.0	-50.0	-13.0	-37.0	
3.5052	-7.3	H	3.0	39.5	1.0	-45.9	-13.0	-32.9	
5.2578	-12.8	H	3.0	39.8	1.0	-51.7	-13.0	-38.7	
7.0104	-11.1	H	3.0	39.6	1.0	-49.7	-13.0	-36.7	

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

WCDMA
Band 2
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