



FCC 47 CFR PART 02  
FCC 47 CFR PART 22  
FCC 47 CFR PART 24  
FCC 47 CFR PART 27  
ISED RSS- 132 issue 3  
ISED RSS- 133 issue 6  
ISED RSS- 139 issue 3

## CERTIFICATION TEST REPORT

*For*

**Harman TAG2.0 OBD II device**

**MODEL NUMBER: HSA-20UG-BA**

**FCC ID: 2AHPN-HSA-20UG-BA  
IC: 6434C-HSA20UGBA**

**REPORT NUMBER: 4789869259-5**

**ISSUE DATE: June 25, 2021**

*Prepared for*

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Revision History

Rev.	Issue Date	Revisions	Revised By
--	6/25/2021	Initial Issue	

## Note:

1. This test report is only published to and used by the applicant, and it is not for evidence purpose in China.
2. The measurement result for the sample received is <Pass> according to < CFR 47 FCC PART 22,24,27>< ISED RSS-132, RSS-133, RSS-139 > when <Accuracy Method> decision rule is applied.

Summary of Test Results			
Standard(s) Section	Description	Requirements	Result
FCC			
§22.913(a)(5)	Effective(Isotropic) Radiated Power of Transmitter	FCC: ERP <7 W	PASS
RSS-132	Effective(Isotropic) Radiated Power of Transmitter	ISED: ERP <11.5 W	PASS
§24.232(c) RSS-133	Effective(Isotropic) Radiated Power of Transmitter	EIRP < 2 W	PASS
§27.50(d) RSS-139	Effective(Isotropic) Radiated Power of Transmitter	EIRP < 1 W	PASS
§24.232(d) RSS-132(5.4) RSS-133(6.4) RSS-139(6.5)	Peak to Average Radio	<13dB	PASS
§2.1049(h) RSS-GEN	Occupied Bandwidth	OBW: No limit EBW: No limit	PASS
§2.1051, §22.917(a) §24.238(a) §27.53(h) RSS-132(5.5) RSS-133(6.5) RSS-139(6.6)	Band Edge Compliance	$\leq 43+10\log_{10}(P[W])/1\%*EBW$ , in 1 MHz bands immediately outside and adjacent to the frequency block.	PASS
§2.1051 §22.917(a) §24.238(a) §27.53(h) RSS-132(5.5) RSS-133(6.5) RSS-139(6.6)	Spurious Emission at Antenna Terminal	$\leq 43+10\log_{10}(P[W])/100 \text{ kHz}$ , from 9 kHz to 10th harmonics but outside authorized operating frequency ranges.	PASS
§2.1053, §22.917(a) §24.238(a) §27.53(h) RSS-132(5.5) RSS-133(6.5) RSS-139(6.6)	Radiated Spurious Emissions	$\leq 43+10\log_{10}(P[W])$	PASS
§2.1055 §22.355 RSS-132(5.3) RSS-133(6.3)	Frequency Stability for Temperature & Voltage	$\leq \pm 2.5\text{ppm}$ (Part 22) Emission must remain in band(Part 24,27)	PASS
§24.235 §27.54 RSS-139(6.6)		Within Authorized Band	PASS

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## 1. ATTESTATION OF TEST RESULTS

### Applicant Information

Company Name: Harman International Industries, Inc.  
Address: 30001 , Cabot Drive, Novi, MI 48377, USA

### Manufacturer Information

Company Name: Harman International Industries, Inc.  
Address: 30001 , Cabot Drive, Novi, MI 48377, USA

### EUT Information

EUT Name: Harman TAG2.0 OBD II device  
Model: HSA-20UG-BA  
Brand: OnStar Link  
Sample Received Date: 03/19/2021  
Sample Status: Normal  
Sample ID: 3752794  
Date of Tested: 03/25/2021~ 06/23/2021

### APPLICABLE STANDARDS

STANDARD	TEST RESULTS
FCC 47 CFR PART 02	PASS
FCC 47 CFR PART 22 Subpart H	PASS
FCC 47 CFR PART 24 Subpart E	PASS
FCC 47 CFR PART 27 Subpart L	PASS
ISED RSS- 132 issue 3	PASS
ISED RSS- 133 issue 6	PASS
ISED RSS- 139 issue 3	PASS

Prepared By:



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## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.26-2015 & KDB971168, FCC CFR 47 Part 2, Part 22, Part 24, Part 27, ISED RSS-132, RSS-133, RSS-139.

## 3. FACILITIES AND ACCREDITATION

Accreditation Certificate	<p><b>A2LA (Certificate No.: 4102.01)</b> UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been assessed and proved to be in compliance with A2LA.</p> <p><b>FCC (FCC Designation No.: CN1187)</b> UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. Has been recognized to perform compliance testing on equipment subject to the Commission's Declaration of Conformity (DoC) and Certification rules</p> <p><b>IC(Company No.: 21320)</b> UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been registered and fully described in a report filed with ISED. The Company Number is 21320.</p> <p><b>VCCI (Registration No.: G-20019, R-20004, C-20012 and T-20011)</b> UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been assessed and proved to be in compliance with VCCI, the Membership No. is 3793.</p> <p><u>Facility Name:</u> Chamber D, the VCCI registration No. is G-20019 and R-20004 Shielding Room B, the VCCI registration No. is C-20012 and T-20011</p>
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Note 1: All tests measurement facilities use to collect the measurement data are located at Building 10, Innovation Technology Park, Song Shan Lake Hi tech Development Zone, Dongguan, 523808, China

Note 2: The test anechoic chamber in UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch had been calibrated and compared to the open field sites and the test anechoic chamber is shown to be equivalent to or worst case from the open field site.

## 4. CALIBRATION AND UNCERTAINTY

### 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.

### MEASUREMENT UNCERTAINTY

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

Test Item	Uncertainty
Uncertainty for Conduction emission test	3.32dB (150KHz-30MHz)
	3.72dB (9KHz-150KHz)
Uncertainty for Radiation Emission test(include Fundamental emission) (30MHz-1GHz)	4.70 dB (Antenna Polarize: V)
	4.84 dB (Antenna Polarize: H)
Uncertainty for Radiation Emission test (1GHz to 26GHz)( include Fundamental emission)	4.10dB(1-6GHz)
	4.40dB (6GHz-18Gz)
	3.54dB (18GHz-26Gz)
Bandwidth	1.1%
Stop Transmitting Time Test	0.6%

Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

## 5. EQUIPMENT UNDER TEST

### 5.1 DESCRIPTION OF EUT

EUT Name	Harman TAG2.0 OBD II device				
Model	HSA-20UG-BA				
Rated Input	DC 12 V				
Supply Voltage	<input type="checkbox"/> AC mains State				
	<input checked="" type="checkbox"/> DC State	<input type="checkbox"/> Internal Power Supply			
		<input checked="" type="checkbox"/> External Power Supply or AC/DC adapter	Rate Input: DC 12V / 24V		
	<input type="checkbox"/> Battery	Rate Output: /			
Software Version	N75NA_TAG20_R4.0.1				
Hardware Version	V1.0				

### 5.2 TECHNICAL INFORMATION

Frequency Bands	<input checked="" type="checkbox"/> WCDMA Band 2	1850 MHz ~ 1910 MHz (Uplink)	
		1930 MHz ~ 1990 MHz (Downlink)	
	<input checked="" type="checkbox"/> WCDMA Band 5	824 MHz ~ 849 MHz (Uplink)	
		869 MHz ~ 894 MHz (Downlink)	
Modulation Mode	<input checked="" type="checkbox"/> WCDMA Band 4	1710 MHz ~ 1755 MHz (Uplink)	
		2110 MHz ~ 2155 MHz (Downlink)	
WCDMA Release Version	WCDMA Release 99	HSPA+ Release Version	Release 8
HSDPA Release Version	Release 5	HSUPA Release Version	Release 6
Power Class	3		

## 5.3 MAXIMUM OUTPUT POWER

### ERP/EIRP RULE PART(S)

FCC: §2.1046, §22.913, §24.232

### LIMITS

22.913(a)(5) The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

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.

### ERP/EIRP TEST PROCEDURE

ANSI C63.26:2015/ KDB 971168 D01 Section 5.6

ERP/ EIRP = PMeas + GT - LC

where:

ERP or EIRP = effective or equivalent isotropically radiated power, respectively (expressed in the same units as PMeas, typically dBW or dBm);

PMeas = measured transmitter output power or PSD, in dBm or dBW;

GT = gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP);

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

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

Mode	Modulation	Conducted(Average) (dBm)	Antenna Gain (dBi)	Limit (W)	EIRP	
					(dBm)	(W)
WCDMA Band 2	REL99	24.41	-1.0	2	23.41	0.219
	HSDPA	22.51	-1.0		21.51	0.142

Mode	Modulation	Conducted(Average) (dBm)	Antenna Gain (dBi)	Limit (W)	EIRP	
					(dBm)	(W)
WCDMA Band 4	REL99	23.86	-0.3	1	23.56	0.227
	HSDPA	22.89	-0.3		22.59	0.182

Mode	Modulation	Conducted(Average) (dBm)	Antenna Gain (dBi)	Limit (W)	ERP	
					(dBm)	(W)
WCDMA Band 5	REL99	23.42	-0.9	7	20.37	0.109
	HSDPA	21.75	-0.9		18.70	0.074

## 5.4 OPERATING CONDITION OF EUT

During all testing, EUT is in link mode with base station emulator at maximum power level. The spurious emission measurements were carried out in semi-anechoic chamber with 3-meter test range, and EUT is rotated on three test planes to find out the worst emission (Y plane).

Worst-case modes:

Test Mode	Test Modes Description
UMTS/TM1	WCDMA REL99
UMTS/TM2	WCDMA HSDPA

Note: If no any other statement, UMTS/TM1 shall be used RCM 12.2K mode.

Note: For simultaneous transmission of multiple channels in the 2.4 / 5GHz and cellular bands, no noticeable emission was found.

## 5.5 TEST ENVIRONMENT

Environment Parameter	Selected Values During Tests	
Relative Humidity	53%	
Atmospheric Pressure:	1025Pa	
Temperature	TN	23.5 °C
Voltage:	VL	9 V
	VN	DC 12 V & 24 V
	VH	36 V
	End Voltage	9 V

Note: VL= Lower Extreme Test Voltage

VN= Nominal Voltage

VH= Upper Extreme Test Voltage

TN= Normal Temperature

## 5.6 TEST CHANNEL LIST

Bands	Channel	Frequency	
		Channel Number	Frequency(MHz)
WCDMA Band 2	Low	9262	1852.4
	Mid	9400	1880.0
	High	9538	1907.6
WCDMA Band 4	Low	1312	1712.4
	Mid	1413	1732.6
	High	1513	1752.6
WCDMA Band 5	Low	4132	826.4
	Mid	4182	836.4
	High	4233	846.6

## 5.7 DESCRIPTION OF AVAILABLE ANTENNAS

Band	Antenna Type	Antenna Gain (dBi)
WCDMA Band 2	PIFA	-1.0
WCDMA Band 4	PIFA	-0.3
WCDMA Band 5	PIFA	-0.9

## 5.8 DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

Item	Equipment	Brand Name	Model Name	Remarks
1	Laptop	ThinkPad	X230i	/
2	Test fixture	/	/	/

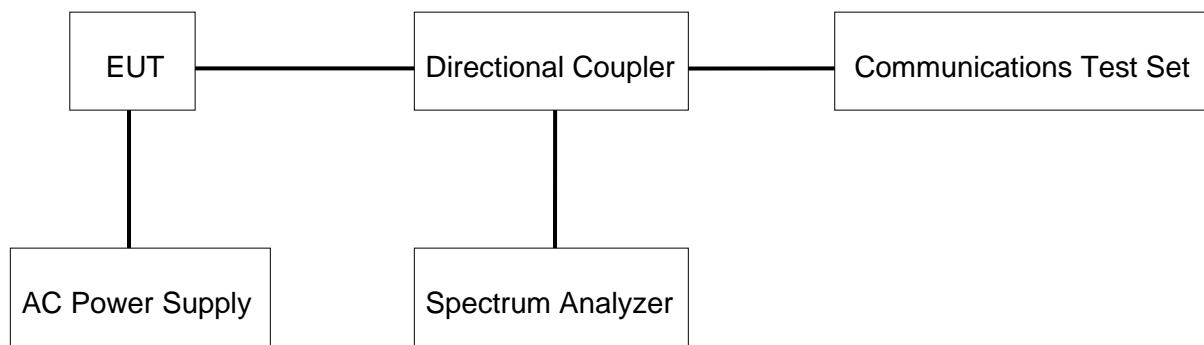
### I/O CABLES

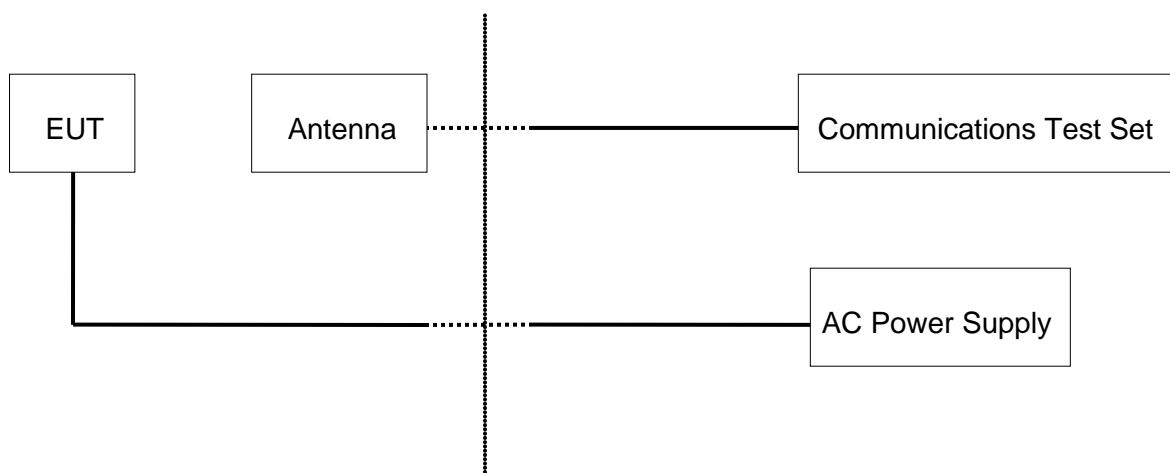
Cable No	Port	Connector Type	Cable Type	Cable Length(m)	Remarks
1	USB	USB	Unshielded	1	/

### ACCESSORY

Item	Accessory	Brand Name	Model Name	Description
1	AC Adapter	/	HJ-0122000	DC 12V,2A

### CONDUCTED TEST SETUP



**RADIATED TEST SETUP**

## 5.9 MEASURING INSTRUMENT AND SOFTWARE USED

Conducted Emissions					
Instrument					
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Wideband Radio Communication Tester	R&S	CMW500	155522	Nov.20,2020	Nov.19,2021
Signal & Spectrum analyzer	R&S	FSW	1312.8000K26-103950-sj	Nov.20,2020	Nov.19,2021
RF conditioning unit	Tonscend	JS0806-1	1518.0003.14-101329-aZ	\	\
Wideband filter unit	Tonscend	JS0806-F	20J8060329	\	\
Software					
Description		Manufacturer	Name	Version	
JS1120 RF Test System		Tonscend	JS1120	Ver 2.6.9	

Radiated Emissions					
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Due Date
MXE EMI Receiver	KESIGHT	N9038A	MY56400036	Nov. 12, 2020	Nov. 11, 2021
Hybrid Log Periodic Antenna	TDK	HLP-3003C	130960	Aug. 11, 2018	Aug. 10, 2021
Preamplifier	HP	8447D	2944A09099	Nov. 12, 2020	Nov. 11, 2021
EMI Measurement Receiver	R&S	ESR26	101377	Nov. 12, 2020	Nov. 11, 2021
Horn Antenna	TDK	HRN-0118	130939	Sept. 17, 2018	Sept. 17, 2021
Preamplifier	TDK	PA-02-0118	TRS-305-00067	Nov. 20, 2020	Nov. 19, 2021
Horn Antenna	Schwarzbeck	BBHA9170	#691	Aug. 11, 2018	Aug. 11, 2021
Preamplifier	TDK	PA-02-2	TRS-307-00003	Nov. 12, 2020	Nov. 11, 2021
Preamplifier	TDK	PA-02-3	TRS-308-00002	Nov. 12, 2020	Nov. 11, 2021
Loop antenna	Schwarzbeck	1519B	00008	Jan.17, 2019	Jan.17,2022
Preamplifier	TDK	PA-02-001-3000	TRS-302-00050	Nov. 12, 2020	Nov. 11, 2021
Preamplifier	Mini-Circuits	ZX60-83LN-S+	SUP01201941	Nov. 20, 2020	Nov. 19, 2021
Band Reject Filter	Wainwright	WRCJV8-2350-2400-	4	Nov. 12, 2020	Nov. 11, 2021



		2483.5- 2533.5-40SS			
High Pass Filter	Wi	WHKX10- 2700-3000- 18000-40SS	23	Nov. 12, 2020	Nov. 11, 2021
Software					
Description		Manufacturer	Name	Version	
Test Software for Radiated Emissions		Farad	EZ-EMC	Ver. UL-3A1	

## 6. TEST RESULTS

### 6.1 OUTPUT POWER VERIFICATION

Band	WCDMA 2		
Tx Channel	9262	9400	9538
Frequency	1852.4	1880	1907.6
Rel99	23.89	23.91	23.81
HSDPA Subtest-1	22.51	22.37	22.44
HSDPA Subtest-2	21.81	21.90	21.93
HSDPA Subtest-3	22.07	21.96	22.07
HSDPA Subtest-4	22.17	21.99	22.13
HSUPA Subtest-1	22.14	21.76	22.38
HSUPA Subtest-2	20.95	21.48	20.99
HSUPA Subtest-3	20.62	21.22	20.92
HSUPA Subtest-4	21.54	21.95	21.56
HSUPA Subtest-5	22.80	22.63	22.63
DC-HSDPA Subtest-1	22.51	22.37	22.44
DC-HSDPA Subtest-2	21.81	21.90	21.93
DC-HSDPA Subtest-3	22.07	21.96	22.07
DC-HSDPA Subtest-4	22.17	21.99	22.13
Band	WCDMA 4		
Tx Channel	1312	1413	1513
Frequency	1712.4	1732.6	1752.6
Rel99	23.65	23.86	23.82
HSDPA Subtest-1	22.35	22.89	22.66
HSDPA Subtest-2	21.92	22.27	22.27
HSDPA Subtest-3	21.91	22.31	22.22
HSDPA Subtest-4	22.04	22.24	22.25
HSUPA Subtest-1	22.59	21.96	22.02
HSUPA Subtest-2	22.18	21.38	21.35
HSUPA Subtest-3	21.57	20.82	21.20
HSUPA Subtest-4	22.11	21.75	21.76
HSUPA Subtest-5	22.82	22.73	22.78
DC-HSDPA Subtest-1	22.35	22.89	22.66
DC-HSDPA Subtest-2	21.92	22.27	22.27
DC-HSDPA Subtest-3	21.91	22.31	22.22
DC-HSDPA Subtest-4	22.04	22.24	22.25
Band	WCDMA 5		
Tx Channel	4132	4182	4233
Frequency	826.4	836.4	846.6
Rel99	22.66	22.66	23.42
HSDPA Subtest-1	21.48	21.65	21.75
HSDPA Subtest-2	21.03	21.15	21.39
HSDPA Subtest-3	21.16	21.15	21.36
HSDPA Subtest-4	21.15	21.10	21.41

<b>HSUPA Subtest-1</b>	21.39	21.26	20.66
<b>HSUPA Subtest-2</b>	20.11	20.36	20.02
<b>HSUPA Subtest-3</b>	20.02	19.37	20.00
<b>HSUPA Subtest-4</b>	20.75	20.51	20.97
<b>HSUPA Subtest-5</b>	21.55	21.41	21.91
<b>DC-HSDPA Subtest-1</b>	21.48	21.65	21.75
<b>DC-HSDPA Subtest-2</b>	21.03	21.15	21.39
<b>DC-HSDPA Subtest-3</b>	21.16	21.15	21.36
<b>DC-HSDPA Subtest-4</b>	21.15	21.10	21.41

## 6.2 PEAK TO AVERAGE RADIO

### Test Procedure

Per KDB 971168 D01 Power Meas License Digital Systems v03r01;

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.

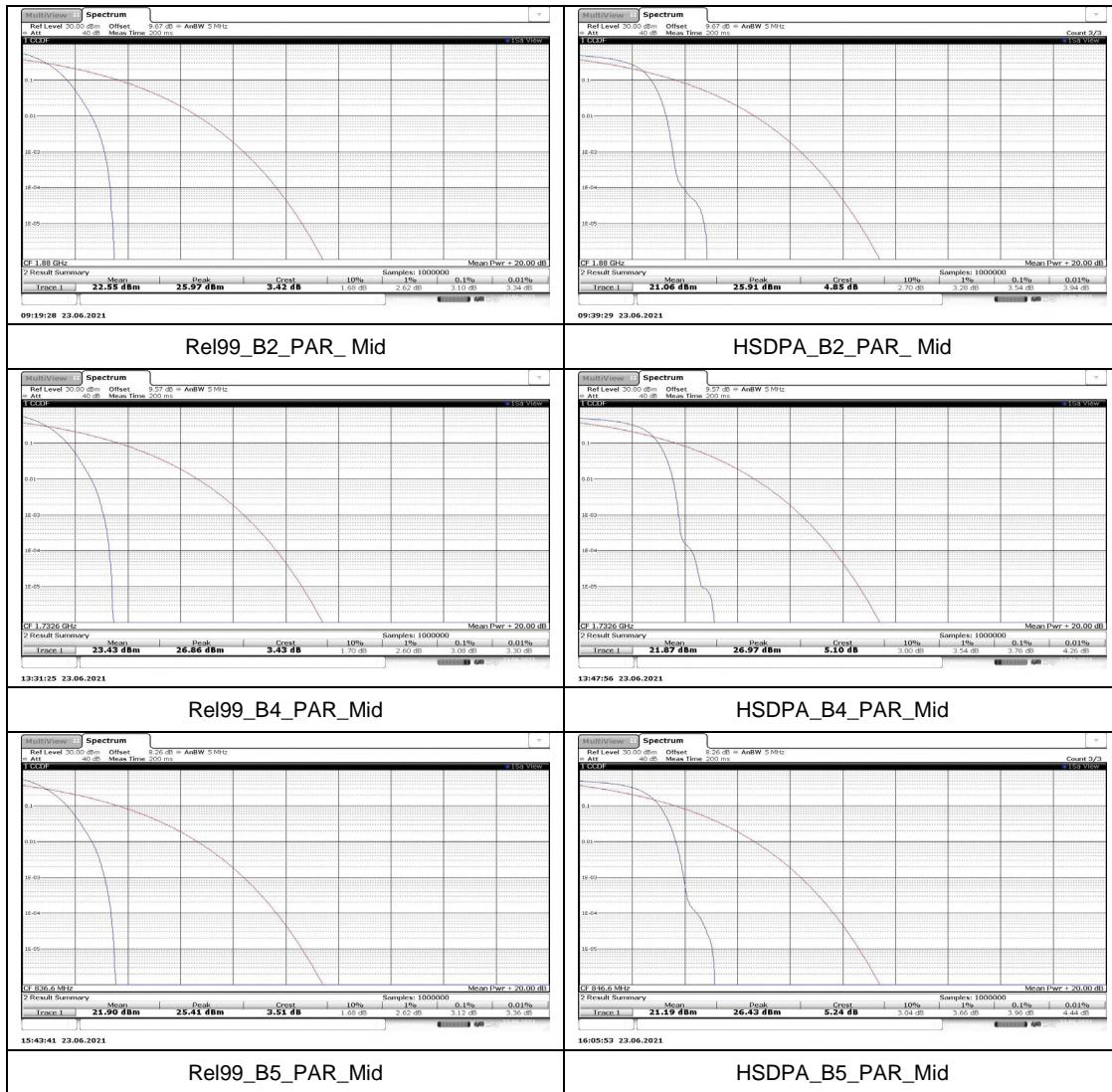
### Test Spec

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.

## RESULTS

See the following pages.

### WCDMA MODE



## 6.3 OCCUPIED BANDWIDTH

### 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 v03r01)

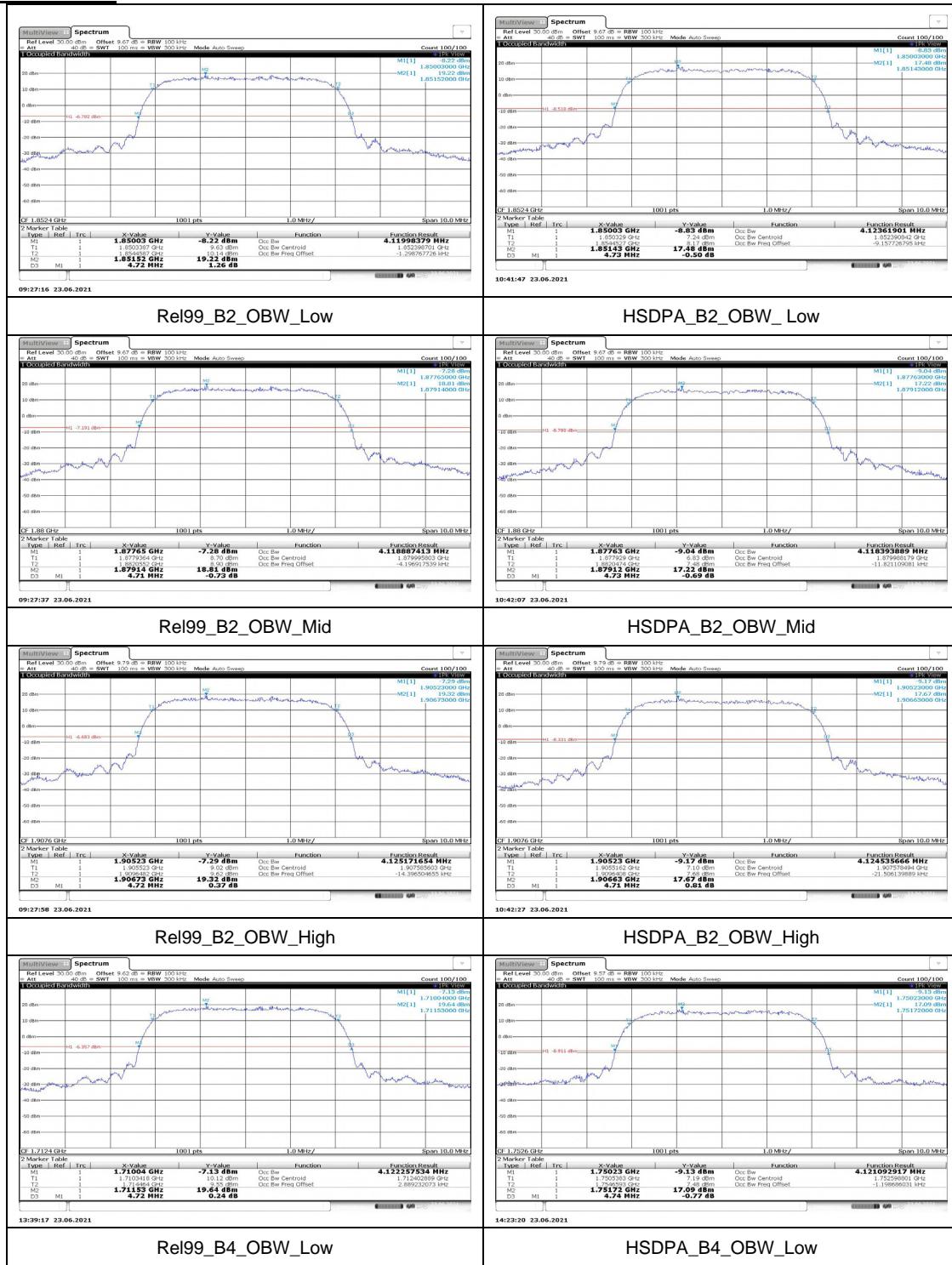
### RESULTS

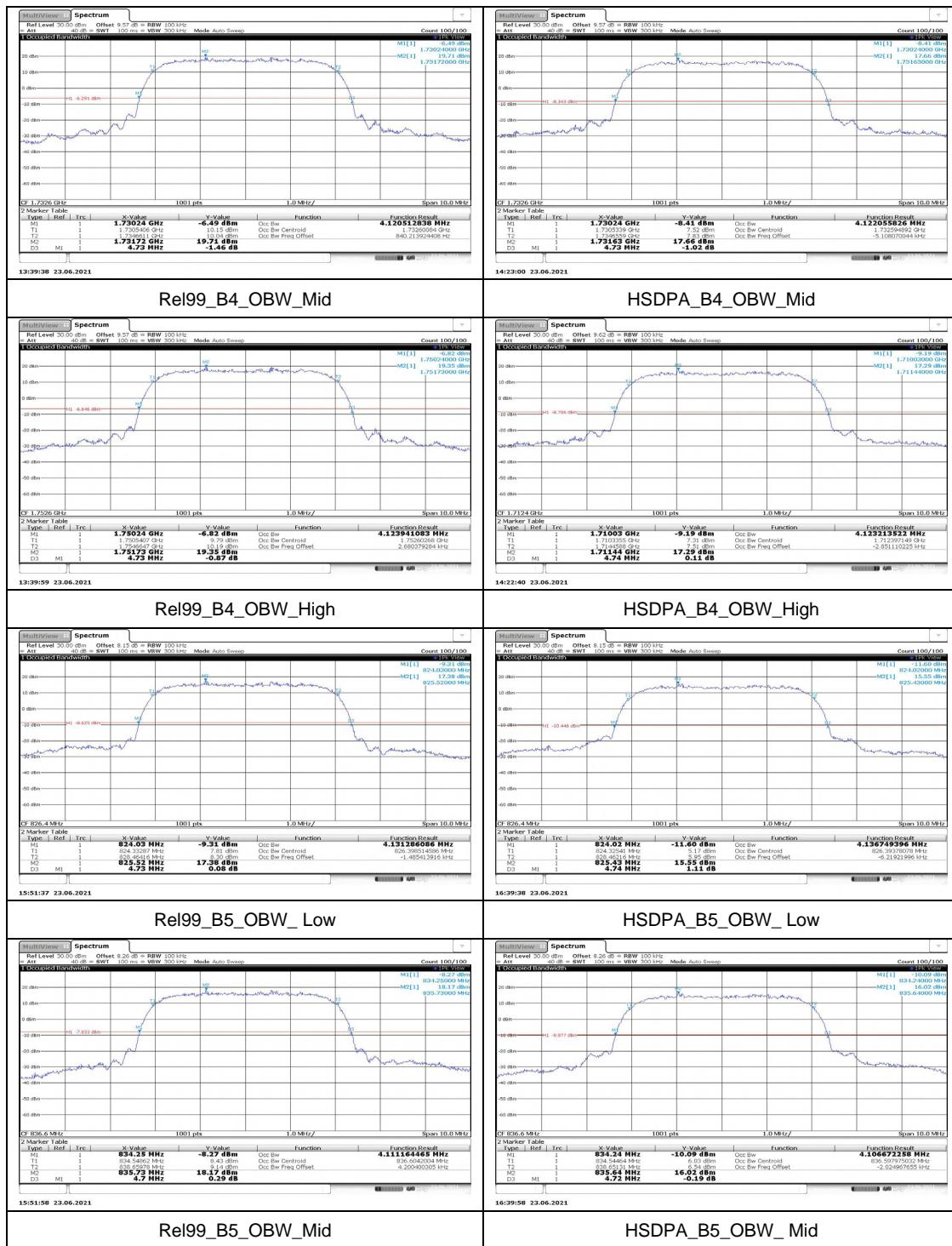
The table shows the worst case results, for the other results please See the following pages.

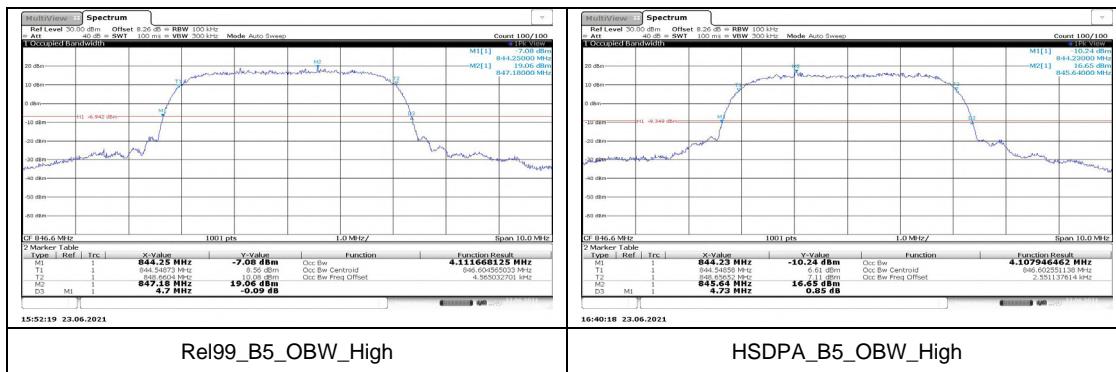
#### WCDMA

Mode	Channel	f(MHz)	Modulation	-26dB BW (MHz)	99% OBW (MHz)
BAND 2	HIGH	1907.6	REL 99	4.72	4.125
	HIGH	1907.6	HSDPA	4.73	4.124
BAND 4	MID	1732.6	REL 99	4.73	4.124
	HIGH	1712.4	HSDPA	4.74	4.137
BAND 5	LOW	826.4	REL 99	4.73	4.131
	LOW	826.4	HSDPA	4.74	4.137

## WCDMA MODE







## 6.4 FREQUENCY STABILITY

### RULE PART(S)

FCC: §2.1055, §22.355, §24.235, 27.54.  
ISED: RSS-GEN, RSS-132, RSS-133, RSS-139

### LIMITS

§22.355, RSS-132, RSS-133 - The carrier frequency shall not depart from the reference frequency in excess of  $\pm 2.5$  ppm for mobile stations.

§24.235, §27.54, RSS-139 - 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 v03r01

### RESULTS

See the following pages.

Test Mode	Test Conditions		Frequency Deviation Middle Channel		
	Power (VDC)	Temperature (°C)	Frequency Error	Frequency Error	Limit
WCDMA Band 2 REL99			Hz	ppm	ppm
VN	-30	3.49	0.001884	2.5	
	-20	3.84	0.002073		
	-10	3.41	0.001841		
	0	3.20	0.001727		
	+10	3.56	0.001922		
	+20	3.37	0.001819		
	+30	3.86	0.002084		
	+40	3.47	0.001873		
	+50	3.90	0.002105		
VL	TN	-1.02	0.000543		
VH		-0.62	0.000330		
End Point		-0.99	-0.000527		

Test Mode	Test Conditions		Frequency Deviation Middle Channel		
	Power (VDC)	Temperature (°C)	Frequency Error	Frequency Error	Limit
WCDMA Band4 REL99			Hz	ppm	ppm
VN	-30	13.27	0.007749	2.5	
	-20	13.55	0.007913		
	-10	13.52	0.007895		
	0	13.80	0.008059		
	+10	13.60	0.007942		
	+20	13.69	0.007995		
	+30	14.22	0.008304		
	+40	13.90	0.008117		
	+50	14.75	0.008614		
WCDMA Band5 REL99	VL	TN	0.51	0.000294	2.5
	VH		-1.29	-0.000745	
	End Point		0.34	0.000196	

Test Mode	Test Conditions		Frequency Deviation Middle Channel		
	Power (VDC)	Temperature (°C)	Frequency Error	Frequency Error	Limit
WCDMA Band5 REL99			Hz	ppm	ppm
VN	-30	1.23	0.001488	2.5	
	-20	1.19	0.001440		
	-10	1.32	0.001597		
	0	1.50	0.001815		
	+10	1.40	0.001694		
	+20	1.34	0.001621		
	+30	1.07	0.001295		
	+40	1.54	0.001864		
	+50	1.52	0.001839		
WCDMA Band5 REL99	VL	TN	-0.34	-0.000406	2.5
	VH		-0.25	-0.000299	
	End Point		0.09	0.000108	

## 6.5 BAND EDGE EMISSIONS

### RULE PART(S)

FCC: §22.359, §24.238, §27.53  
ISED:RSS-132, RSS-133, RSS-139

### 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 v03r01  
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.

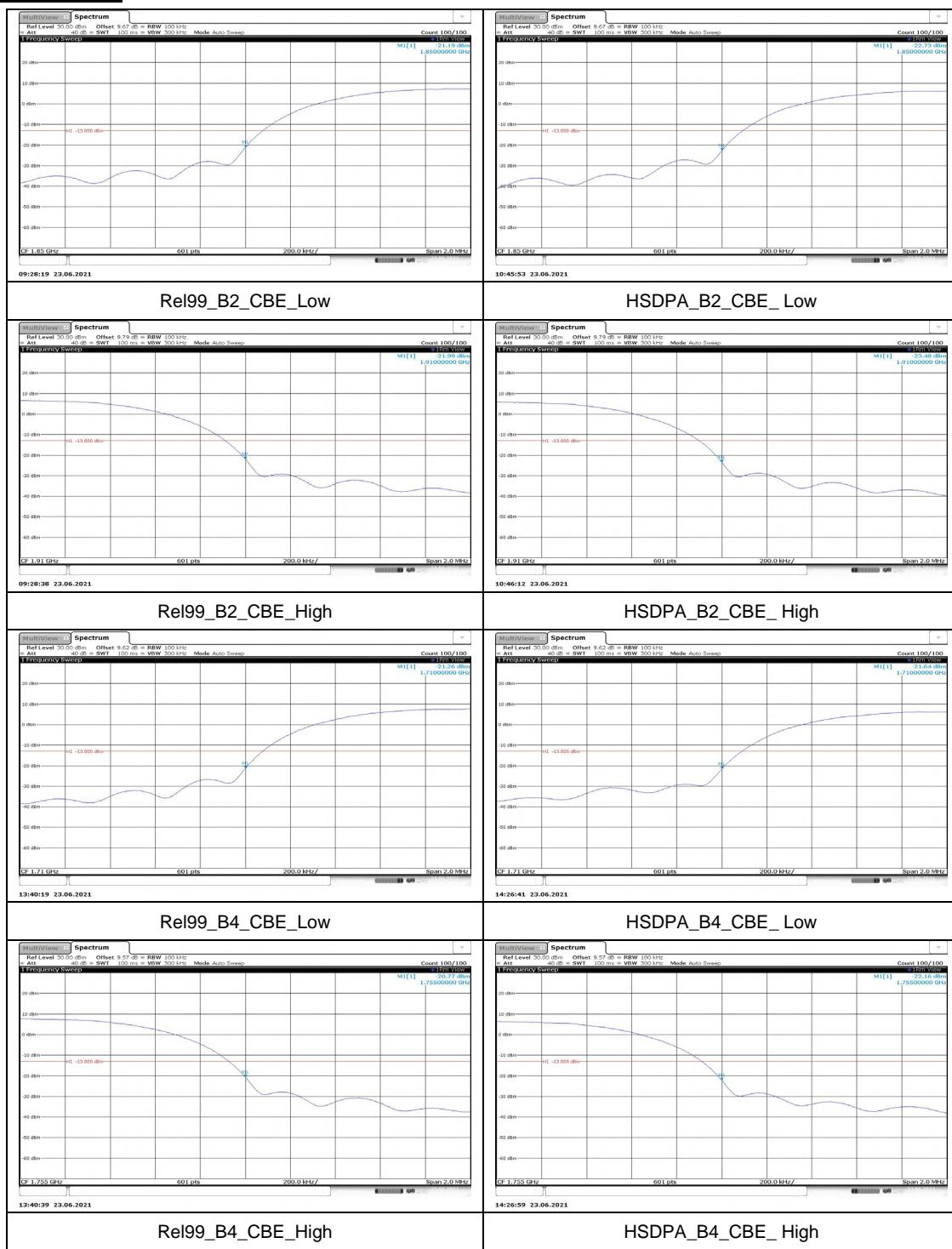
**GSM/WCDMA**

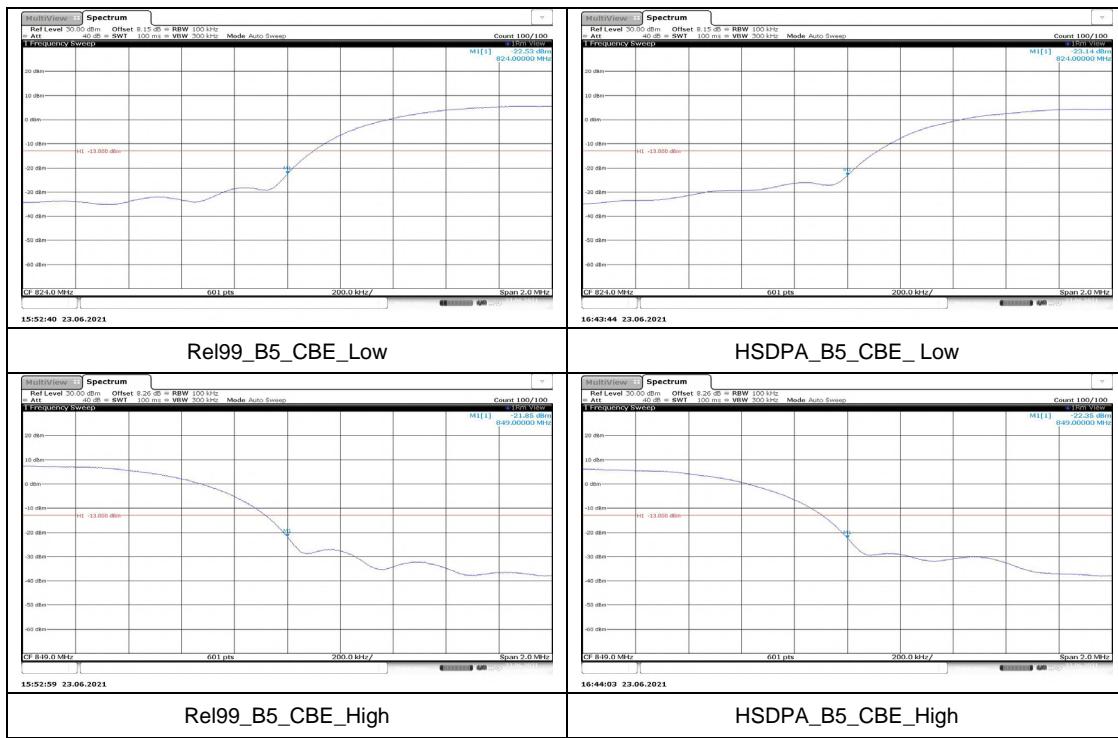
- a) Set the RBW = 1 ~ 1.5 % of OBW(Typically limited to a minimum RBW of 1% of the OBW)
- b) Set VBW  $\geq 3 \times$  RBW;
- c) Set span  $\geq 1.5$  times the OBW;
- d) Sweep time = Auto;
- e) Detector = RMS;
- f) Ensure that the number of measurement points  $\geq 2 \times$  Span/RBW;
- g) Trace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

**RESULTS**

See the following pages.

## WCDMA MODE





## 6.6 CONDUCTED OUT OF BAND EMISSIONS

### RULE PART(S)

FCC: §2.1051, §22.917, §24.238, §27.53.  
ISED: RSS-132, RSS-133, RSS-139.

### 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 v03r01

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  $\geq 1.5$  times the OBW;
- d) Sweep time = auto couple;
- e) Detector = rms;
- f) Ensure that the number of measurement points = Max (40001);
- g) Trace mode = average(LTE 5), Maxhold(LTE Band41);

Note : Please refer to section 5.4 for bandwidth and RB setting about LTE bands.

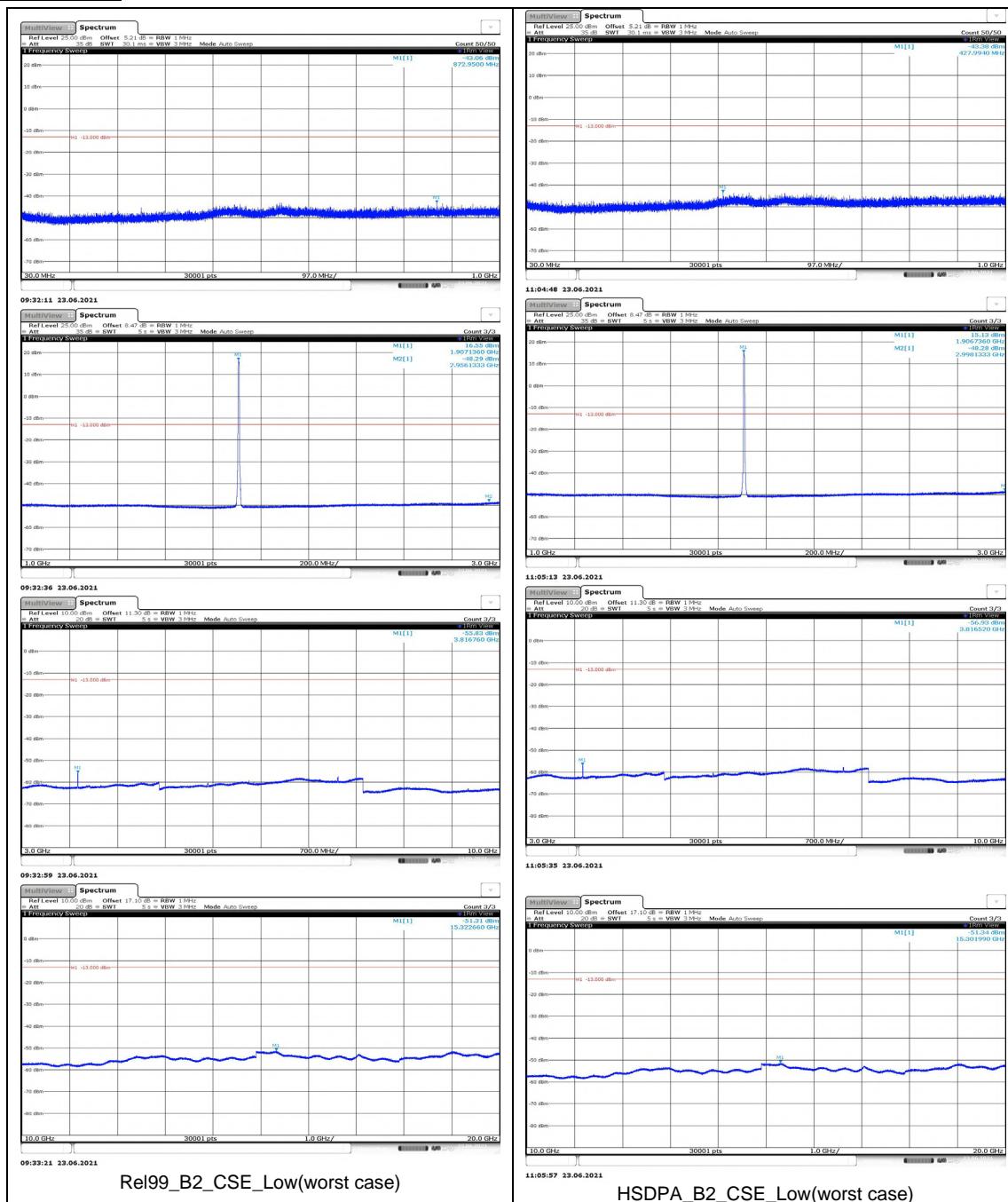
### RESULTS

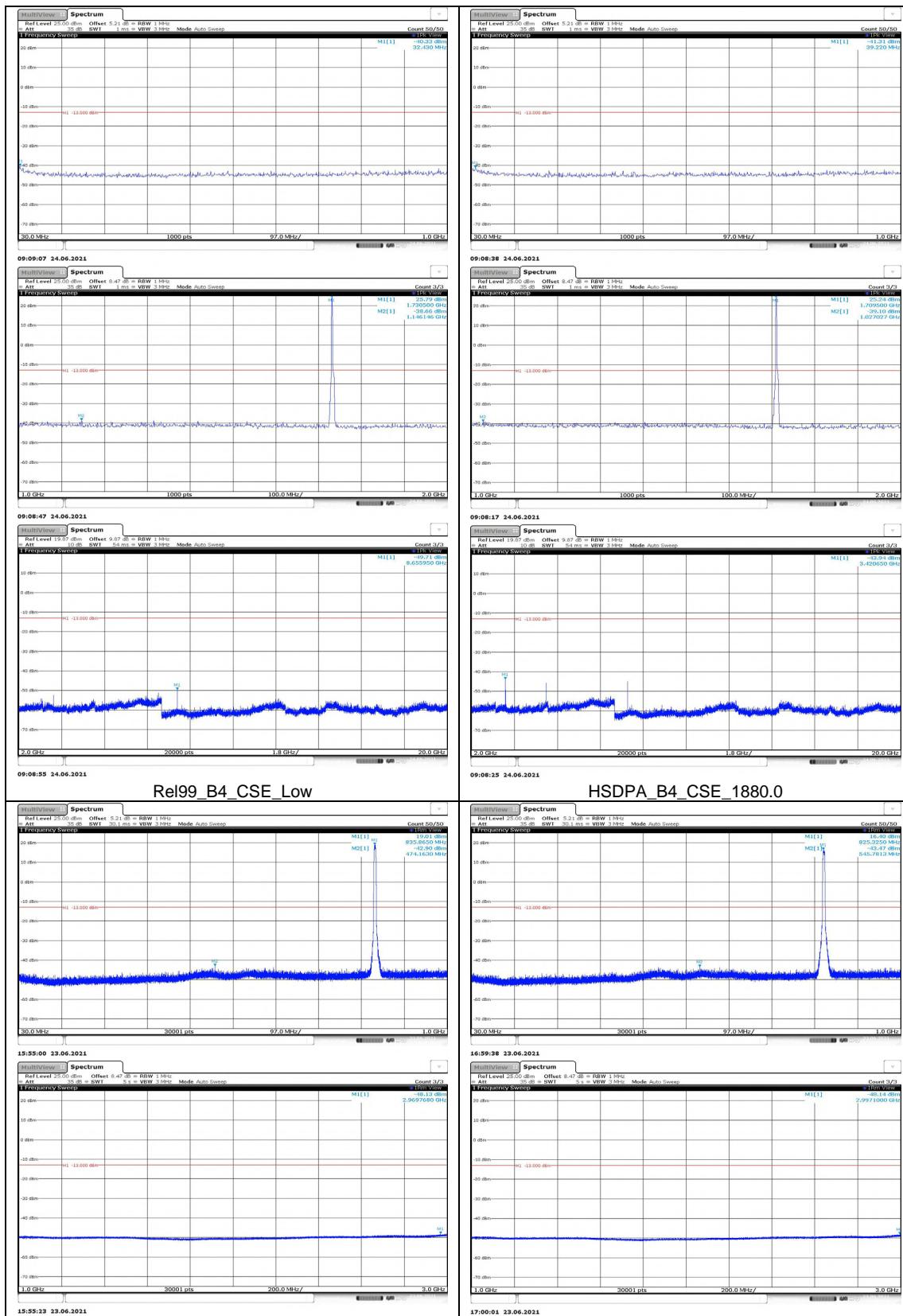
See the following pages.

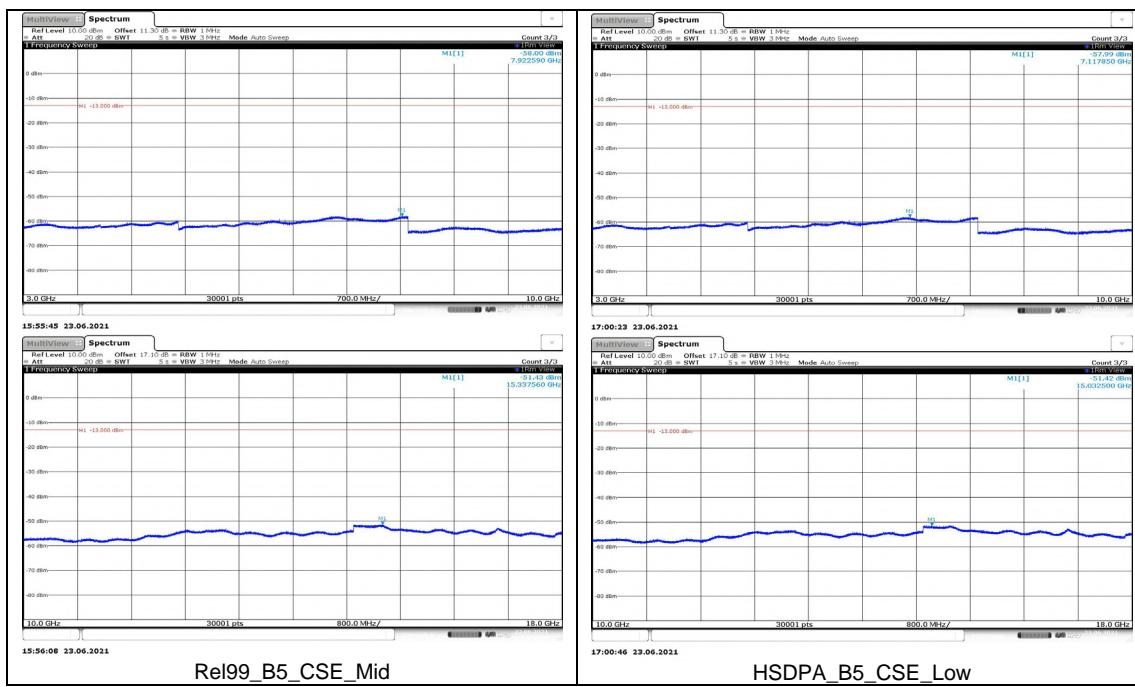
### WCDMA

Mode	Channel	F (MHz)	Modulation	The maximum Emissions (dBm)	Limit (dBm)	Verdict
Band 2	Low	1852.4	REL 99	-42.99	-13	PASS
	Low	1852.4	HSDPA	-42.51	-13	PASS
Band 4	Mid	1732.6	REL 99	-38.41	-13	PASS
	Mid	1732.6	HSDPA	-39.33	-13	PASS
Band 5	Mid	826.4	REL 99	-34.53	-13	PASS
	Mid	846.6	HSDPA	-34.35	-13	PASS

## WCDMA Mode







## 6.7 FIELD STRENGTH OF SPURIOUS RADIATION

### RULE PART(S)

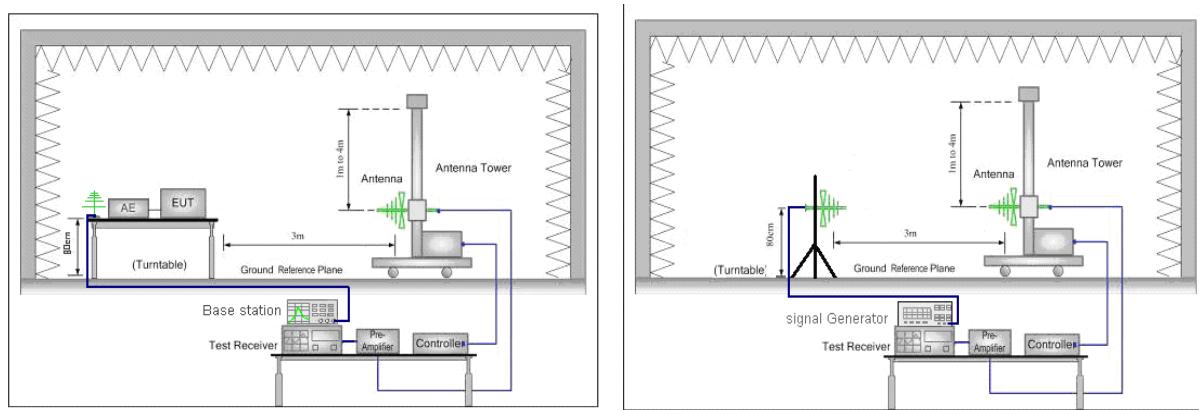
FCC: §2.1053, §22.917, §24.238, §27.53  
ISED: RSS-132, RSS-133, RSS-139.

### LIMIT

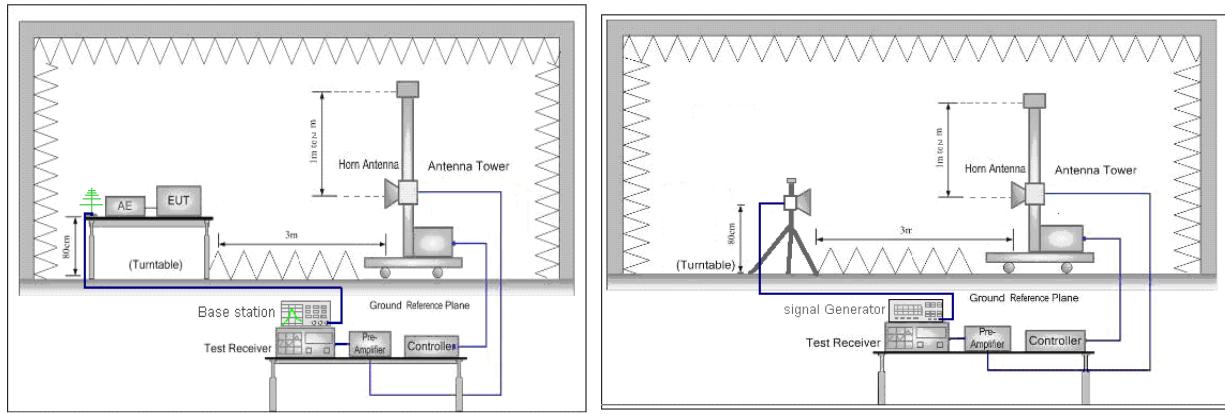
The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log (P)$  dB.

### TEST SETUP

#### Test Setup for Below 1G



#### Test Setup for Above 1G



### TEST PROCEDURE

#### KDB 971168 D01 Section 7

Below 1GHz test procedure as below:

1. The EUT was placed on a rotatable wooden table with 0.8 meter above ground.
2. The EUT was set 3 meters from the receiving antenna, which was mounted on the antenna tower.
3. The table was rotated 360 degrees to determine the position of the highest spurious emission.

4. The height of the receiving antenna is varied between one meter and four meters to search the maximum spurious emission for both horizontal and vertical polarizations.
5. Taking the record of maximum spurious emission.
6. A horn antenna was substituted in place of the EUT and was driven by a signal generator.
7. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission.
8. Taking the record of output power at antenna port.
9. Repeat step 7 to step 8 for another polarization.
10. Calculate power in dBm by the following formula:  
$$\text{ERP(dBm)} = \text{Pg(dBm)} - \text{cable loss (dB)} + \text{antenna gain (dBd)}$$

Where:

$P_d$  is the dipole equivalent power,  $P_g$  is the generator output into the substitution antenna, and the antenna gain is the gain of the substitute antenna used relative to either a half-wave dipole (dBd) or an isotropic source (dBi). The substitute level is equal to  $P_g$  [dBm] – cable loss [dB]. The calculated  $P_d$  levels are then compared to the absolute spurious emission limit of -13dBm which is equivalent to the required minimum attenuation of  $43 + 10\log_{10}(\text{Power [Watts]})$ .

Above 1GHz test procedure as below:

1. The EUT was placed on a rotatable wooden table with 0.8 meter above ground.
2. The EUT was set 3 meters from the receiving antenna, which was mounted on the antenna tower.
3. The table was rotated 360 degrees to determine the position of the highest spurious emission.
4. The height of the receiving antenna is varied between one meter and four meters to search the maximum spurious emission for both horizontal and vertical polarizations.
5. Taking the record of maximum spurious emission.
6. A horn antenna was substituted in place of the EUT and was driven by a signal generator.
7. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission.
8. Taking the record of output power at antenna port.
9. Repeat step 7 to step 8 for another polarization.
10. Calculate power in dBm by the following formula:  
$$\text{EIRP(dBm)} = \text{Pg(dBm)} - \text{cable loss (dB)} + \text{antenna gain (dBi)}$$
  
$$\text{EIRP} = \text{ERP} + 2.15\text{dB}$$

Where:  $P_g$  is the generator output power into the substitution antenna.

11. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

The limit line is derived from  $43 + 10\log(P)$ dB below the transmitter power  $P$ (Watts)

$$\begin{aligned} &= P(\text{W}) - [43 + 10\log(P)] \text{ (dB)} \\ &= [30 + 10\log(P)] \text{ (dBm)} - [43 + 10\log(P)] \text{ (dB)} \\ &= -13\text{dBm.} \end{aligned}$$

NOTE 1: Radiated spurious emissions were investigated below 30MHz, 30MHz – 1GHz and above 1GHz. There were no emissions found on below 30MHz.

Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 30 m open are test site.

Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the one of tests made in an open field based on KDB 414788.

## **RESULTS**

See the following pages.

### 6.7.1 Radiated spurious emissions 30MHz to 1GHz

Frequency (MHz)	Level (dB)	Limit Line (dB)	Over Limit (dB)	Polarization	Frequency (MHz)	Level (dB)	Limit Line (dB)	Over Limit (dB)	Polarization
32.91	-70.18	-13.00	-57.18	Horizontal	216.24	-41.79	-13.00	-28.79	Horizontal
176.47	-82.97	-13.00	-69.97	Horizontal	359.80	-45.99	-13.00	-32.99	Horizontal
299.66	-79.60	-13.00	-66.60	Horizontal	455.83	-48.40	-13.00	/	Horizontal
350.10	-80.62	-13.00	-67.62	Horizontal	600.36	-56.07	-13.00	-43.07	Horizontal
800.18	-69.03	-13.00	-56.03	Horizontal	669.23	-55.97	-13.00	-42.97	Horizontal
960.23	-69.71	-13.00	-56.71	Horizontal	744.89	-45.93	-13.00	-32.93	Horizontal
Frequency (MHz)	Level (dB)	Limit Line (dB)	Over Limit (dB)	Polarization	36.79	-39.41	-13.00	-28.41	Vertical
32.91	-65.50	-13.00	-52.50	Vertical	216.24	-43.26	-13.00	-30.26	Vertical
61.04	-73.89	-13.00	-60.89	Vertical	289.96	-46.77	-13.00	-33.77	Vertical
202.66	-77.71	-13.00	-64.71	Vertical	455.83	-45.62	-13.00	-32.62	Vertical
385.02	-78.45	-13.00	-65.45	Vertical	600.36	-45.68	-13.00	-32.68	Vertical
676.99	-75.80	-13.00	-62.80	Vertical	700.27	-53.22	-13.00	-40.22	Vertical
858.38	-71.44	-13.00	-58.44	Vertical					

WCDMA Band 2					WCDMA Band 4																																																																																																								
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Frequency (MHz)	Level (dB)	Limit Line (dB)	Over Limit (dB)	Polarization																																																																																																									
32.91	-71.41	-13.00	-58.41	Vertical																																																																																																									
167.74	-85.74	-13.00	-72.74	Vertical																																																																																																									
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944.71	-69.27	-13.00	-56.27	Vertical																																																																																																									
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669.23	-55.97	-13.00	-42.97	Horizontal																																																																																																									
744.89	-45.93	-13.00	-32.93	Horizontal																																																																																																									
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455.83	-45.62	-13.00	-32.62	Vertical																																																																																																									
600.36	-45.68	-13.00	-32.68	Vertical																																																																																																									
700.27	-53.22	-13.00	-40.22	Vertical																																																																																																									

### 6.7.2 Radiated spurious emissions above 1GHz

Frequency (MHz)	Level (dB)	Limit Line (dB)	Over Limit (dB)	Polarization	Frequency (MHz)	Level (dB)	Limit Line (dB)	Over Limit (dB)	Polarization
1250.00	-43.54	-13.00	-30.54	Horizontal	1520.00	-41.71	-13.00	-28.71	Horizontal
1746.00	-30.96	-13.00	-17.96	Horizontal	1710.00	21.99	-13.00	/	Horizontal
1760.00	-30.39	-13.00	-17.39	Horizontal	1760.00	-22.07	-13.00	-9.07	Horizontal
1850.00	0.86	-13.00	/	Horizontal	2110.00	-34.22	-13.00	-21.22	Horizontal
2334.00	-36.48	-13.00	-23.48	Horizontal	2680.00	-34.15	-13.00	-21.15	Horizontal
2854.00	-32.89	-13.00	-19.89	Horizontal	2856.00	-32.02	-13.00	-19.02	Horizontal
3690.00	-32.61	-13.00	-19.61	Horizontal	3420.00	-21.92	-13.00	-8.92	Horizontal
7395.00	-47.41	-13.00	-34.41	Horizontal	5130.00	-39.62	-13.00	-26.62	Horizontal
10560.00	-47.17	-13.00	-34.17	Horizontal	6840.00	-45.70	-13.00	-32.70	Horizontal
13950.00	-42.46	-13.00	-29.46	Horizontal	10485.00	-45.59	-13.00	-32.59	Horizontal
15150.00	-44.63	-13.00	-31.63	Horizontal	14400.00	-43.96	-13.00	-30.96	Horizontal
16890.00	-43.66	-13.00	-30.66	Horizontal	17070.00	-42.32	-13.00	-29.32	Horizontal
Frequency (MHz)	Level (dB)	Limit Line (dB)	Over Limit (dB)	Polarization	Frequency (MHz)	Level (dB)	Limit Line (dB)	Over Limit (dB)	Polarization
1748.00	-27.88	-13.00	-14.88	Vertical	1492.00	-42.85	-13.00	-29.85	Vertical
1852.00	3.50	-13.00	/	Vertical	1710.00	21.66	-13.00	/	Vertical
1932.00	-36.47	-13.00	-23.47	Vertical	1762.00	-23.50	-13.00	-10.50	Vertical
2162.00	-37.57	-13.00	-24.57	Vertical	2112.00	-25.29	-13.00	-12.29	Vertical
2374.00	-35.65	-13.00	-22.65	Vertical	2660.00	-34.72	-13.00	-21.72	Vertical
2822.00	-32.67	-13.00	-19.67	Vertical	2846.00	-33.23	-13.00	-20.23	Vertical
3705.00	-31.84	-13.00	-18.84	Vertical	3420.00	-23.13	-13.00	-10.13	Vertical
7275.00	-48.66	-13.00	-35.66	Vertical	5130.00	-23.13	-13.00	-10.13	Vertical
10410.00	-45.95	-13.00	-32.95	Vertical	6840.00	-39.42	-13.00	-26.42	Vertical
12195.00	-45.49	-13.00	-32.49	Vertical	9555.00	-45.90	-13.00	-32.90	Vertical
14715.00	-43.56	-13.00	-30.56	Vertical	14385.00	-47.54	-13.00	-34.54	Vertical
17730.00	-42.91	-13.00	-29.91	Vertical	17805.00	-43.80	-13.00	-30.80	Vertical

WCDMA Band2 REL99 Low Channel					WCDMA Band4 REL99 Low Channel																																																																																																																																						
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Frequency (MHz)	Level (dB)	Limit Line (dB)	Over Limit (dB)	Polarization																																																																																																																																							
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1760.00	-42.64	-13.00	-29.64	Horizontal																																																																																																																																							
1878.00	0.75	-13.00	/	Horizontal																																																																																																																																							
1960.00	-28.16	-13.00	-15.16	Horizontal																																																																																																																																							
2902.00	-47.96	-13.00	-34.96	Horizontal																																																																																																																																							
9420.00	-58.23	-13.00	-45.23	Horizontal																																																																																																																																							
11370.00	-59.50	-13.00	-46.50	Horizontal																																																																																																																																							
13965.00	-61.27	-13.00	-48.27	Horizontal																																																																																																																																							
14820.00	-61.32	-13.00	-48.32	Horizontal																																																																																																																																							
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2912.00	-48.25	-13.00	-35.25	Horizontal																																																																																																																																							
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Frequency (MHz)	Level (dB)	Limit Line (dB)	Over Limit (dB)	Polarization	Frequency (MHz)	Level (dB)	Limit Line (dB)	Over Limit (dB)	Polarization
1198.00	-42.70	-13.00	-29.70	Vertical	1198.00	-43.55	-13.00	-30.55	Vertical
1438.00	-44.00	-13.00	-31.00	Vertical	1438.00	-30.66	-13.00	-17.66	Vertical
1746.00	-43.14	-13.00	-30.14	Vertical	1734.00	21.89	-13.00	/	Vertical
1878.00	-0.68	-13.00	/	Vertical	1920.00	-37.77	-13.00	-24.77	Vertical
1960.00	-33.68	-13.00	-20.68	Vertical	2132.00	-36.40	-13.00	-23.40	Vertical
2820.00	-47.15	-13.00	-34.15	Vertical	2972.00	-32.83	-13.00	-19.83	Vertical
7890.00	-56.58	-13.00	-43.58	Vertical	3465.00	-32.88	-13.00	-19.68	Vertical
9390.00	-57.79	-13.00	-44.79	Vertical	8655.00	-50.95	-13.00	-37.95	Vertical
11685.00	-60.16	-13.00	-47.16	Vertical	10395.00	-47.43	-13.00	-34.43	Vertical
14220.00	-61.10	-13.00	-48.10	Vertical	12135.00	-46.17	-13.00	-33.17	Vertical
14820.00	-61.16	-13.00	-48.16	Vertical	15600.00	-45.02	-13.00	-32.02	Vertical
18000.00	-65.28	-13.00	-52.28	Vertical	17325.00	-43.24	-13.00	-30.24	Vertical
WCDMA Band2 REL99 Mid Channel					WCDMA Band4 REL99 Mid Channel				
Frequency (MHz)	Level (dB)	Limit Line (dB)	Over Limit (dB)	Polarization	Frequency (MHz)	Level (dB)	Limit Line (dB)	Over Limit (dB)	Polarization
1410.00	-43.55	-13.00	-30.55	Horizontal	1436.00	-42.82	-13.00	-29.82	Horizontal
1748.00	-30.66	-13.00	-17.66	Horizontal	1694.00	-35.36	-13.00	-22.36	Horizontal
1906.00	1.89	-13.00	/	Horizontal	1754.00	21.77	-13.00	/	Horizontal
2160.00	-37.77	-13.00	-24.77	Horizontal	2154.00	-35.18	-13.00	-22.18	Horizontal
2290.00	-36.40	-13.00	-23.40	Horizontal	2400.00	-36.30	-13.00	-23.30	Horizontal
2860.00	-32.83	-13.00	-19.83	Horizontal	2776.00	-33.36	-13.00	-20.36	Horizontal
3810.00	-32.68	-13.00	-19.68	Horizontal	3495.00	-23.75	-13.00	-10.75	Horizontal
6570.00	-50.95	-13.00	-37.95	Horizontal	5265.00	-40.45	-13.00	-27.45	Horizontal
9225.00	-47.43	-13.00	-34.43	Horizontal	7020.00	-41.41	-13.00	-28.41	Horizontal
11355.00	-46.17	-13.00	-33.17	Horizontal	11505.00	-46.23	-13.00	-33.23	Horizontal
13770.00	-45.02	-13.00	-32.02	Horizontal	14340.00	-44.15	-13.00	-31.15	Horizontal
16755.00	-43.24	-13.00	-30.24	Horizontal	16905.00	-43.59	-13.00	-30.59	Horizontal
Frequency (MHz)	Level (dB)	Limit Line (dB)	Over Limit (dB)	Polarization	Frequency (MHz)	Level (dB)	Limit Line (dB)	Over Limit (dB)	Polarization
1504.00	-42.50	-13.00	-29.50	Vertical	1038.00	-44.33	-13.00	-31.33	Vertical
1764.00	-29.81	-13.00	-16.81	Vertical	1594.00	-42.10	-13.00	-29.10	Vertical
1906.00	2.11	-13.00	/	Vertical	1732.00	-17.43	-13.00	-4.43	Vertical
2146.00	-37.13	-13.00	-24.13	Vertical	1754.00	22.11	-13.00	/	Vertical
2698.00	-33.74	-13.00	-20.74	Vertical	2154.00	-25.62	-13.00	-12.62	Vertical
2862.00	-33.18	-13.00	-20.18	Vertical	2784.00	-33.82	-13.00	-20.82	Vertical
3810.00	-32.98	-13.00	-19.98	Vertical	3495.00	-24.84	-13.00	-11.84	Vertical
6345.00	-50.08	-13.00	-37.08	Vertical	5265.00	-37.97	-13.00	-24.97	Vertical
9300.00	-47.51	-13.00	-34.51	Vertical	7020.00	-41.40	-13.00	-28.40	Vertical
12270.00	-45.83	-13.00	-32.83	Vertical	11490.00	-45.93	-13.00	-32.93	Vertical
14400.00	-44.01	-13.00	-31.01	Vertical	14460.00	-43.94	-13.00	-30.94	Vertical
16875.00	-43.43	-13.00	-30.43	Vertical	17625.00	-43.17	-13.00	-30.17	Vertical
WCDMA Band2 REL99 High Channel					WCDMA Band4 REL99 High Channel				
Frequency (MHz)	Level (dB)	Limit Line (dB)	Over Limit (dB)	Polarization	Frequency (MHz)	Level (dB)	Limit Line (dB)	Over Limit (dB)	Polarization
2395.00	-49.53	-13.00	-36.53	Horizontal	1054.00	-29.25	-13.00	-16.25	Horizontal
4996.00	-42.55	-13.00	-29.55	Horizontal	1918.00	-28.60	-13.00	-15.60	Horizontal
6004.00	-43.61	-13.00	-30.61	Horizontal	4753.00	-53.01	-13.00	-40.01	Horizontal
7255.00	-43.28	-13.00	-30.28	Horizontal	6778.00	-53.71	-13.00	-40.71	Horizontal
7498.00	-43.11	-13.00	-30.11	Horizontal	8119.00	-56.81	-13.00	-43.81	Horizontal
8506.00	-43.90	-13.00	-30.90	Horizontal	9397.00	-57.43	-13.00	-44.43	Horizontal
Frequency (MHz)	Level (dB)	Limit Line (dB)	Over Limit (dB)	Polarization	1495.00	-28.36	-13.00	-15.36	Vertical
4996.00	-42.40	-13.00	-29.40	Vertical	1918.00	-29.80	-13.00	-16.80	Vertical
6004.00	-42.83	-13.00	-29.83	Vertical	4996.00	-53.74	-13.00	-40.74	Vertical
7255.00	-42.42	-13.00	-29.42	Vertical	6967.00	-55.44	-13.00	-42.44	Vertical
7498.00	-43.45	-13.00	-30.45	Vertical	8083.00	-56.10	-13.00	-43.10	Vertical
8506.00	-43.42	-13.00	-30.42	Vertical	9595.00	-57.15	-13.00	-44.15	Vertical
WCDMA Band5 REL99 Low Channel					WCDMA Band5 REL99 Mid Channel				
Frequency (MHz)	Level (dB)	Limit Line (dB)	Over Limit (dB)	Polarization	/				
4996.00	-43.11	-13.00	-30.11	Horizontal	/				
6004.00	-42.98	-13.00	-29.98	Horizontal	/				
7003.00	-44.88	-13.00	-31.88	Horizontal	/				
7255.00	-41.63	-13.00	-28.63	Horizontal	/				
7498.00	-43.94	-13.00	-30.94	Horizontal	/				
8506.00	-43.60	-13.00	-30.60	Horizontal	/				
Frequency (MHz)	Level (dB)	Limit Line (dB)	Over Limit (dB)	Polarization	/				
4978.00	-39.33	-13.00	-26.33	Vertical	/				
5752.00	-42.51	-13.00	-29.51	Vertical	/				
6004.00	-42.40	-13.00	-29.40	Vertical	/				
7003.00	-42.80	-13.00	-29.80	Vertical	/				
7255.00	-43.41	-13.00	-30.41	Vertical	/				
8110.00	-42.45	-13.00	-29.45	Vertical	/				
WCDMA Band5 REL99 High Channel					/				

## END OF REPORT