

**FCC PART 22/24/27 TEST REPORT****FCC Part 22H / Part 24E / Part 27****Report Reference No.**.....: LCS211011003AED**FCC ID**.....: 2ATDMOVMS-33-7600G**Date of Issue**.....: November 01, 2021**Testing Laboratory Name**.....: Shenzhen LCS Compliance Testing Laboratory Ltd.

Address.....: 101, 201 Bldg A & 301 Bldg C, Juji Industrial Park Yabianxueziwei, Shajing Street, Baoan District, Shenzhen, 518000, China

Applicant's name.....: Open Vehicles Ltd

Address.....: House 8 Hong Hay Villa, Chuk Kok Road Sai Kung, Hong Kong

Test specification.....:

FCC Part 22H: Cellular Radiotelephone Service

Standard.....: FCC Part 24E: Broadband PCS

FCC Part 27

Test Report Form No: LCSEMC-1.0

TRF Originator.....: Shenzhen LCS Compliance Testing Laboratory Ltd.

Master TRF.....: Dated 2011-03

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Test item description.....: OVMS

Trade Mark.....: Open Vehicles

Test Model.....: OVMS-33-7600G

Ratings.....: Input: DC 12V-15V (Vehicle Power)

Hardware version.....: /

Software version: /

Frequency: UMTS Band II/IV/V

Result.....: PASS

Compiled by:**Supervised by:****Approved by:**

Kevin Huang/ Administrator

Jin Wang/ Technique principal

Gavin Liang/ Manager



TEST REPORT

Test Report No. :	LCS211011003AED	November 01, 2021
		Date of issue

EUT.....	: OVMS
Test Model.....	: OVMS-33-7600G
Applicant	: Open Vehicles Ltd
Address.....	: House 8 Hong Hay Villa, Chuk Kok Road Sai Kung, Hong Kong
Telephone.....	: /
Fax.....	: /
Manufacturer	: Open Vehicles Ltd
Address.....	: House 8 Hong Hay Villa, Chuk Kok Road Sai Kung, Hong Kong
Telephone.....	: /
Fax.....	: /
Factory	: Open Vehicles Ltd
Address.....	: House 8 Hong Hay Villa, Chuk Kok Road Sai Kung, Hong Kong
Telephone.....	: /
Fax.....	: /

Test Result:	PASS
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The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.



Revision History

Revision	Issue Date	Revisions	Revised By
000	November 01, 2021	Initial Issue	Gavin Liang



Contents

1	TEST STANDARDS	5
2	SUMMARY	6
2.1	General Remarks	6
2.2	Product Description	6
2.3	Equipment under Test	8
2.4	Short description of the Equipment under Test (EUT)	8
2.5	Internal Identification of AE used during the test	8
2.6	Normal Accessory setting	8
2.7	EUT configuration	9
2.8	Related Submittal(s) / Grant (s)	9
2.9	Modifications	9
2.10	General Test Conditions/Configurations	9
3	TEST ENVIRONMENT	10
3.1	Address of the test laboratory	10
3.2	Test Facility	10
3.3	Environmental conditions	10
3.4	Test Description	10
3.5	Equipments Used during the Test	12
3.6	Measurement uncertainty	13
4	TEST CONDITIONS AND RESULTS	14
4.1	Output Power	14
4.2	Radiated Spurious Emssion	17
4.3	Occupied Bandwidth and Emission Bandwith	21
4.4	Band Edge Compliance	24
4.5	Spurious Emssion on Antenna Port	26
4.6	Frequency Stability Test	35
4.7	Peak-to-Average Ratio (PAR)	38
5	TEST SETUP PHOTOS OF THE EUT	41
6	EXTERNAL PHOTOS OF THE EUT	41
7	INTERNAL PHOTOS OF THE EUT	41



1 TEST STANDARDS

The tests were performed according to following standards:

[FCC Part 22H](#): Cellular Radiotelephone Service.

[FCC Part 24E](#): Broadband PCS.

[FCC Part 27](#)

[TIA-603-E March 2016](#): Land Mobile FM or PM Communications Equipment Measurement and Performance Standards.

[47 CFR FCC Part 15 Subpart B](#): Unintentional Radiators.

[FCC Part 2](#): Frequency Allocations And Radio Treaty Matters; General Rules And Regulations.

[ANSI C63.4:2014](#): Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

[FCC KDB971168 D01](#) Power Meas License Digital Systems v03r01



2 SUMMARY

2.1 General Remarks

Date of receipt of test sample	:	October 13, 2021
Date of Test	:	October 13, 2021 ~ November 01, 2021
Date of Report	:	November 01, 2021

2.2 Product Description

The **Open Vehicles Ltd**'s Model: OVMS-33-7600G or the "EUT" as referred to in this report; more general information as follows, for more details, refer to the user's manual of the EUT.

EUT	:	OVMS
Test Model	:	OVMS-33-7600G
Power Supply	:	Input: DC 12V-15V (Vehicle Power)
Hardware Version	:	/
Software Version	:	/
WIFI(2.4G Band)	:	
Frequency Range	:	2412MHz ~ 2462MHz
Channel Spacing	:	5MHz
Channel Number	:	11 Channels for 20MHz bandwidth (2412~2462MHz) 7 Channels for 40MHz bandwidth (2422~2452MHz)
Modulation Type	:	IEEE 802.11b: DSSS (CCK, DQPSK, DBPSK) IEEE 802.11g: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n: OFDM (64QAM, 16QAM, QPSK, BPSK)
Antenna Description	:	PCB Antenna; 2.0dBi (max.)
2G	:	
Support Band	:	<input checked="" type="checkbox"/> GSM 900 (EU-Band) <input checked="" type="checkbox"/> DCS 1800 (EU-Band) <input checked="" type="checkbox"/> GSM 850 (U.S.-Band) <input checked="" type="checkbox"/> PCS 1900 (U.S.-Band)
Release Version	:	R99
GPRS Class	:	Class 12
EGPRS Class	:	Class 12
Type Of Modulation	:	GMSK for GSM/GPRS; 8PSK for EGPRS
Antenna Description	:	Stick Antenna 5.0dBi (max.) For GSM 850 5.0dBi (max.) For PCS 1900
3G	:	
Support Band	:	<input checked="" type="checkbox"/> WCDMA Band II (U.S.-Band) <input checked="" type="checkbox"/> WCDMA Band V (U.S.-Band) <input checked="" type="checkbox"/> WCDMA Band IV (U.S.-Band) <input type="checkbox"/> WCDMA Band I (EU-Band) <input type="checkbox"/> WCDMA Band VIII (EU-Band)
Release Version	:	R99
Type Of Modulation	:	WCDMA: QPSK; HSDPA/HSUPA: QPSK



Antenna Description	:	Stick Antenna 5.0dBi (max.) For WCDMA Band II 5.0dBi (max.) For WCDMA Band IV 5.0dBi (max.) For WCDMA Band V
LTE	:	
Support Band	:	<input checked="" type="checkbox"/> E-UTRA Band 2(U.S.-Band) <input checked="" type="checkbox"/> E-UTRA Band 4(U.S.-Band) <input checked="" type="checkbox"/> E-UTRA Band 5(U.S.-Band) <input checked="" type="checkbox"/> E-UTRA Band 7(U.S.-Band) <input checked="" type="checkbox"/> E-UTRA Band 12(U.S.-Band) <input checked="" type="checkbox"/> E-UTRA Band 13(U.S.-Band) <input checked="" type="checkbox"/> E-UTRA Band 25(U.S.-Band) <input checked="" type="checkbox"/> E-UTRA Band 26(U.S.-Band) <input checked="" type="checkbox"/> E-UTRA Band 38(U.S.-Band) <input checked="" type="checkbox"/> E-UTRA Band 41(U.S.-Band) <input checked="" type="checkbox"/> E-UTRA Band 66(U.S.-Band)
LTE Release Version	:	R8
Type Of Modulation	:	QPSK/16QAM
Antenna Description	:	Stick Antenna 5.0dBi (max.) For E-UTRA Band 2 5.0dBi (max.) For E-UTRA Band 4 5.0dBi (max.) For E-UTRA Band 5 5.0dBi (max.) For E-UTRA Band 7 5.0dBi (max.) For E-UTRA Band 12 5.0dBi (max.) For E-UTRA Band 13 5.0dBi (max.) For E-UTRA Band 25 5.0dBi (max.) For E-UTRA Band 26 5.0dBi (max.) For E-UTRA Band 38 5.0dBi (max.) For E-UTRA Band 41 5.0dBi (max.) For E-UTRA Band 66
Power Class	:	Class 3
GPS function	:	Support and only RX
Extreme temp.	:	-30°C to +50°C
Tolerance	:	
Extreme vol. Limits	:	10.2VDC to 15VDC (nominal: 12VDC)

2.3 Equipment under Test

Power supply system utilised

Power supply voltage	:	<input type="radio"/>	120V / 60 Hz	<input type="radio"/>	115V / 60Hz
		<input type="radio"/>	12 V DC	<input type="radio"/>	24 V DC
		<input checked="" type="radio"/>	Other (specified in blank below)	12 V DC	

Test frequency list

Test Mode	TX/RX	RF Channel		
		Low(L)	Middle (M)	High (H)
WCDMA Band V	TX	Channel 4132	Channel 4182	Channel 4233
		826.4 MHz	836.4 MHz	846.6 MHz
	RX	Channel 4357	Channel 4407	Channel 4458
		871.4 MHz	881.4 MHz	891.6 MHz
Test Mode	TX/RX	RF Channel		
		Low(L)	Middle (M)	High (H)
WCDMA Band II	TX	Channel 9262	Channel 9400	Channel 9538
		1852.4 MHz	1880.0 MHz	1907.6 MHz
	RX	Channel 9662	Channel 9800	Channel 9938
		1932.4 MHz	1960.0 MHz	1987.6 MHz
Test Mode	TX/RX	RF Channel		
		Low(L)	Middle (M)	High (H)
WCDMA Band IV	TX	Channel1312	Channel1413	Channel1513
		1712.4MHz	1732.6MHz	1752.6MHz
	RX	Channel1537	Channel1638	Channel1738
		2112.4MHz	2132.6MHz	2152.6MHz

2.4 Short description of the Equipment under Test (EUT)

2.4.1 General Description

OVMS is subscriber equipment in the 2.4G WIFI/GSM/WCDMA/LTE system. GSM/GPRS/EGPRS frequency band is Band II//V. The HSPA/UMTS frequency band is Band II/IV/V. LTE frequency band is band 2/4/5/7/12/13/25/26/38/41/66. The HSPA/UMTS frequency band II and Band V test data included in this report. The OVMS implements such functions as RF signal receiving/transmitting, GSM/GPRS/EGPRS/HSPA/UMTS/LTE protocol processing, video MMS service and etc. Externally it provides SIM card interface.

2.5 Internal Identification of AE used during the test

AE ID*	Description
AE1	Rechargeable Li-Polymer Battery
AE2	Switching Adapter

2.6 Normal Accessory setting

N/A



2.7 EUT configuration

The following peripheral devices and interface cables were connected during the measurement:

- - supplied by the manufacturer
- - supplied by the lab

<input type="radio"/>	Power Cable	Length (m) :	/
		Shield :	/
		Detachable :	/
<input type="radio"/>	Multimeter	Manufacturer :	/
		Model No. :	/

2.8 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for FCC ID: 2ATDMOVMS-33-7600G filing to comply with FCC Part 22H, Part 24E, Part 27 Rules.

2.9 Modifications

No modifications were implemented to meet testing criteria.

2.10 General Test Conditions/Configurations

2.10.1 Test Modes

NOTE: The test mode(s) are selected according to relevant radio technology specifications.

Test Mode	Test Modes Description
UMTS/TM1	WCDMA system, QPSK modulation
UMTS/TM2	HSDPA system, QPSK modulation
UMTS/TM3	HSUPA system, QPSK modulation

Note: As WCDMA, HSDPA and HSUPA with the same emission designator, test result recorded in this report at the worst case UMTS/TM1 only after exploratory scan.

2.10.2 Test Environment

Environment Parameter	Selected Values During Tests	
Relative Humidity	Ambient	
Temperature	TN	Ambient
Voltage	VL	DC 10.2V
	VN	DC 12V
	VH	DC 15V

NOTE: VL=lower extreme test voltage VN=nominal voltage

VH=upper extreme test voltage TN=normal temperature



3 TEST ENVIRONMENT

3.1 Address of the test laboratory

Shenzhen LCS Compliance Testing Laboratory Ltd

101, 201 Bldg A & 301 Bldg C, Juji Industrial Park Yabianxueziwei, Shajing Street, Baoan District, Shenzhen, 518000, China

The sites are constructed in conformance with the requirements of ANSI C63.4 (2014) and CISPR Publication 22.

3.2 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

NVLAP Accreditation Code is 600167-0.

FCC Designation Number is CN5024.

CAB identifier is CN0071.

CNAS Registration Number is L4595.

Test Firm Registration Number: 254912

3.3 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	15-35 ° C
Humidity:	30-60 %
Atmospheric pressure:	950-1050mbar

(1)expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

3.4 Test Description

3.4.1 Cellular Band (824-849MHz paired with 869-894MHz) (Band V)

Test Item	FCC Rule No.	Requirements	Verdict
Effective(Isotropic) Radiated Output Power	§2.1046, §22.913	FCC: ERP ≤ 7W.	Pass
Modulation Characteristics	§2.1047	Digital modulation	N/A
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.	Pass
Band Edges Compliance	§2.1051, §22.917	≤-13dBm/1%*EBW, in 1MHz bands immediately outside and adjacent to The frequency block.	Pass
Spurious Emission at Antenna Terminals	§2.1051, §22.917	≤ -13dBm/100kHz, from 9kHz to 10 th harmonics but outside authorized operating frequency ranges.	Pass
Field Strength of Spurious Radiation	§2.1053, §22.917	≤ -13dBm/100kHz.	Pass
Frequency Stability	§2.1055, §22.355	≤ ±2.5ppm.	Pass
Peak-Average Ratio	§24.232	≤13dB	Pass

NOTE 1: For the verdict, the "N/A" denotes "not applicable", the "N/T" de notes "not tested".



3.4.2 PCS Band (1850-1910MHz paired with 1930-1990MHz) (Band II)

Test Item	FCC Rule No.	Requirements	Verdict
Effective(Isotropic) Radiated Output Power	§2.1046, §24.232	EIRP \leq 2W	Pass
Peak-Average Ratio	§2.1046, §24.232	\leq 13dB	Pass
Modulation Characteristics	§2.1047	Digital modulation	N/A
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.	Pass
Band Edges Compliance	§2.1051, §24.238	\leq -13dBm/1%*EBW, In 1MHz bands immediately outside and adjacent to The frequency block.	Pass
Spurious Emission at Antenna Terminals	§2.1051, §24.238	\leq -13dBm/1MHz, from 9kHz to 10 th harmonics but outside authorized operating frequency ranges.	Pass
Field Strength of Spurious Radiation	§2.1053, §24.238	\leq -13dBm/1MHz.	Pass
Frequency Stability	§2.1055, §24.235	\leq \pm 2.5ppm.	Pass

NOTE 1: For the verdict, the “N/A” denotes “not applicable”, the “N/T” de notes “not tested”.

3.4.3 AWS Band (1710-1755MHz pairedwith 2110-2155MHz) (Band IV)

Test Item	FCC RuleNo.	Requirements	Verdict
Effective(Isotropic) Radiated Power Output Data	§2.1046, §27.50(d)	EIRP \leq 1W;	Pass
Peak-Average Ratio	§2.1046, §27.50(d)	Limit \leq 13dB	Pass
Modulation Characteristics	§2.1047	Digitalmodulation	N/A
Bandwidth	§2.1049	OBW: Nolimit. EBW: Nolimit.	Pass
BandEdges Compliance	§2.1051, §27.53(h)	\leq -13dBm/1%*EBW,in1 MHz bands immediately outside and adjacent to the frequency block.	Pass
Spurious Emission at Antenna Terminals	§2.1051, §27.53(h)	\leq -13dBm/1MHz, from 9kHz to 10 th harmonics but outside authorized operating frequency ranges.	Pass
Frequency Stability	§2.1055, §27.54	Within authorized bands of operation/frequency block.	Pass
Radiated spurious emission	§2.1053, §27.53(h)	\leq -13dBm/1MHz.	Pass

NOTE 1: For the verdict, the “N/A” denotes “not applicable”, the “N/T” de notes “not tested”



3.5 Equipments Used during the Test

Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	Power Meter	R&S	NRVS	100444	2021-06-21	2022-06-20
2	Power Sensor	R&S	NRV-Z81	100458	2021-06-21	2022-06-20
3	Power Sensor	R&S	NRV-Z32	10057	2021-06-21	2022-06-20
4	LTE Test Software	Tonscend	JS1120-1	N/A	N/A	N/A
5	RF Control Unit	Tonscend	JS0806	158060009	2020-11-26	2021-11-25
6	MXA Signal Analyzer	Agilent	N9020A	MY51250905	2020-11-17	2021-11-16
7	WIDEBAND RADIO COMMUNICATION TESTER	R&S	CMW 500	103818	2021-06-21	2022-06-20
8	DC Power Supply	Agilent	E3642A	N/A	2020-11-26	2021-11-25
9	EMI Test Software	AUDIX	E3	/	N/A	N/A
10	3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	2021-06-21	2022-06-20
11	Positioning Controller	MF	MF7082	MF78020803	2021-06-21	2022-06-20
12	Active Loop Antenna	SCHWARZBECK	FMZB 1519B	00005	2021-07-25	2024-07-24
13	By-log Antenna	SCHWARZBECK	VULB9163	9163-470	2021-07-25	2024-07-24
14	Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-1925	2021-07-01	2024-06-30
15	Broadband Horn Antenna	SCHWARZBECK	BBHA 9170	791	2020-09-20	2023-09-19
16	Broadband Preamplifier	SCHWARZBECK	BBV9745	9719-025	2021-06-21	2022-06-20
17	EMI Test Receiver	R&S	ESR 7	101181	2021-06-21	2022-06-20
18	RS SPECTRUM ANALYZER	R&S	FSP40	100503	2020-11-17	2021-11-16
19	Broadband Preamplifier	/	BP-01M18G	P190501	2021-06-21	2022-06-20
20	6dB Attenuator	/	100W/6dB	1172040	2021-06-21	2022-06-20
21	3dB Attenuator	/	2N-3dB	/	2020-11-17	2021-11-16
22	Temperature & Humidity Chamber	GUANGZHOU GOGNWEN	GDS-100	70932	2021-10-07	2022-10-06
23	EMI Test Software	Farad	EZ	N/A	N/A	N/A



3.6 Measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to ETSI TR 100 028 “ Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics” and is documented in the Shenzhen LCS Compliance Testing Laboratory Ltd. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Shenzhen LCS Compliance Testing Laboratory Ltd. is reported:

Test	Range	Measurement Uncertainty	Notes
Radiated Emission	30~1000MHz	3.10 dB	(1)
Radiated Emission	1~18GHz	3.80 dB	(1)
Radiated Emission	18-40GHz	3.90 dB	(1)
Conducted Disturbance	0.15~30MHz	1.63 dB	(1)
Conducted Power	9KHz~18GHz	0.61 dB	(1)
Spurious RF Conducted Emission	9KHz~40GHz	1.22 dB	(1)
Band Edge Compliance of RF Emission	9KHz~40GHz	1.22 dB	(1)
Occupied Bandwidth	9KHz~40GHz	-	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=1.96$.

4 TEST CONDITIONS AND RESULTS

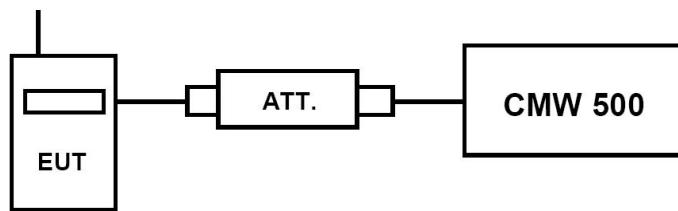
4.1 Output Power

TEST APPLICABLE

During the process of testing, the EUT was controlled via R&S WIDEBAND RADIO COMMUNICATION TESTER (CMW 500) to ensure max power transmission and proper modulation. This result contains output power and EIRP measurements for the EUT. In all cases, output power is within the specified limits.

4.1.1. Conducted Output Power

TEST CONFIGURATION



TEST PROCEDURE

Conducted Power Measurement:

- Place the EUT on a bench and set it in transmitting mode.
- Connect a low loss RF cable from the antenna port to a CMW 500 by an Att.
- EUT Communicate with CMW 500 then selects a channel for testing.
- Add a correction factor to the display CMW 500, and then test.

TEST RESULTS

Item	band	WCDMA Band II result (dBm)			WCDMA Band IV result (dBm)			WCDMA Band V result (dBm)		
		Channel/Frequency(MHz)		Channel/Frequency(MHz)	Channel/Frequency(MHz)		Channel/Frequency(MHz)	Channel/Frequency(MHz)		
sub-test	sub-test	9262/ 1852.4	9400/ 1880	9538/ 1907.6	1312/ 1712.4	1413/ 1732.6	1513/ 1752.6	4132/ 826.4	4182/ 836.4	4233/ 846.6
RMC	12.2kbps RMC	23.53	23.50	23.49	23.54	23.39	23.48	21.78	20.98	21.65
HSDPA	Sub -Test 1	22.85	22.98	22.82	22.73	22.80	22.84	21.59	21.39	21.07
	Sub -Test 2	22.87	22.88	22.85	22.77	22.71	22.86	21.49	21.74	21.42
	Sub -Test 3	22.87	22.81	22.81	22.85	22.82	22.88	20.68	20.32	20.73
	Sub -Test 4	22.74	22.72	22.77	22.80	22.82	22.72	21.29	21.11	21.19
HSUPA	Sub -Test 1	22.72	22.84	22.72	22.80	22.78	22.83	22.11	22.15	22.63
	Sub -Test 2	22.89	22.87	22.78	22.87	22.78	22.81	21.42	20.89	21.32
	Sub -Test 3	22.81	22.82	22.72	22.88	22.72	22.86	22.09	21.72	21.62
	Sub -Test 4	22.75	22.85	22.87	22.82	22.86	22.85	20.59	21.13	20.75
	Sub -Test 5	22.74	22.73	22.85	22.78	22.73	22.87	21.02	21.43	20.87

4.1.1 Radiated Output Power

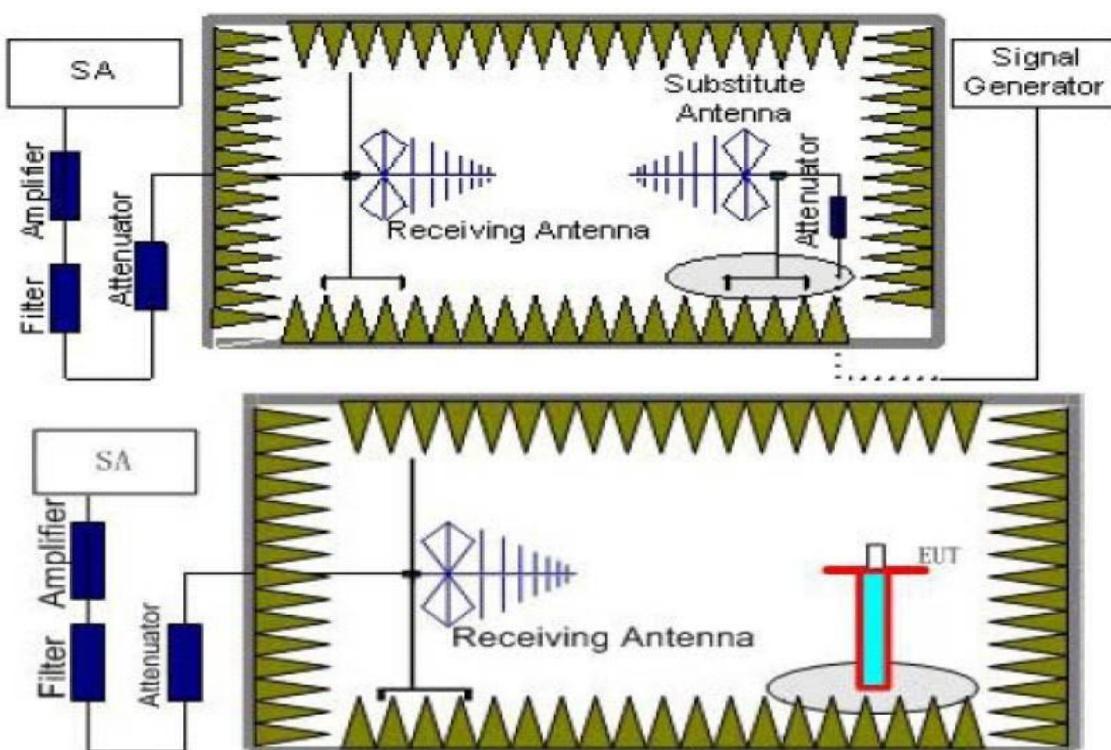
TEST DESCRIPTION

This is the test for the maximum radiated power from the EUT.

Rule Part 24.232(c) specifies, "Mobile/portable stations are limited to 2 watts e.i.r.p. Peak power" and 24.232(e) specifies that "Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage."

Rule Part 22.913(a) specifies "The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts."

TEST CONFIGURATION



TEST PROCEDURE

1. EUT was placed on a 1.50 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The height of receiving antenna is 1.50m. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all transmit frequencies in three channels (High, Middle, Low) were measured with peak detector.
2. A log-periodic antenna or double-ridged waveguide horn antenna shall be substituted in place of the EUT. The log-periodic antenna will be driven by a signal generator and the level will be adjusted till the same power value on the spectrum analyzer or receiver. The level of the spurious emissions can be calculated through the level of the signal generator, cable loss, the gain of the substitution antenna and the reading of the spectrum analyzer or receiver.
3. The EUT is then put into continuously transmitting mode at its maximum power level during the test. Set Test Receiver or Spectrum RBW=10MHz, VBW=10MHz, And the maximum value of the receiver should be recorded as (P_r).
4. The EUT shall be replaced by a substitution antenna. In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power (P_{Mea}) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded (P_r). The power of signal source (P_{Mea}) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.
5. An amplifier should be connected to the Signal Source output port. And the cable should be connect between the Amplifier and the Substitution Antenna. The cable loss (P_{cl}), the Substitution Antenna Gain (G_a) and the Amplifier Gain (P_{Ag}) should be recorded after test.



The measurement results are obtained as described below:

$$\text{Power(EIRP)} = P_{\text{Mea}} + P_{\text{Ag}} - P_{\text{cl}} + G_a$$

6. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power.
7. ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP = EIRP-2.15dBi.

TEST LIMIT

According to 22.913(a)(5), 24.232(c), §27.50(d) the ERP(EIRP) should be not exceeding following table limits:

		Burst Average EIRP
UMTS Band II		FCC: $\leq 33.01\text{dBm}$ (2W)
		Burst Average EIRP
UMTS Band V		FCC: $\leq 38.45\text{dBm}$ (7W)
		Burst Average EIRP
UMTS Band IV		FCC: $\leq 30.00\text{dBm}$ (1W)

TEST RESULTS

Remark:

1. We were tested all Configuration refer 3GPP TS134 121.
2. $EIRP = P_{\text{Mea}}(\text{dBm}) - P_{\text{cl}}(\text{dB}) + P_{\text{Ag}}(\text{dB}) + G_a(\text{dBi})$
3. $ERP = EIRP - 2.15\text{dBi}$ as EIRP by subtracting the gain of the dipole.
4. Margin = Emission Level - Limit
5. We test the V direction recorded worst case.

UMTS/TM1/UMTS Band II

Frequency (MHz)	P _{Mea} (dBm)	P _{cl} (dB)	G _a Antenna Gain (dB)	P _{Ag} (dB)	Burst Average EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
1852.4	-18.73	4.03	8.38	35.51	21.13	33.01	-11.88	V
1880.0	-18.99	4.08	8.33	35.56	20.82	33.01	-12.19	V
1907.6	-18.64	4.14	8.26	35.63	21.11	33.01	-11.90	V

UMTS/TM1/UMTS Band V

Frequency (MHz)	P _{Mea} (dBm)	P _{cl} (dB)	G _a Antenna Gain (dB)	Correction (dB)	P _{Ag} (dB)	Burst Average EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
826.4	-16.34	3.45	8.45	2.15	33.79	20.30	38.45	-18.15	V
836.4	-16.26	3.49	8.45	2.15	33.85	20.40	38.45	-18.05	V
846.6	-16.38	3.55	8.36	2.15	33.88	20.16	38.45	-18.29	V

UMTS/TM1/UMTS Band IV

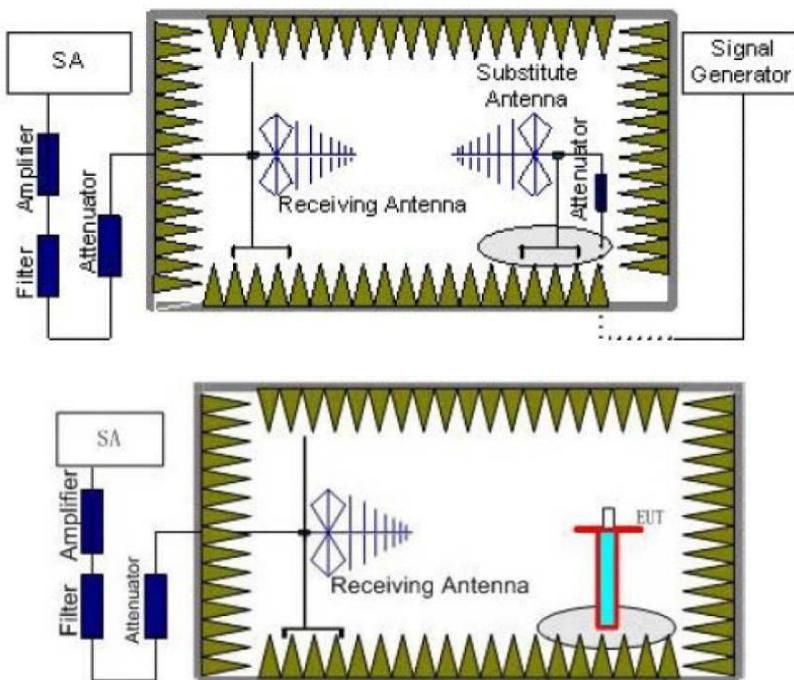
Frequency (MHz)	P _{Mea} (dBm)	P _{cl} (dB)	G _a Antenna Gain (dB)	P _{Ag} (dB)	Burst Average EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
1712.4	-18.97	3.93	9.05	34.96	21.11	30	-8.89	V
1732.6	-18.89	3.93	8.89	35.01	21.08	30	-8.92	V
1752.6	-18.85	3.94	8.76	35.08	21.05	30	-8.95	V

4.2 Radiated Spurious Emission

TEST APPLICABLE

According to the TIA-603-E:2016 and FCC Part 2.1033 test method, The Receiver or Spectrum was scanned from lowest frequency frequency generated within the equipment to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier that can be as high as 1910 MHz. The resolution bandwidth is set as outlined in Part 24.238, Part 22.917, The spectrum is scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of WCDMA Band II and WCDMA Band V.

TEST CONFIGURATION



TEST PROCEDURE

1. EUT was placed on a 1.50 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The height of receiving antenna is 1.50 m. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all transmit frequencies in three channels (High, Middle, Low) were measured with peak detector.
2. A log-periodic antenna or double-ridged waveguide horn antenna shall be substituted in place of the EUT. The log-periodic antenna will be driven by a signal generator and the level will be adjusted till the same power value on the spectrum analyzer or receiver. The level of the spurious emissions can be calculated through the level of the signal generator, cable loss, the gain of the substitution antenna and the reading of the spectrum analyzer or receiver.
3. The EUT is then put into continuously transmitting mode at its maximum power level during the test. Set Test Receiver or Spectrum RBW=1MHz, VBW=3MHz, And the maximum value of the receiver should be recorded as (P_r).
4. The EUT shall be replaced by a substitution antenna. In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power (P_{Mea}) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded (P_r). The power of signal source (P_{Mea}) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.
5. A amplifier should be connected to the Signal Source output port. And the cable should be connect between the Amplifier and the Substitution Antenna. The cable loss (P_{cl}), the Substitution Antenna Gain (G_a) and the Amplifier Gain (P_{Ag}) should be recorded after test.

The measurement results are obtained as described below:

$$\text{Power(EIRP)} = P_{Mea} + P_{Ag} - P_{cl} + G_a$$



6. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power.
7. ERP can be calculated from EIRP by subtracting the gain of the dipole, $ERP = EIRP - 2.15\text{dBi}$.
8. In order to make sure test results more clearly, we set frequency range and sweep time for difference frequency range as follows table:

Working Frequency	Subrange (GHz)	RBW	VBW	Sweep time (s)
UMTS/TM1/ WCDMA Band V	0.00009~0.15	1KHz	3KHz	30
	0.00015~0.03	10KHz	30KHz	10
	0.03~1	100KHz	300KHz	10
	1~2	1 MHz	3 MHz	2
	2~5	1 MHz	3 MHz	3
	5~8	1 MHz	3 MHz	3
	8~10	1 MHz	3 MHz	3
UMTS/TM1/ WCDMA Band II	0.00009~0.15	1KHz	3KHz	30
	0.00015~0.03	10KHz	30KHz	10
	0.03~1	100KHz	300KHz	10
	1~2	1 MHz	3 MHz	2
	2~5	1 MHz	3 MHz	3
	5~8	1 MHz	3 MHz	3
	8~11	1 MHz	3 MHz	3
	11~14	1 MHz	3 MHz	3
	14~18	1 MHz	3 MHz	3
	18~20	1 MHz	3 MHz	2
UMTS/TM1/ WCDMA Band IV	0.00009~0.15	1KHz	3KHz	30
	0.00015~0.03	10KHz	30KHz	10
	0.03~1	100KHz	300KHz	10
	1~2	1 MHz	3 MHz	2
	2~5	1 MHz	3 MHz	3
	5~8	1 MHz	3 MHz	3
	8~11	1 MHz	3 MHz	3
	11~14	1 MHz	3 MHz	3
	14~18	1 MHz	3 MHz	3

TEST LIMITS

According to 24.238, 22.917, specify that 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.

The specification that emissions shall be attenuated below the transmitter power (P) by at least $43 + 10 \log(P)$ dB, translates in the relevant power range (1 to 0.001 W) to -13 dBm. At 1 W the specified minimum attenuation becomes 43 dB and relative to a 30 dBm (1 W) carrier becomes a limit of -13 dBm. At 0.001 W (0 dBm) the minimum attenuation is 13 dB, which again yields a limit of -13 dBm. In this way a translation of the specification from relative to absolute terms is carried out.

Frequency	Channel	Frequency Range	Verdict
UMTS/TM1/ WCDMA Band V	Low	9KHz - 10GHz	PASS
	Middle	9KHz - 10GHz	PASS
	High	9KHz - 10GHz	PASS
UMTS/TM1/ WCDMA Band II	Low	9KHz - 20GHz	PASS
	Middle	9KHz - 20GHz	PASS
	High	9KHz - 20GHz	PASS
UMTS/TM1/ WCDMA Band IV	Low	9KHz - 18GHz	PASS
	Middle	9KHz - 18GHz	PASS
	High	9KHz - 18GHz	PASS



TEST RESULTS

Remark:

1. We were tested all Configuration refer 3GPP TS134 121.
2. $EIRP = P_{Mea}(dBm) - P_{cl}(dB) + P_{Ag}(dB) + G_a(dBi)$
3. $ERP = EIRP - 2.15dB$ as EIRP by subtracting the gain of the dipole.
4. Margin = EIRP - Limit

UMTS/TM1/ WCDMA Band II Low Channel

Frequency (MHz)	P _{Mea} (dBm)	P _{cl} (dB)	Diatance	G _a Antenna Gain(dB)	Peak EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
3704.8	-39.28	5.26	3.00	9.88	-34.66	-13.00	-21.66	H
5557.2	-44.75	6.11	3.00	11.36	-39.50	-13.00	-26.50	H
3704.8	-44.23	5.26	3.00	9.88	-39.61	-13.00	-26.61	V
5557.2	-48.01	6.11	3.00	11.36	-42.76	-13.00	-29.76	V

UMTS/TM1/ WCDMA Band II Middle Channel

Frequency (MHz)	P _{Mea} (dBm)	P _{cl} (dB)	Diatance	G _a Antenna Gain(dB)	Peak EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
3760.0	-38.44	5.32	3.00	10.03	-33.73	-13.00	-20.73	H
5640.0	-43.74	6.19	3.00	11.41	-38.52	-13.00	-25.52	H
3760.0	-43.44	5.32	3.00	10.03	-38.73	-13.00	-25.73	V
5640.0	-47.66	6.19	3.00	11.41	-42.44	-13.00	-29.44	V

UMTS/TM1/ WCDMA Band II High Channel

Frequency (MHz)	P _{Mea} (dBm)	P _{cl} (dB)	Diatance	G _a Antenna Gain(dB)	Peak EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
3815.2	-43.03	5.36	3.00	9.62	-38.77	-13.00	-25.77	H
5722.8	-51.74	6.24	3.00	11.46	-46.52	-13.00	-33.52	H
3815.2	-46.63	5.36	3.00	9.62	-42.37	-13.00	-29.37	V
5722.8	-53.77	6.24	3.00	11.46	-48.55	-13.00	-35.55	V

UMTS/TM1/ WCDMA Band V Low Channel

Frequency (MHz)	P _{Mea} (dBm)	P _{cl} (dB)	Diatance	G _a Antenna Gain(dB)	Peak EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
1652.8	-47.61	3.86	3.00	8.56	-42.91	-13.00	-29.91	H
2479.2	-48.93	4.29	3.00	6.98	-46.24	-13.00	-33.24	H
1652.8	-44.45	3.86	3.00	8.56	-39.75	-13.00	-26.75	V
2479.2	-44.62	4.29	3.00	6.98	-41.93	-13.00	-28.93	V

UMTS/TM1/ WCDMA Band V Middle Channel

Frequency (MHz)	P _{Mea} (dBm)	P _{cl} (dB)	Diatance	G _a Antenna Gain(dB)	Peak EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
1672.8	-49.25	3.9	3.00	8.58	-44.57	-13.00	-31.57	H
2509.2	-50.98	4.32	3.00	6.8	-48.50	-13.00	-35.50	H
1672.8	-45.05	3.9	3.00	8.58	-40.37	-13.00	-27.37	V
2509.2	-45.39	4.32	3.00	6.8	-42.91	-13.00	-29.91	V



UMTS/TM1/ WCDMA Band V High Channel

Frequency (MHz)	P _{Mea} (dBm)	P _{cl} (dB)	Diatance	G _a Antenna Gain(dB)	Peak EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
1693.2	-52.27	3.91	3.00	9.06	-47.12	-13.00	-34.12	H
2539.8	-54.93	4.32	3.00	6.65	-52.60	-13.00	-39.60	H
1693.2	-49.82	3.91	3.00	9.06	-44.67	-13.00	-31.67	V
2539.8	-51.16	4.32	3.00	6.65	-48.83	-13.00	-35.83	V

UMTS/TM1/ WCDMA Band IV Low Channel

Frequency (MHz)	P _{Mea} (dBm)	P _{cl} (dB)	Diatance	G _a Antenna Gain(dB)	Peak EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
3424.8	-46.02	4.62	3.00	9.81	-40.83	-13.00	-27.83	H
5137.2	-49.74	5.94	3.00	10.86	-44.82	-13.00	-31.82	H
3424.8	-49.03	4.62	3.00	9.81	-43.84	-13.00	-30.84	V
5137.2	-53.75	5.94	3.00	10.86	-48.83	-13.00	-35.83	V

UMTS/TM1/ WCDMA Band IV Middle Channel

Frequency (MHz)	P _{Mea} (dBm)	P _{cl} (dB)	Diatance	G _a Antenna Gain(dB)	Peak EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
3465.2	-41.37	4.63	3.00	9.84	-36.16	-13.00	-23.16	H
5197.8	-46.08	5.94	3.00	10.86	-41.16	-13.00	-28.16	H
3465.2	-44.28	4.63	3.00	9.84	-39.07	-13.00	-26.07	V
5197.8	-49.53	5.94	3.00	10.86	-44.61	-13.00	-31.61	V

UMTS/TM1/ WCDMA Band IV High Channel

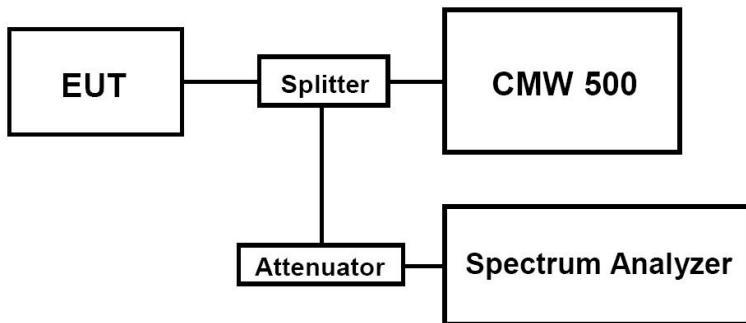
Frequency (MHz)	P _{Mea} (dBm)	P _{cl} (dB)	Diatance	G _a Antenna Gain(dB)	Peak EIRP (dBm)	Limit (dBm)	Margin (dB)	Polarization
3505.2	-47.89	4.65	3.00	9.9	-42.64	-13.00	-29.64	H
5257.8	-51.69	5.95	3.00	10.91	-46.73	-13.00	-33.73	H
3505.2	-50.97	4.65	3.00	9.9	-45.72	-13.00	-32.72	V
5257.8	-53.55	5.95	3.00	10.91	-48.59	-13.00	-35.59	V

4.3 Occupied Bandwidth and Emission Bandwidth

TEST APPLICABLE

Similar to conducted emissions; occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. The table below lists the measured 99% Bandwidth and -26dBc Bandwidth.

TEST CONFIGURATION



TEST PROCEDURE

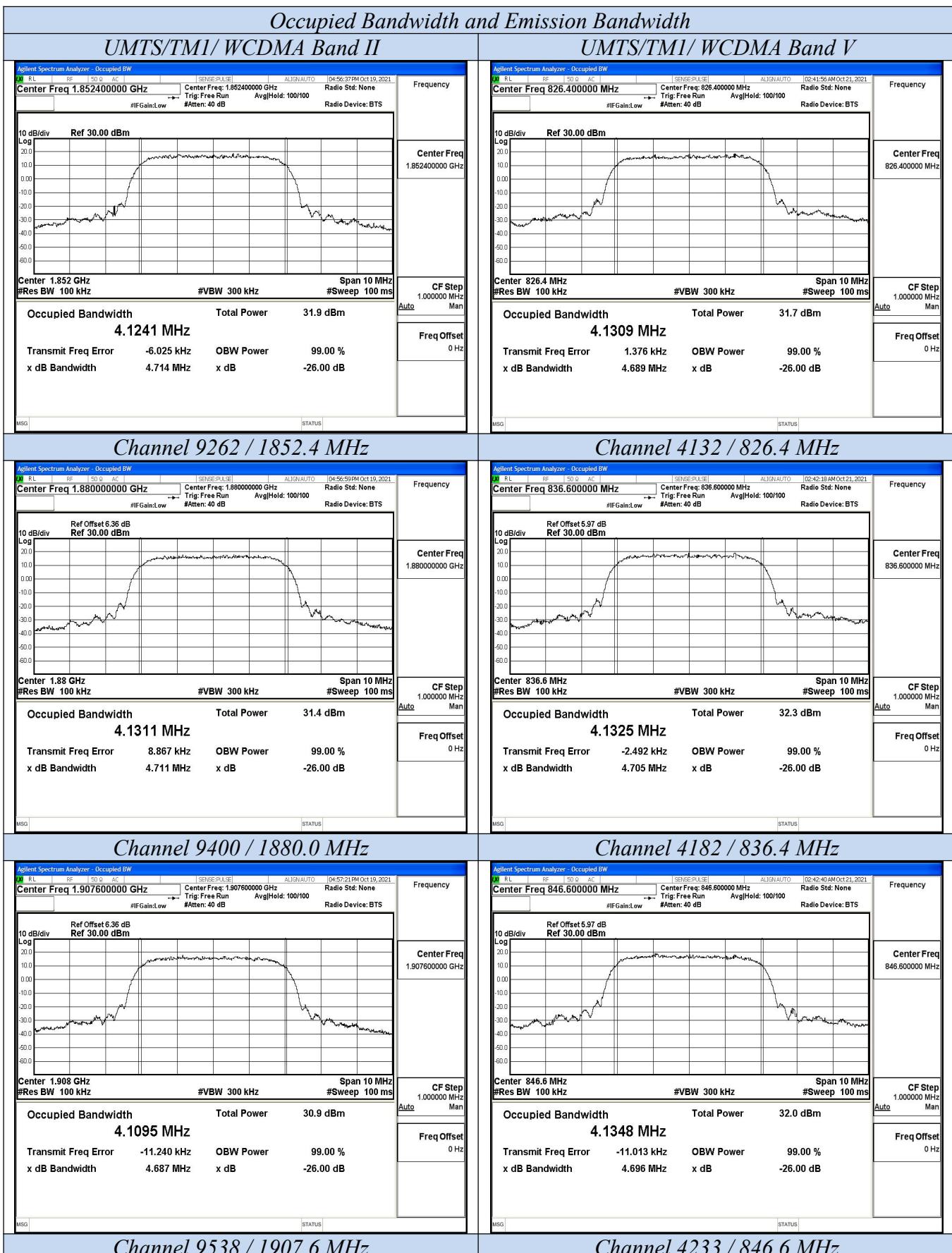
1. The EUT was set up for the max output power with pseudo random data modulation;
2. The Occupied bandwidth and Emission Bandwidth were measured with Agilent Spectrum Analyzer N9020A (peak);
3. Set RBW=100KHz,VBW=300KHz,Span=10MHz,SWT=Auto;
4. Set SPA Max hold and View, Set 99% Occupied Bandwidth/ Set -26dBc Occupied Bandwidth
5. These measurements were done at 3 frequencies for WCDMA band II/V. (low, middle and high of operational frequency range).

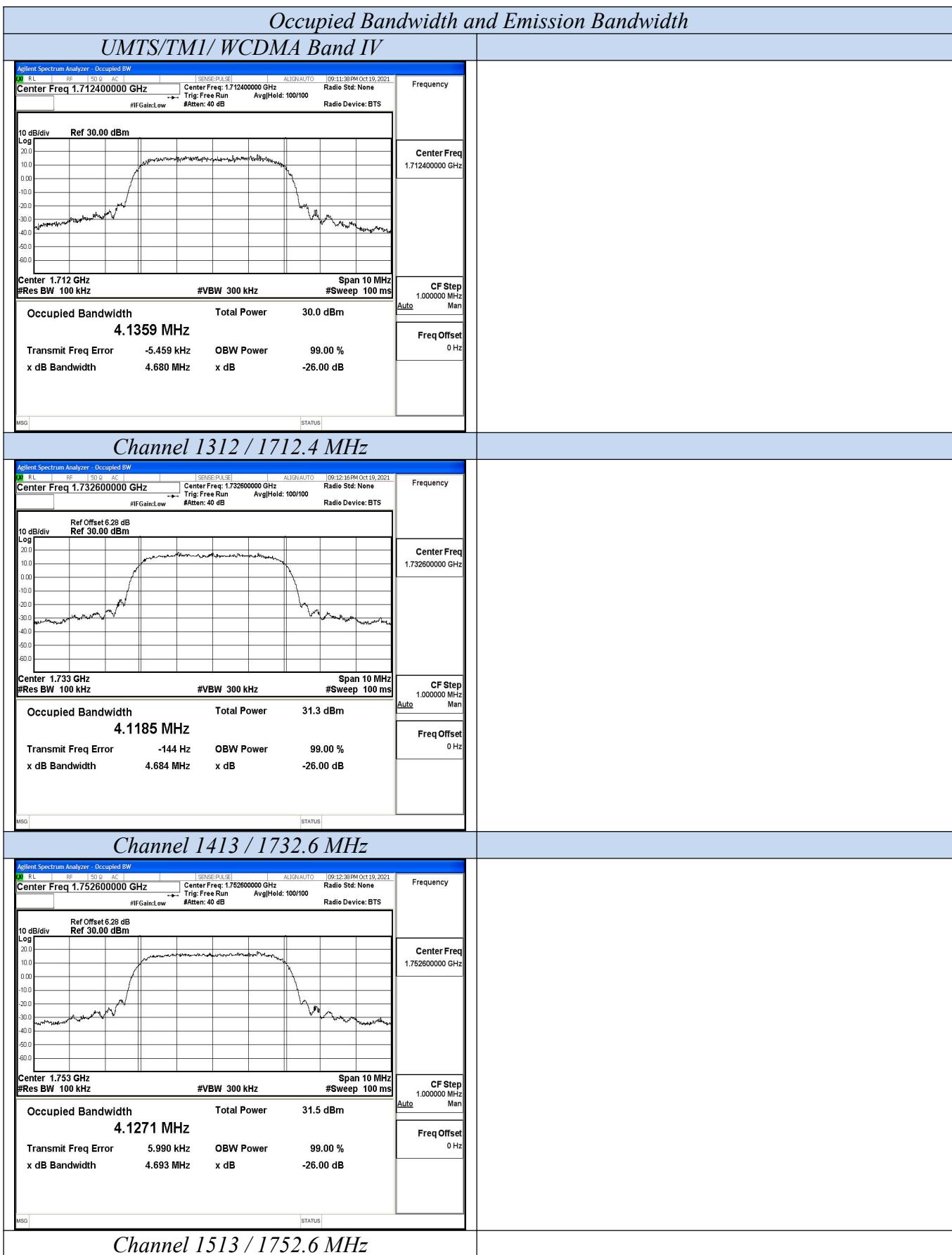
TEST RESULTS

Test Mode	Channel	Frequency (MHz)	Occupied Bandwidth (99% BW) (MHz)	Emission Bandwidth (-26 dBc BW) (MHz)	Verdict
UMTS/TM1/ WCDMA Band II	9262	1852.4	4.1241	4.714	PASS
	9400	1880.0	4.1311	4.711	PASS
	9538	1907.6	4.1095	4.687	PASS
UMTS/TM1/ WCDMA Band V	4132	826.4	4.1309	4.689	PASS
	4182	836.4	4.1325	4.705	PASS
	4233	846.6	4.1348	4.696	PASS
UMTS/TM1/ WCDMA Band IV	1312	1712.4	4.1359	4.680	PASS
	1413	1732.6	4.1185	4.684	PASS
	1513	1752.6	4.1271	4.693	PASS

Remark:

1. Test results including cable loss;
2. Please refer to following plots;



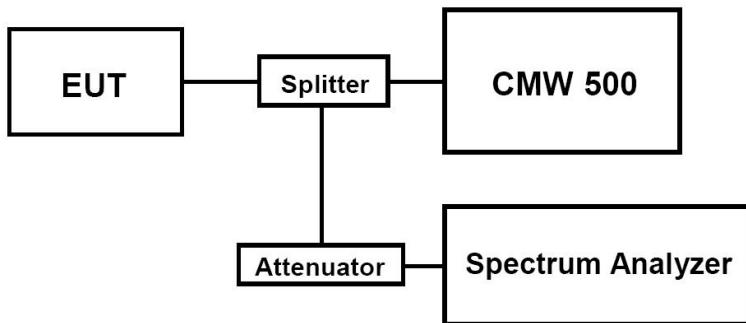


4.4 Band Edge Compliance

TEST APPLICABLE

During the process of testing, the EUT was controlled via R&S WIDEBAND RADIO COMMUNICATION TESTER (CMW 500) to ensure max power transmission and proper modulation.

TEST CONFIGURATION



TEST PROCEDURE

1. The EUT was set up for the max output power with pseudo random data modulation;
2. The power was measured with Spectrum Analyzer N9020A;
3. Set RBW=51KHz, VBW=200KHz, Span=10MHz, SWT=Auto, Dector: RMS;

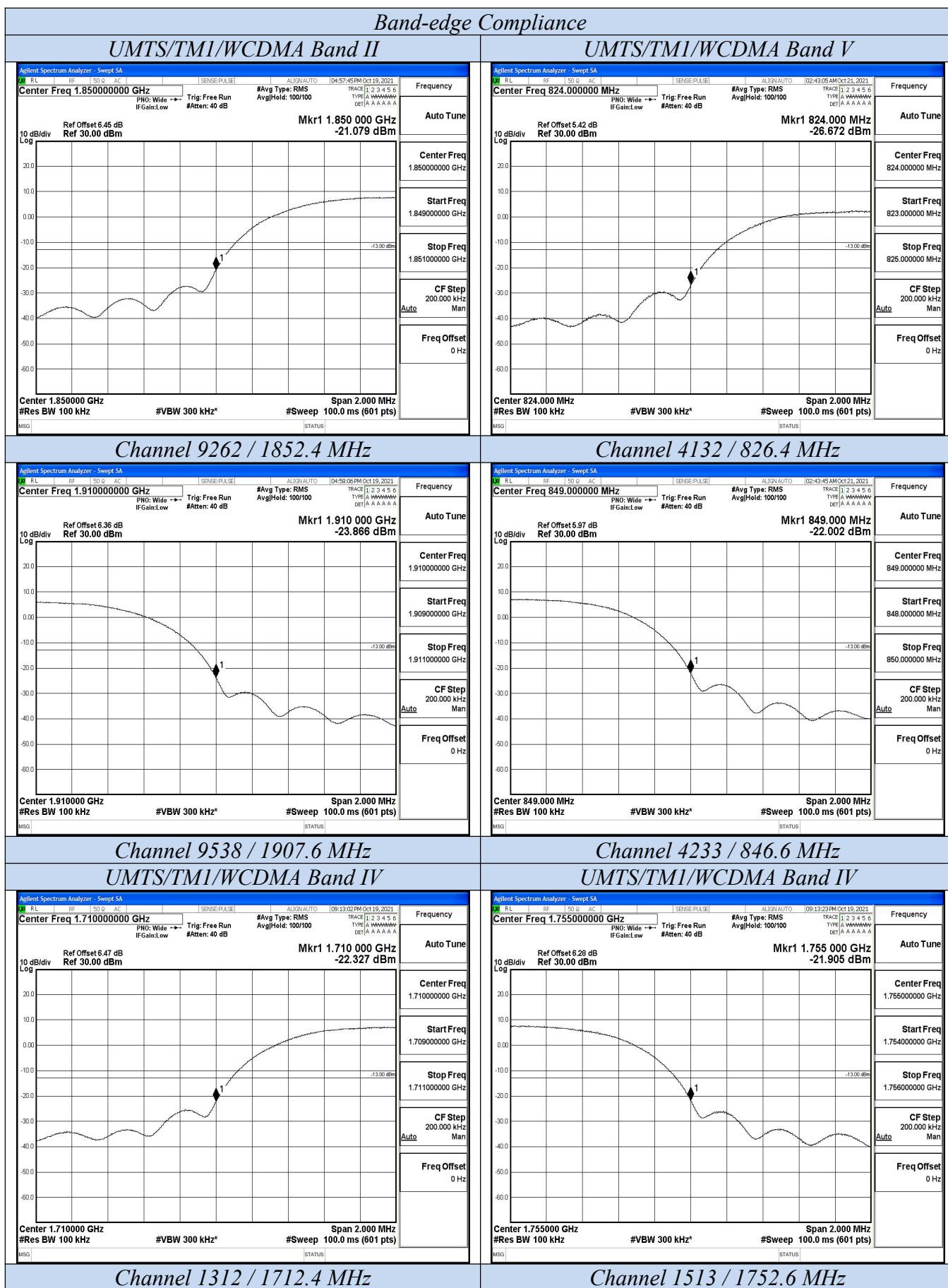
These measurements were done at 2 frequencies for WCDMA Band II/IV/V. (low and high of operational frequency range).

TEST RESULTS

UMTS/TM1/WCDMA Band II					
Test Mode	Channel	Frequency (MHz)	Band Edg Compliance (dBm)	Limits (dBm)	Verdict
UMTS/TM1/WCDMA Band II	9262	1852.4	<-13dBm	-13dBm	PASS
	9538	1907.6	<-13dBm	-13dBm	
	1513	1752.6	<-13dBm	-13dBm	
UMTS/TM1/WCDMA Band V					
Test Mode	Channel	Frequency (MHz)	Band Edg Compliance (dBm)	Limits (dBm)	Verdict
UMTS/TM1/WCDMA Band V	4132	826.4	<-13dBm	-13dBm	PASS
	4233	846.6	<-13dBm	-13dBm	
UMTS/TM1/WCDMA Band IV					
Test Mode	Channel	Frequency (MHz)	Band Edg Compliance (dBm)	Limits (dBm)	Verdict
UMTS/TM1/WCDMA Band IV	1312	1712.4	<-13dBm	-13dBm	PASS
	1513	1752.6	<-13dBm	-13dBm	

Remark:

1. Test results including cable loss;
2. Please refer to following plots;



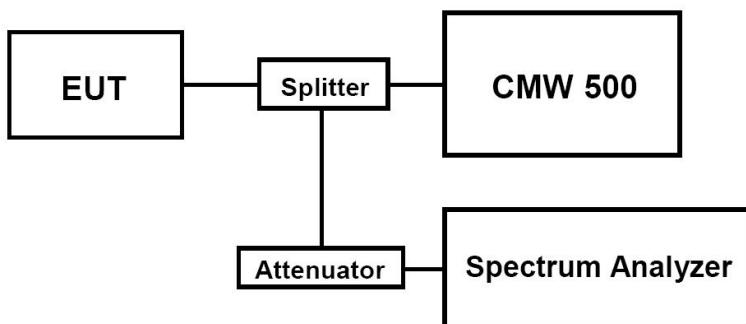
4.5 Spurious Emission on Antenna Port

TEST APPLICABLE

The following steps outline the procedure used to measure the conducted emissions from the EUT.

1. Determine frequency range for measurements: From CFR 2.1057 the spectrum should be investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency. For the equipment of WCDMA band II/IV, this equates to a frequency range of 9 KHz to 20GHz, data taken from 30 MHz to 20 GHz. For WCDMA Band V, this equates to a frequency range of 9 KHz to 20 GHz, data taken from 30 MHz to 20 GHz.
2. The sweep time is set automatically by instrument itself. That should be the optimal sweep time for the span and the RBW. If the sweep time is too short, that is sweep is too fast, the sweep result is not accurate; if the sweep time is too long, that is sweep is too low, some frequency components may be lost. The instrument will give an optimal sweep time according the selected span and RBW.
3. The procedure to get the conducted spurious emission is as follows:
The trace mode is set to MaxHold to get the highest signal at each frequency;
Wait 25 seconds;
Get the result.
4. Determine EUT transmit frequencies: below outlines the band edge frequencies pertinent to conducted emissions testing.

TEST CONFIGURATION



TEST PROCEDURE

1. The EUT was set up for the max output power with pseudo random data modulation;
2. The power was measured with Spectrum Analyzer N9020A;
3. These measurements were done at 3 frequencies for WCDMA band II/IV/V. (low, middle and high of operational frequency range).

TEST LIMIT

Part 24.238, Part 22.917, specify that 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.

The specification that emissions shall be attenuated below the transmitter power (P) by at least $43 + 10 \log(P)$ dB, translates in the relevant power range (1 to 0.001 W) to -13 dBm. At 1 W the specified minimum attenuation becomes 43 dB and relative to a 30 dBm (1 W) carrier becomes a limit of -13 dBm. At 0.001 W (0 dBm) the minimum attenuation is 13 dB, which again yields a limit of -13 dBm. In this way a translation of the specification from relative to absolute terms is carried out.

**TEST RESULTS**

Test Mode	Channel	Frequency (MHz)	Spurious RF Conducted Emission (dBm)	Limits (dBm)	Verdict
UMTS/TM1/WCDMA Band II	9262	1852.4	<-13dBm	-13dBm	PASS
	9400	1880.0	<-13dBm	-13dBm	
	9538	1907.6	<-13dBm	-13dBm	
UMTS/TM1/WCDMA Band V	4132	826.4	<-13dBm	-13dBm	PASS
	4182	836.4	<-13dBm	-13dBm	
	4233	846.6	<-13dBm	-13dBm	
UMTS/TM1/WCDMA Band IV	1312	1712.4	<-13dBm	-13dBm	PASS
	1413	1732.6	<-13dBm	-13dBm	
	1513	1752.6	<-13dBm	-13dBm	

Remark:

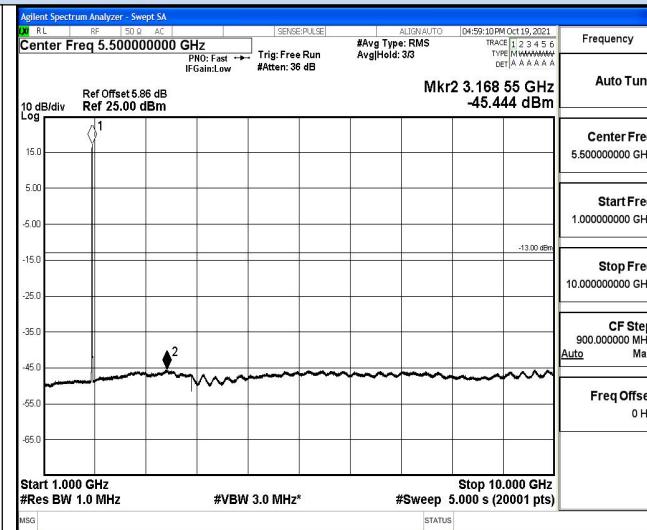
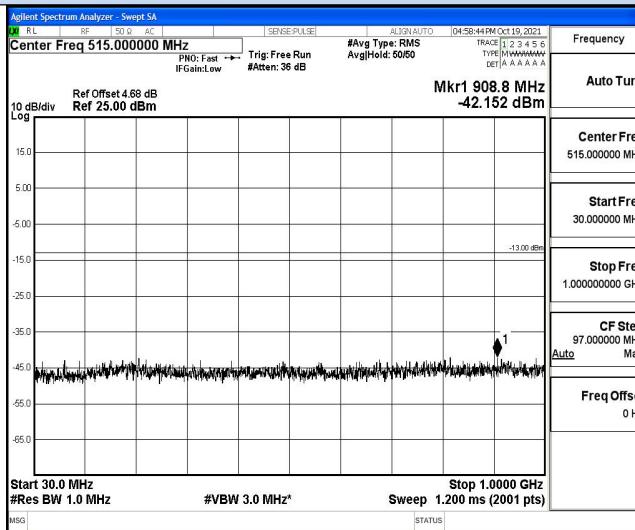
1. Test results including cable loss;
2. Please refer to following plots;
3. Not reordered test plots from 9 KHz to 30 MHz as emission levels 20dB lower than emission limit;



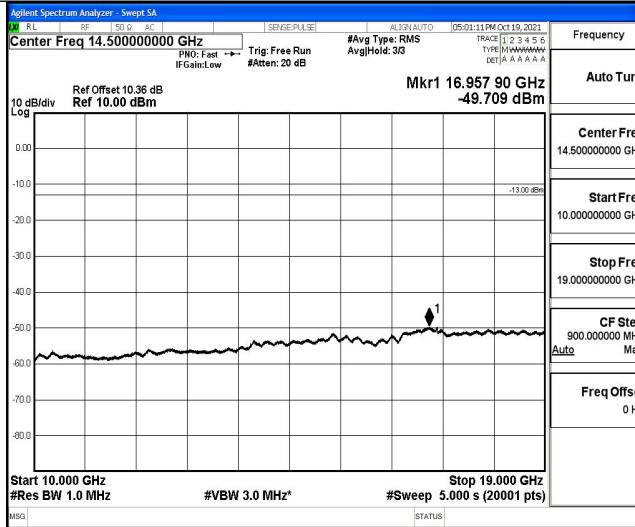
Spurious Emission on Antenna Port

UMTS/TMI/WCDMA Band II

Channel 9262 / 1852.4 MHz



30 MHz – 1000 MHz

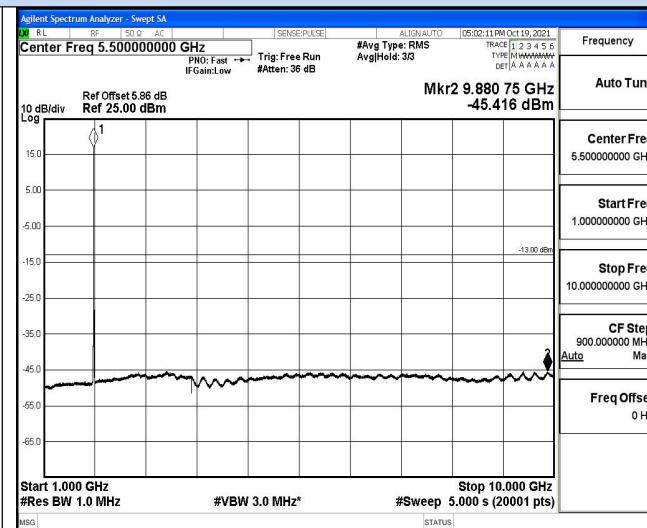
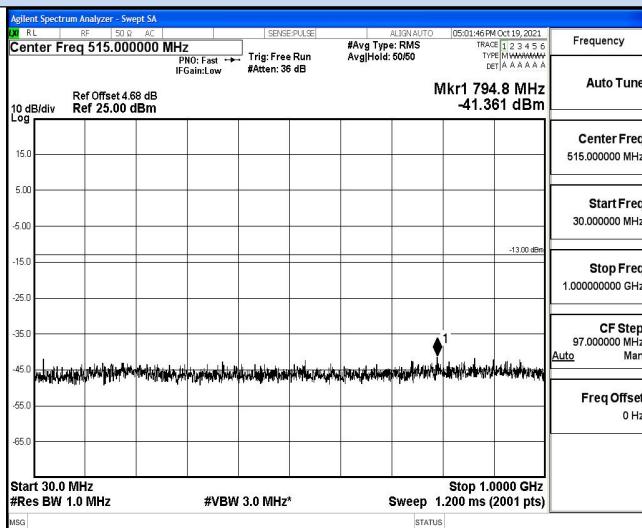


1 GHz – 10 GHz

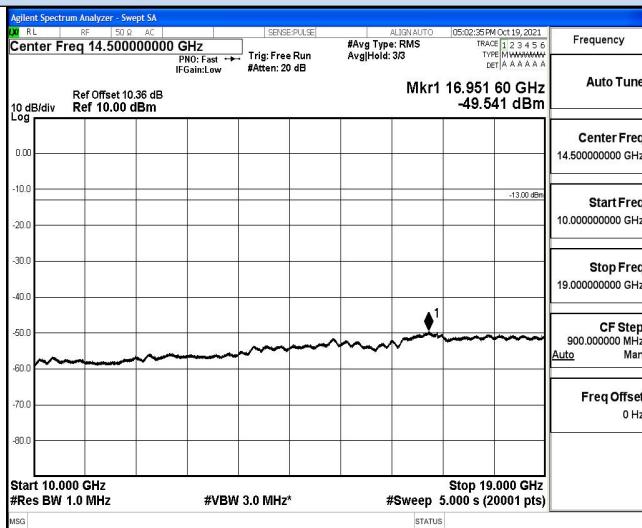


10 GHz – 19 GHz

Spurious Emission on Antenna Port UMTS/TM1/WCDMA Band II Channel 9400 / 1880 MHz



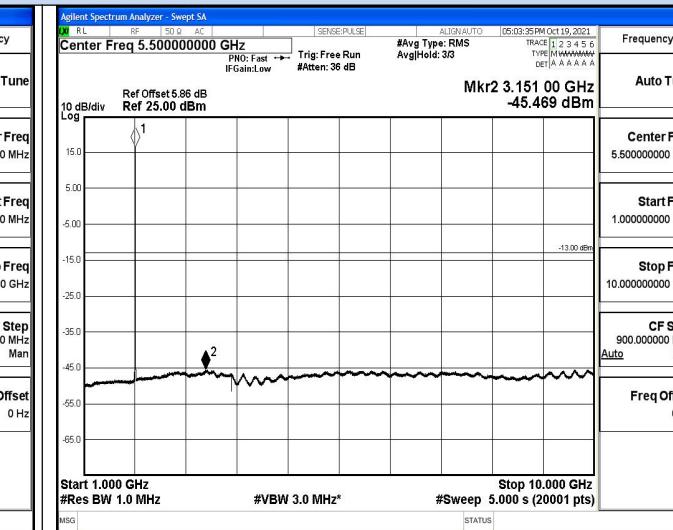
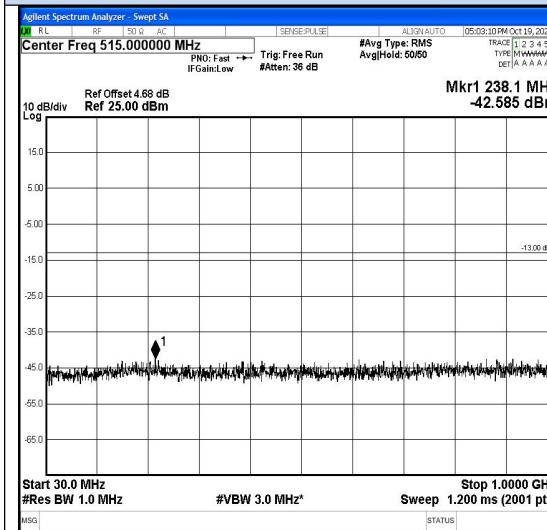
30 MHz – 1000 MHz



1 GHz – 10 GHz

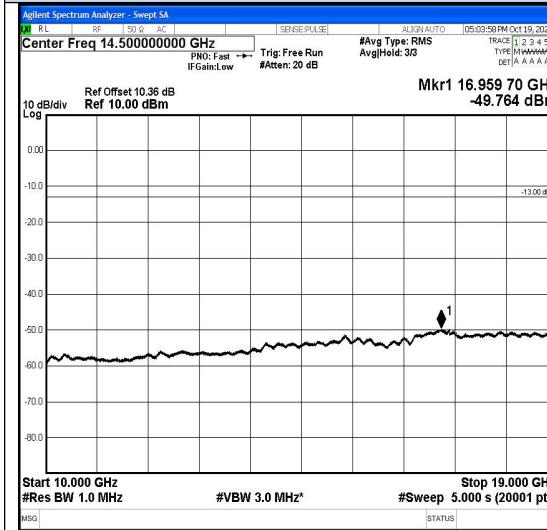
10 GHz – 19 GHz

Spurious Emission on Antenna Port
UMTS/TM1/WCDMA Band II
Channel 9538 / 1907.6 MHz

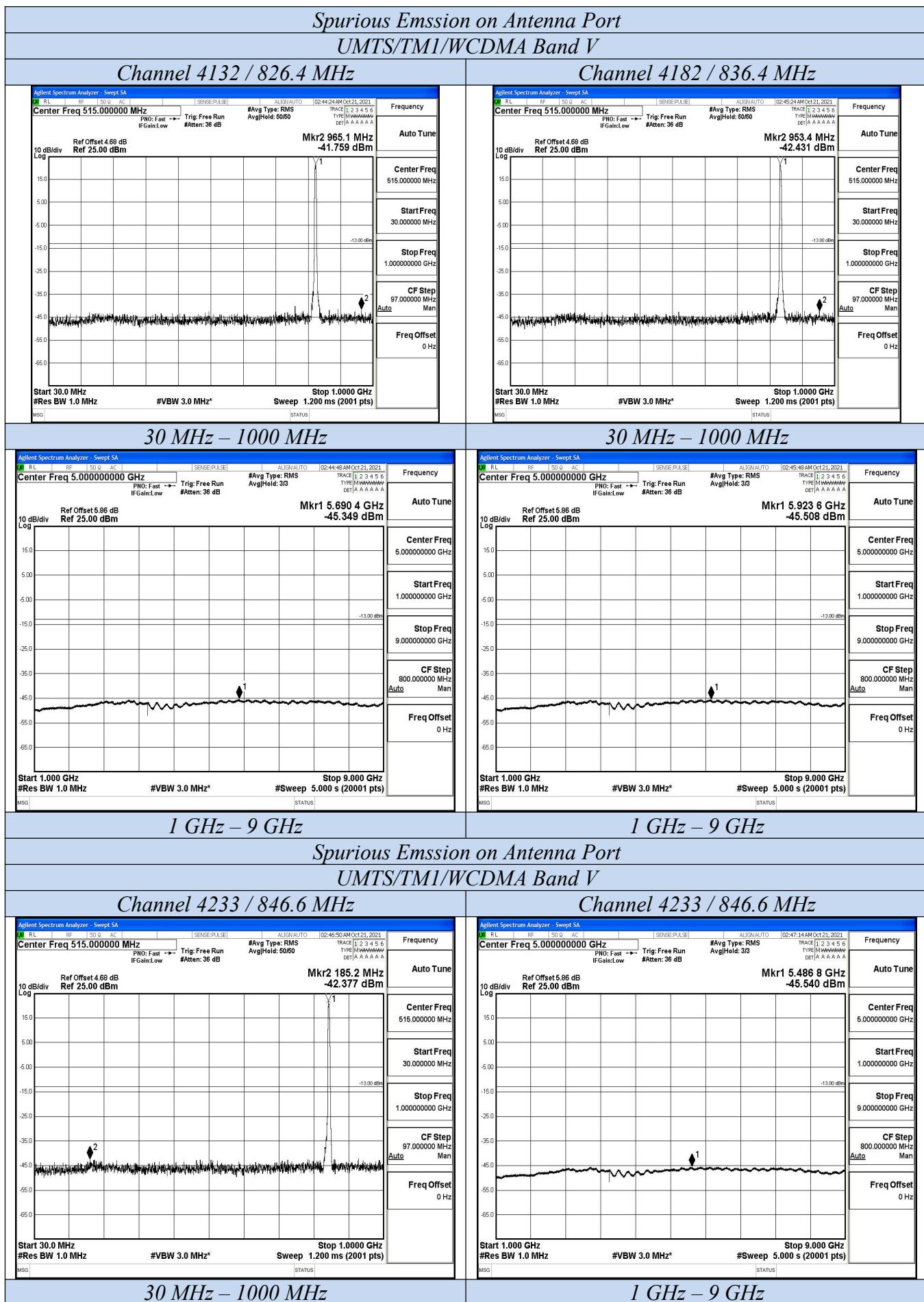


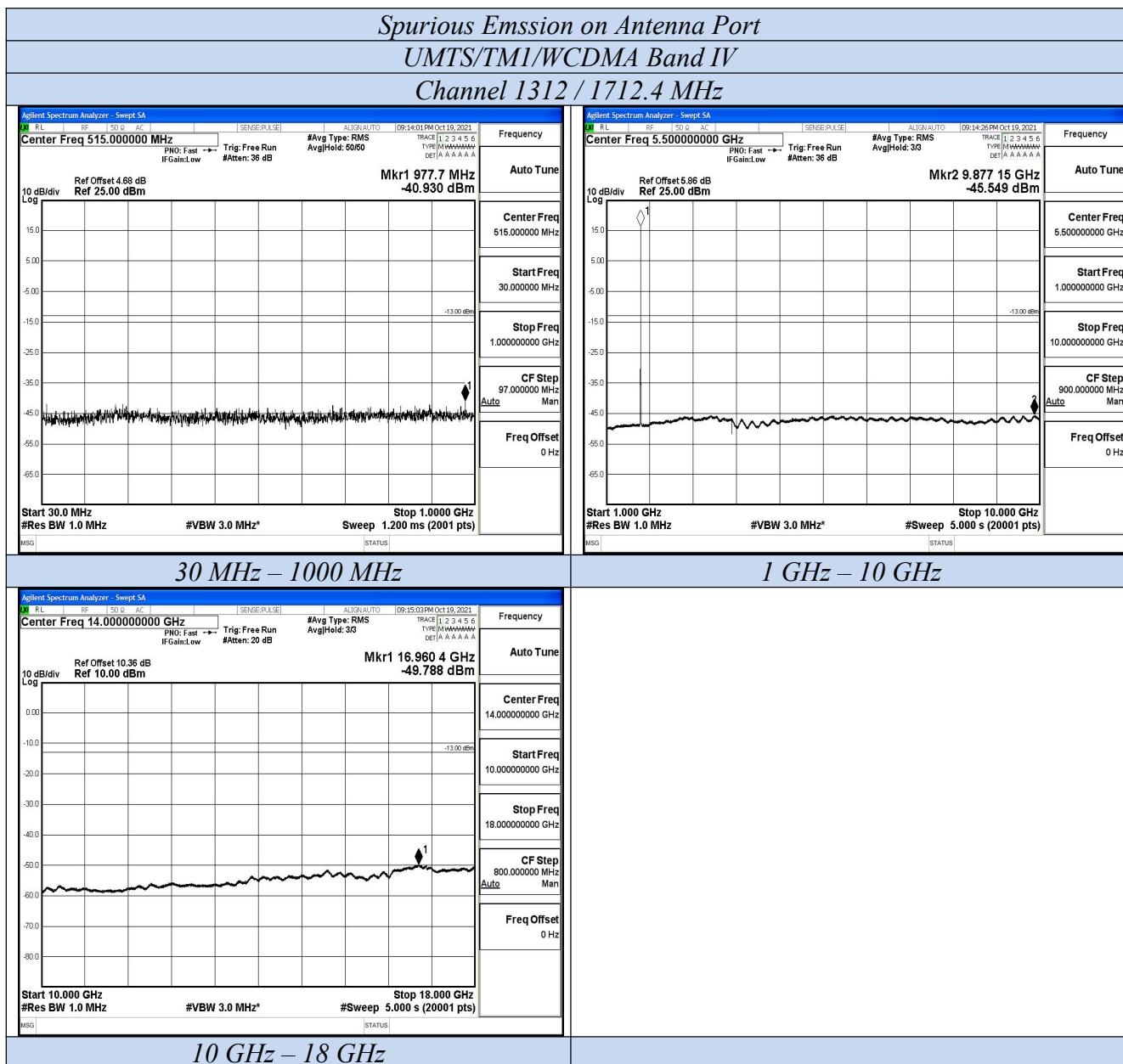
30 MHz – 1000 MHz

1 GHz – 10 GHz

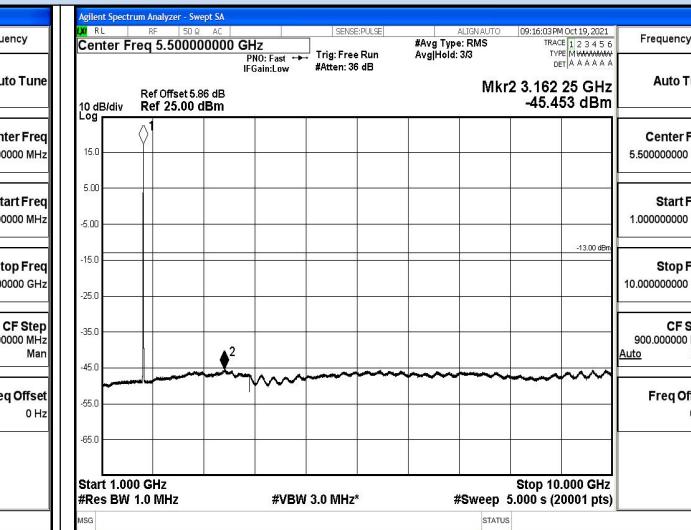
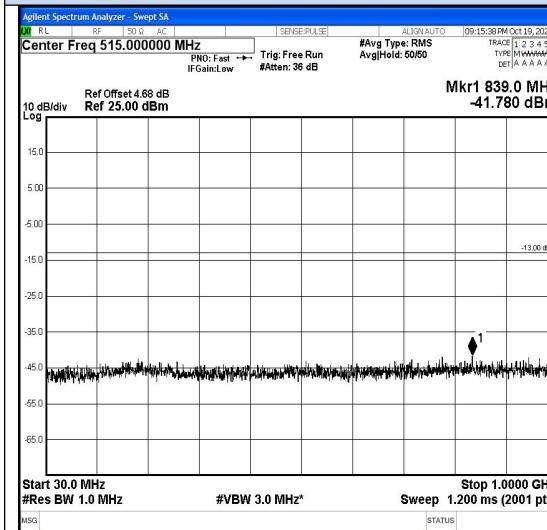


10 GHz – 19 GHz

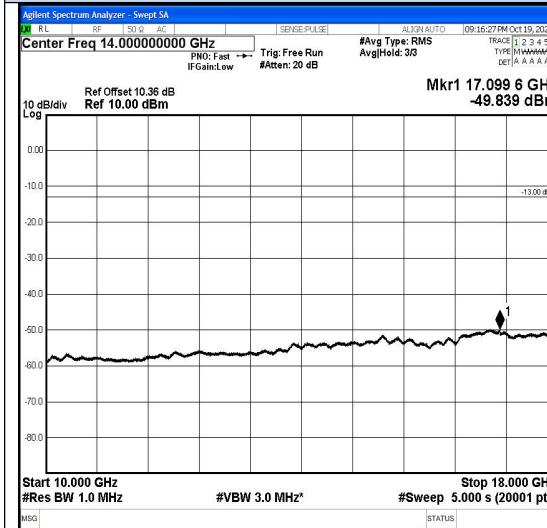




Spurious Emission on Antenna Port
UMTS/TM1/WCDMA Band IV
Channel 1413 / 1732.6 MHz



30 MHz – 1000 MHz



1 GHz – 10 GHz

10 GHz – 18 GHz