CERTIFICATION TEST REPORT

Report Number. : 12802195-E6V2

Applicant	:	MICROSOFT CORPORATION ONE MICROSOFT WAY REDMOND, WA 98052, U.S.A
Model	:	1876
FCC ID	:	C3K1876
IC	:	3048A-1876
EUT Description	:	PORTABLE COMPUTING DEVICE
Test Standard(s)	:	FCC CFR47 PART 22H, 24E ISED RSS-132 ISSUE 3, RSS-133 ISSUE 6

Date Of Issue:
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Revision History

Rev.	Issue Date	Revisions	Revised By
V1	8/30/2019	Initial Review	--
V2	9/6/2019	Revised report to address TCB's questions	Tina Chu

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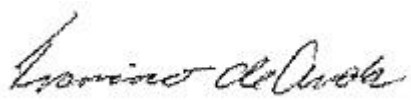
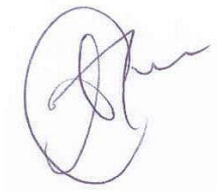
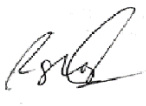
1. ATTESTATION OF TEST RESULTS

Applicant Name and Address	MICROSOFT CORPORATION ONE MICROSOFT WAY REDMOND, WA 98052, U.S.A
Model	1876
FCC ID	C3K1876
IC	3048A-1876
EUT Description	PORTABLE COMPUTING DEVICE
Serial Number	005767392553, 024266192753, 053697593153
Date Tested	JULY 02, 2019 to JULY 17, 2019 , AUGUST 29, 2019
Applicable Standards	FCC CFR 47 Part 22H, 24E ISED RSS-132 ISSUE 3, RSS-133 ISSUE 6
Test Results	COMPLIES

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of the U.S. government.

Approved & Released By:	Reviewed By:	Prepared By:
		
Francisco de Anda Operation Leader UL Verification Services Inc.	Tina Chu Senior Project Handler UL Verification Services Inc.	Rolly Alegre Test Engineer UL Verification Services Inc.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, Part 22, Part 24, FCC KDB 971168 D01 v03r01/ D02 v02r01, KDB 412172 D01 v01r01, ANSI C63.26:2015, IC RSS-132, RSS-133.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, and 47658 Kato Road, Fremont, California, USA. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

47173 Benicia Street	47266 Benicia Street	47658 Kato Road
☐ Chamber A	☐ Chamber D	☐ Chamber I
☐ Chamber B	☐ Chamber E	☒ Chamber J
☐ Chamber C	☐ Chamber F	☐ Chamber K
	☐ Chamber G	☐ Chamber L
	☐ Chamber H	☐ Chamber M

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers above are covered under Industry Canada company address and respective code: 2324A.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0

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

RADIATED EMISSIONS

Where relevant, the following sample calculation is provided:
Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)
36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:
Final Voltage (dBuV) = Measured Voltage (dBuV) + Cable Loss (dB) + Limiter Factor (dB) + LISN Insertion Loss.
36.5 dBuV + 0 dB +10.1 dB+ 0 dB = 46.6 dBuV

4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Conducted Disturbance, 9KHz to 0.15 MHz	3.84 dB
Conducted Disturbance, 0.15 to 30 MHz	3.65 dB
Radiated Disturbance, 9KHz to 30 MHz	2.52 dB
Radiated Disturbance, 30 to 1000 MHz	4.88 dB
Radiated Disturbance,1000 to 18000 MHz	4.24 dB
Radiated Disturbance,18000 to 26000 MHz	4.37 dB
Radiated Disturbance,26000 to 40000 MHz	5.17 dB
Occupied Channel Bandwidth	±0.39 %
Temperature	±0.9 °C
Supply voltages	±0.45 %
Time	±0.02 %

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a portable computing device with 802.11 a/b/g/n/ac 2x2 WLAN, Bluetooth, Bluetooth LE, WCDMA and LTE radios.

5.2. MAXIMUM OUTPUT POWER

ERP/EIRP LIMIT

FCC: §2.1046, §22.913, §24.232
IC: RSS132§5.4; RSS133§6.4

EIRP/ERP TEST PROCEDURE

ANSI C63.26:2015
KDB 971168 D01 Section 5.6

ERP/EIRP = PMeas + GT − LC
where: ERP/EIRP = effective or equivalent 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.

For devices utilizing multiple antennas, KDB 662911 provides guidance for determining the effective array transmit antenna gain term to be used in the above equation.

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

WCDMA MODE

RSS 132 Band 5								
Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	Limit (W)	EIRP		99% BW (kHz)	Emission Designator
					(dBm)	(W)		
826.4-846.6	REL 99	24.0	-0.80	11.5	23.19	0.209	4134.8	4M13F9W
	HSDPA	23.9			23.12	0.205	4130.7	4M13F9W
Part 22 Band 5								
Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	Limit (W)	ERP		99% BW (kHz)	Emission Designator
					(dBm)	(W)		
826.4-846.6	REL 99	24.0	-0.80	7.0	21.04	0.127	4134.8	4M13F9W
	HSDPA	23.9			20.97	0.125	4130.7	4M13F9W
Part 24 / RSS 133 Band 2								
Frequency range (MHz)	Modulation	Conducted (Average) (dBm)	Antenna Gain (dBi)	Limit (W)	EIRP		99% BW (kHz)	Emission Designator
					(dBm)	(W)		
1852.4-1907.6	REL 99	24.0	1.60	2.0	25.60	0.363	4136.5	4M14F9W
	HSDPA	23.9			25.50	0.355	4146.6	4M15F9W

5.3. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was version BSP 6300.

5.4. MAXIMUM ANTENNA GAIN

Frequency Range (MHz)	Antenna Gain (dBi)
824 - 849	-0.8
1850 - 1910	1.6

5.5. WORST-CASE CONFIGURATION AND MODE

The worst-case is EUT on the highest power. Based on average conducted output power measurement investigations, the following modes should be considered as worst-case scenario for all other measurements.

Worst-case modes:
- WCDMA REL 99
- WCDMA HSDPA

The EUT was investigated in different orthogonal orientations X/Y/Z, and 45 degree angle when attached with the keyboard, with/without AC/DC adapter, cables and accessories. It was determined that 45 degree angle orientation when attached with the keyboard was the worst-case orientation for 800/1900MHz bands with AC/DC adapter, cables and accessories.

All radios that can be transmitted simultaneously have been evaluated for radiated for all possible combinations of transmission and found to be in compliance.

For simultaneous transmission of any BT/BLE/WLAN (2.4GHz) and WWAN bands or WLAN 5GHz and WWAN bands, investigation has been performed and no noticeable new emission was found.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID/DoC
Keyboard	Microsoft	N/A	E2XEV2BB01A0004	DoC
AC/DC Adapter	Microsoft	1706	0C130J00DMN94	DoC
USB Type C to A adapter	Amazon Basics	Gen1	N/A	DoC
Flash Drive	SanDisk	SDCZ36-008G	N/A	DoC
USB Type C to audio aux jack adapter	Amazon Basics	N/A	N/A	DoC
Earphone	Sony	AG1100	N/A	DoC

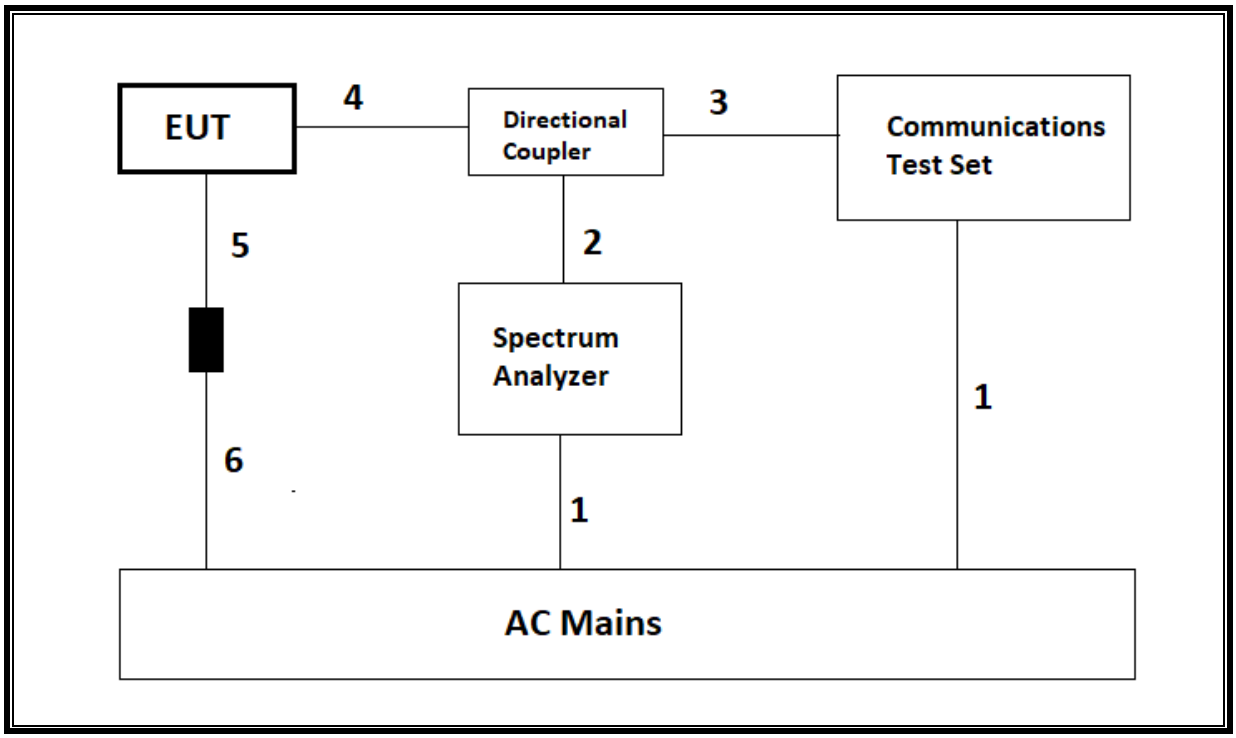
I/O CABLES (RF Conducted Test)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	3-prongs	Shielded	1.5	N/A
2	RF In/Out	1	Barrel	N/A	N/A	N/A
3	RF In/Out	1	SMA	Shielded	1	N/A
4	Antenna	1	SMA	Un-Shielded	0.2	N/A
5	DC	1	magnetic	Shielded	1.5	N/A
6	AC	1	2-prongs	Shielded	2	N/A

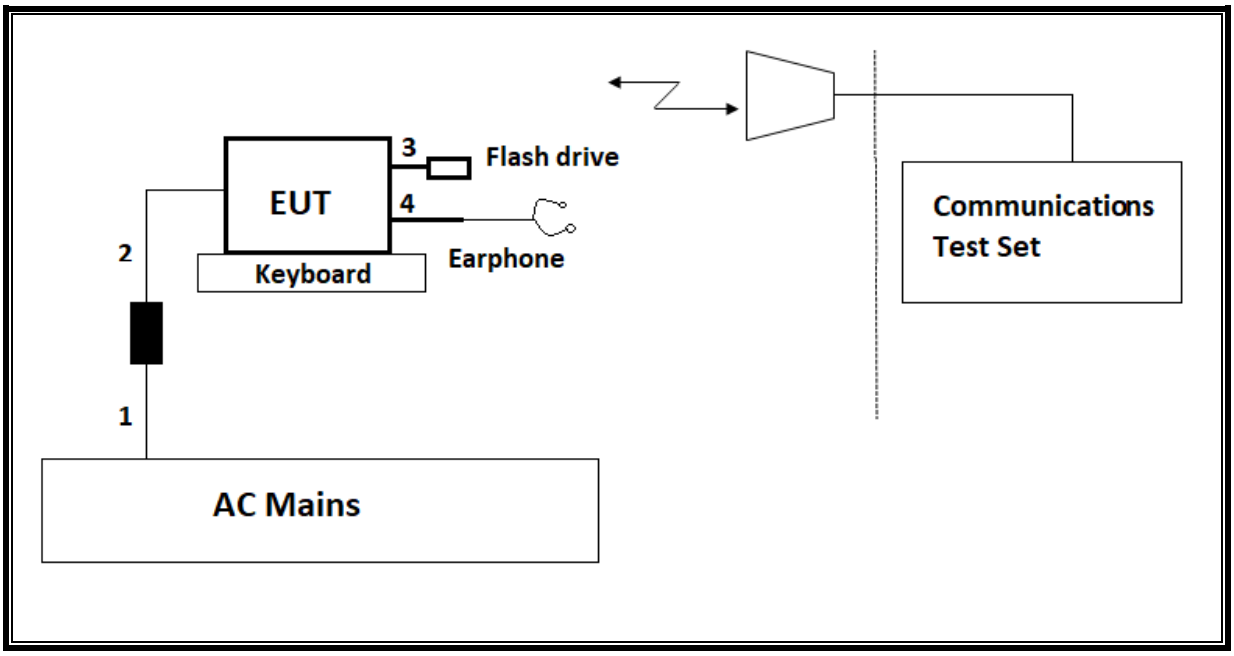
I/O CABLES (RF Radiated Test)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	2-prongs	Shielded	2	To AC mains
2	DC	1	magnetic	Shielded	1.5	to EUT
3	USB	1	USB type C to type A	Shielded	0.09	USB type C to A adapter to Flash drive
4	USB	1	USB type C to audio aux jack	Shielded	0.07	to earphone

CONDUCTED SETUP



RADIATED 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**	**Asset**	**Cal Due**
Highpass Filter, 3GHz	Micro-Tronics	HPM17543	PRE0181635	5/28/2020
Highpass Filter, 1.5 GHz	Micro-Tronics	HPM50114	T1852	7/31/2020
Highpass Filter, 1.2GHz	Micro-Tronics	HPM50108	PRE0182423	9/4/2019
Highpass Filter, 4GHz	Micro-Tronics	HPM13351	T1240	8/31/2019
Wideband Radio Communication Tester – Call Box	Rohde & Schwarz	CMW500	T953	2/18/2020
Wideband Radio Communication Tester – Call Box	Rohde & Schwarz	CMW500	T959	2/16/2020
Wideband Radio Communication Tester – Call Box	Rohde & Schwarz	CMW500	T957	2/14/2020
Wideband Radio Communication Tester – Call Box	Rohde & Schwarz	CMW500	T268	2/21/2020
Wideband Radio Communication Tester – Call Box	Rohde & Schwarz	CMW500	T703	2/20/2020
Spectrum Analyzer – PSA	Agilent (Keysight)	E440A	T200	1/28/2020
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight)	N9030A	T917	1/24/2020
Spectrum Analyzer – PXA	Agilent (Keysight)	N3090A	T1450	1/23/2020
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	PRE0179377	2/15/2020
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	PRE0189055	4/20/2020
RF Filter Box, 1-18GHz	UL(IN HOUSE)	NSN	PRE0181597	5/28/2020
RF Amplifier	AMPLICAL	AMP1G18-35	T1571	*7/30/2019
Temperature Chamber	Thermotron Industries	SE-600-10-10	T80	11/13/2019
Power Sensor	Agilent (Keysight)	N1921A	T1225	3/1/2020
Power Meter	Agilent (Keysight)	N1911A	T1264	1/31/2020
Power Sensor	Agilent (Keysight)	N1921A	T1226	2/6/2020
Power Meter	Agilent (Keysight)	N1911A	T1269	1/31/2020
Directional Coupler	KRYTAR	152610	T922	6/5/2020
DC power supply, 8 V @ 3 A or 15 V @ 2 A	Agilent / HP	E3610A	None	CNR
DC power supply 15V	Sprensen	XT15-4	T463	CNR
UL AUTOMATION SOFTWARE				
CLT Software	UL	UL RF	Ver 7.6, November 11, 2017	
Power Measurement Software	UL	UL RF	Ver 2.7, 2019	
Radiated test software	UL	UL RF	Ver 9.5 June 15, 2019	

NOTES:

*Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.

7. RF OUTPUT POWER VERIFICATION

7.1. WCDMA

TEST PROCEDURE

The transmitter output was connected to the input terminal of Directional Coupler via calibrated coaxial cable. The output coupling terminal of the Directional Coupler was directly connected to a spectrum analyzer while the output through terminal connected to the communication test set via calibrated coaxial cable.

The output power was measured with the spectrum analyzer at the low, middle and high channel in each band.

- Set the spectrum analyzer span wide enough or greater than the modulated signal BW.
- Set a spectrum analyzer at peak detection mode with VBW ≥ RBW.≥ 26dB BW, typically 5MHz.
- Set a marker to point the corresponding peak value.

REL 99

The following tests were completed according to the test requirements outlined in section 5.2 of the 3GPP TS34.121-1 specification. The DUT supports power Class 3, which has a nominal maximum output power of 24 dBm (+1.7/-3.7).

Mode	Subtest	Rel99
WCDMA General Settings	Loopback Mode	Test Mode 2
	Rel99 RMC	12.2kbps RMC
	Power Control Algorithm	Algorithm2
	βc/βd	8/15

HSDPA REL 5

The following 4 Sub-tests were completed according to Release 5 procedures in table C.10.1.4 of 3GPP TS 34.121-1
A summary of these settings are illustrated below:

Table C.10.1.4: β values for transmitter characteristics tests with HS-DPCCH

Sub-test	β_c	β_d	β_d *(SF)*	β_c/β_d	β_{HS} *(Note1, Note 2)*	**CM** (dB) *(Note 3)*	**MPR** (dB) *(Note 3)*
1	2/15	15/15	64	2/15	4/15	0.0	0.0
2	12/15 *(Note 4)*	15/15 *(Note 4)*	64	12/15 *(Note 4)*	24/15	1.0	0.0
3	15/15	8/15	64	15/8	30/15	1.5	0.5
4	15/15	4/15	64	15/4	30/15	1.5	0.5

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{hs} = 30/15 * β_c.

Note 2: For the HS-DPCCH power mask requirement test in clause 5.2C, 5.7A, and the Error Vector Magnitude (EVM) with HS-DPCCH test in clause 5.13.1A, and HSDPA EVM with phase discontinuity in clause 5.13.1AA, Δ_{ACK} and Δ_{NACK} = 30/15 with β_{hs} = 30/15 * β_c, and Δ_{CQI} = 24/15 with β_{hs} = 24/15 * β_c.

Note 3: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.

Note 4: For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 11/15 and β_d = 15/15.

HSPA REL 6 (HSDPA & HSUPA)

The following 5 Sub-tests were completed according to Release 6 procedures in table C.11.1.3 of 3GPP TS 34.121-1. A summary of these settings are illustrated below:

Table C.11.1.3: β values for transmitter characteristics tests with HS-DPCCH and E-DCH

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{HS} (Note1)	β_{ec}	β_{ed} (Note 4) (Note 5)	β_{ed} (SF)	β_{ed} (Codes)	CM (dB) (Note 2)	MPR (dB) (Note 2) (Note 6)	AG Index (Note 5)	E-TFCI
1	11/15 (Note 3)	15/15 (Note 3)	64	11/15 (Note 3)	22/15	209/225	1309/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	$\beta_{ed}1$: 47/15 $\beta_{ed}2$: 47/15	4 4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15	0	-	-	5/15	5/15	47/15	4	1	1.0	0.0	12	67

Note 1: For sub-test 1 to 4, Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{hs} = 30/15 * β_c. For sub-test 5, Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 5/15 with β_{hs} = 5/15 * β_c.

Note 2: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH, HS- DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.

Note 3: For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 10/15 and β_d = 15/15.

Note 4: In case of testing by UE using E-DPDCH Physical Layer category 1, Sub-test 3 is omitted according to TS25.306 Table 5.1g.

Note 5: β_{ed} can not be set directly; it is set by Absolute Grant Value.

Note 6: For subtests 2, 3 and 4, UE may perform E-DPDCH power scaling at max power which could results in slightly smaller MPR values.

DUAL CARRIER HSDPA (DC-HSDPA (REL 8, CAT 24)

The following 4 Sub-tests for DC-HSDPA were completed according to Release 8 procedures in table C08.1.12 of 3GPP TS 34.121-1. A summary of subtest settings are illustrated below:

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

Parameter	Unit	Value
Nominal Avg. Inf. Bit Rate	kbps	60
Inter-TTI Distance	TTI's	1
Number of HARQ Processes	Processes	6
Information Bit Payload (N_{INF})	Bits	120
Number Code Blocks	Blocks	1
Binary Channel Bits Per TTI	Bits	960
Total Available SML's in UE	SML's	19200
Number of SML's per HARQ Proc.	SML's	3200
Coding Rate		0.15
Number of Physical Channel Codes	Codes	1
Modulation		QPSK

Note 1: The RMC is intended to be used for DC-HSDPA mode and both cells shall transmit with identical parameters as listed in the table.

Note 2: Maximum number of transmission is limited to 1, i.e., retransmission is not allowed. The redundancy and constellation version 0 shall be used.

7.1.1. WCDMA BAND 5

ID:	19498ER	Date:	7/2/2019

Band	Mode		UL Ch No.	Freq. (MHz)	MPR (dB)	Conducted Average Power (dBm)
W-CDMA Band 5 (850MHz)	Rel 99	RMC, 12.2 kbps	4132	826.4	N/A	23.9
			4183	836.6	N/A	24.0
			4233	846.6	N/A	**24.0**
	HSDPA	Subtest 1	4132	826.4	0	23.8
			4183	836.6	0	23.9
			4233	846.6	0	**23.9**
		Subtest 2	4132	826.4	0	23.8
			4183	836.6	0	23.8
			4233	846.6	0	23.8
		Subtest 3	4132	826.4	0.5	23.4
			4183	836.6	0.5	23.5
			4233	846.6	0.5	23.5
		Subtest 4	4132	826.4	0.5	23.3
			4183	836.6	0.5	23.5
			4233	846.6	0.5	23.2
	HSPA (HSDPA & HSUPA)	Subtest 1	4132	826.4	0	23.4
			4183	836.6	0	23.5
			4233	846.6	0	23.5
		Subtest 2	4132	826.4	2	21.9
			4183	836.6	2	22.0
			4233	846.6	2	22.0
		Subtest 3	4132	826.4	1	22.9
			4183	836.6	1	23.0
			4233	846.6	1	23.0
		Subtest 4	4132	826.4	2	21.9
			4183	836.6	2	22.0
			4233	846.6	2	22.0
		Subtest 5	4132	826.4	0	23.2
			4183	836.6	0	23.4
			4233	846.6	0	23.4
	DC-HSDPA	Subtest 1	4132	826.4	0	23.8
			4183	836.6	0	23.8
			4233	846.6	0	23.8
		Subtest 2	4132	826.4	0	23.8
			4183	836.6	0	23.8
			4233	846.6	0	23.8
		Subtest 3	4132	826.4	0.5	23.4
			4183	836.6	0.5	23.5
			4233	846.6	0.5	23.5
		Subtest 4	4132	826.4	0.5	23.3
			4183	836.6	0.5	23.5
			4233	846.6	0.5	23.3

7.1.2. WCDMA BAND 2

ID:	19498ER	Date:	7/2/2019

Band	Mode		UL Ch No.	Freq. (MHz)	MPR (dB)	Conducted Average Power (dBm)
W-CDMA Band 2 (1900MHz)	Rel 99	RMC, 12.2 kbps	9262	1852.4	N/A	**24.0**
			9400	1880.0	N/A	23.9
			9538	1907.6	N/A	23.6
	HSDPA	Subtest 1	9262	1852.4	0	**23.9**
			9400	1880.0	0	23.7
			9538	1907.6	0	23.5
		Subtest 2	9262	1852.4	0	**23.9**
			9400	1880.0	0	23.7
			9538	1907.6	0	23.5
		Subtest 3	9262	1852.4	0.5	23.5
			9400	1880.0	0.5	23.3
			9538	1907.6	0.5	23.1
		Subtest 4	9262	1852.4	0.5	23.5
			9400	1880.0	0.5	23.3
			9538	1907.6	0.5	23.1
	HSPA (HSDPA & HSUPA)	Subtest 1	9262	1852.4	0	23.8
			9400	1880.0	0	23.7
			9538	1907.6	0	23.5
		Subtest 2	9262	1852.4	2	22.0
			9400	1880.0	2	21.8
			9538	1907.6	2	21.5
		Subtest 3	9262	1852.4	1	23.0
			9400	1880.0	1	22.9
			9538	1907.6	1	22.6
		Subtest 4	9262	1852.4	2	21.9
			9400	1880.0	2	21.8
			9538	1907.6	2	21.6
		Subtest 5	9262	1852.4	0	**23.9**
			9400	1880.0	0	23.7
			9538	1907.6	0	23.5
	DC-HSDPA	Subtest 1	9262	1852.4	0	**23.9**
			9400	1880.0	0	23.7
			9538	1907.6	0	23.5
		Subtest 2	9262	1852.4	0	**23.9**
			9400	1880.0	0	23.7
			9538	1907.6	0	23.5
		Subtest 3	9262	1852.4	0.5	23.5
			9400	1880.0	0.5	23.3
			9538	1907.6	0.5	23.1
		Subtest 4	9262	1852.4	0.5	23.5
			9400	1880.0	0.5	23.3
			9538	1907.6	0.5	23.1

8. CONDUCTED TEST RESULTS

8.1. OCCUPIED BANDWIDTH

RULE PART(S)

FCC: §2.1049
IC: RSS132; RSS133§2.3

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 middle channel in each band. The 99% and -26dB bandwidths was also measured and recorded.

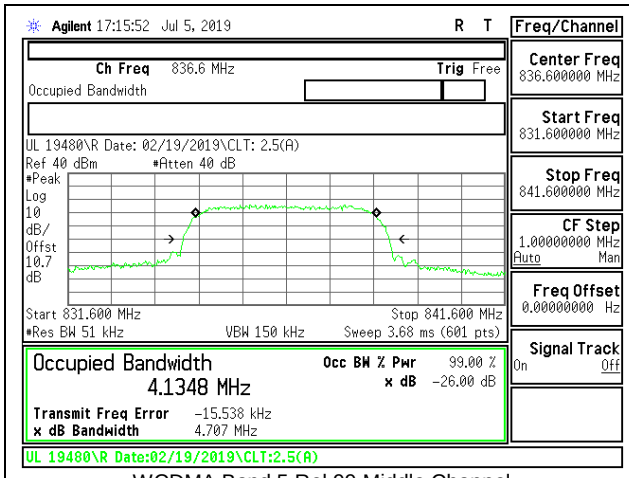
RESULTS

There is no limit required and power is the same for low, middle and high channel; therefore, only middle channel was tested.

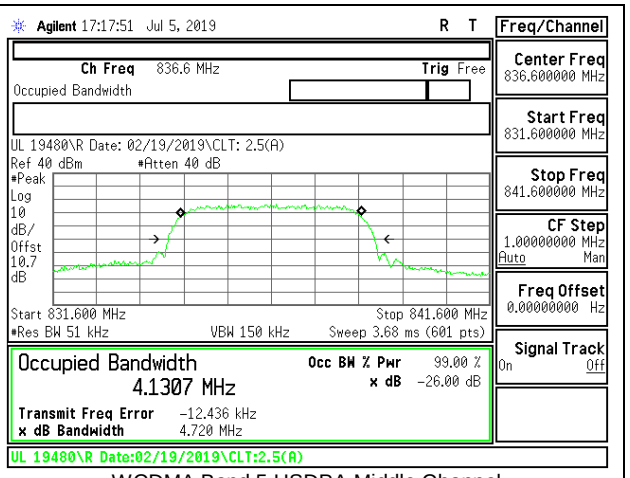
WCDMA

Band	Modulation	Channel	f(MHz)	99% BW (MHz)	-26dB BW (MHz)
BAND 5	REL 99	4408	836.6	4.1348	4.707
	HSDPA			4.1307	4.720
BAND 2	REL 99	9800	1880.0	4.1365	4.706
	HSDPA			4.1466	4.710

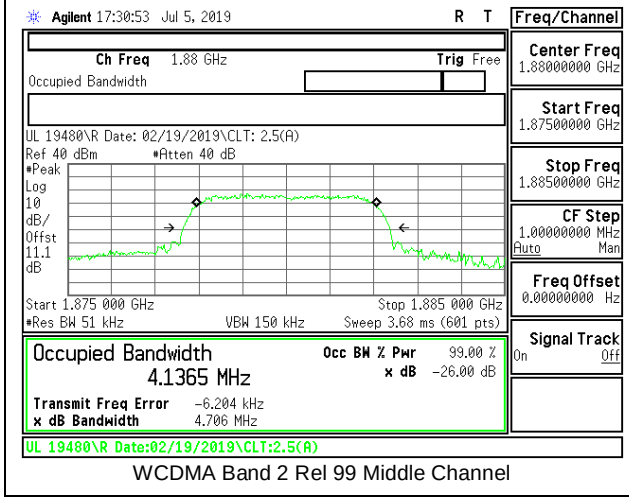
8.1.1. WCDMA



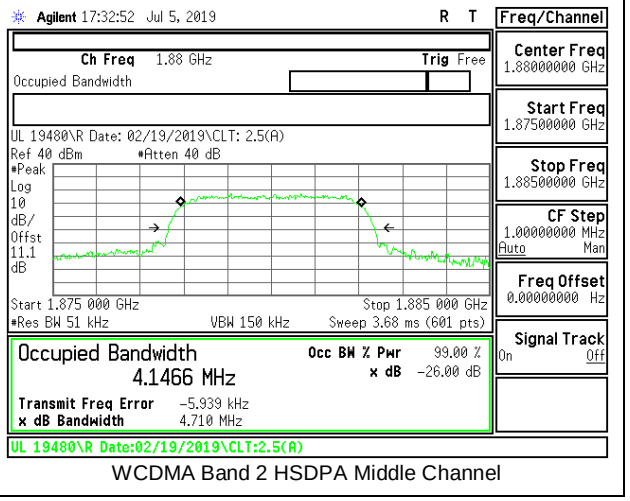
WCDMA Band 5 Rel 99 Middle Channel



WCDMA Band 5 HSDPA Middle Channel



WCDMA Band 2 Rel 99 Middle Channel



WCDMA Band 2 HSDPA Middle Channel

8.2. BAND EDGE AND EMISSION MASK

RULE PART(S)

FCC: §2.1051, §22.917, §24.238
IC: RSS132§5.5; RSS133§6.5

LIMITS

FCC: §22.917, §24.238
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.

RSS132§5.5
Mobile and base station equipment shall comply with the limits in (i) and (ii) below.

(i) In the first 1.0 MHz band immediately outside and adjacent to each of the sub-bands specified in Section 5.1, the power of emissions per any 1% of the occupied bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10p (watts).

(ii) After the first 1.0 MHz immediately outside and adjacent to each of the sub-bands, the power of emissions in any100 kHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least43 + 10 log10 p (watts). If the measurement is performed using 1% of the occupied bandwidth, power integration over 100 kHz is required.

RSS133§6.5
Equipment shall comply with the limits in (i) and (ii) below.

(i) In the 1.0 MHz bands immediately outside and adjacent to the equipment's operating frequency block, the emission power per any 1% of the emission bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10p(watts).

(ii) After the first 1.0 MHz, the emission power in any 1 MHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10p (watts). If the measurement is performed using 1% of the emission bandwidth, power integration over 1.0 MHz is required.

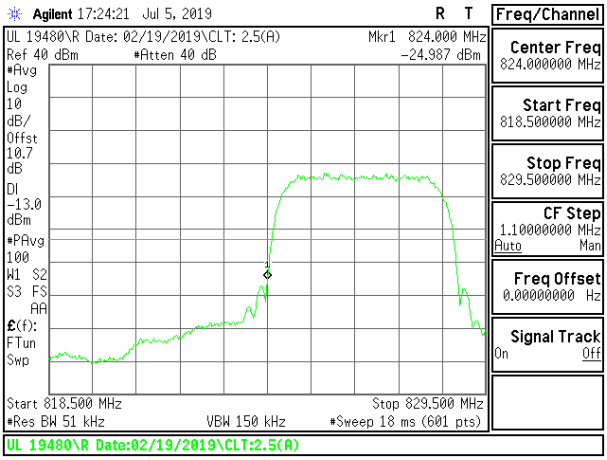
TEST PROCEDURE

The transmitter output was connected to a R&S 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.
For each band edge measurement:

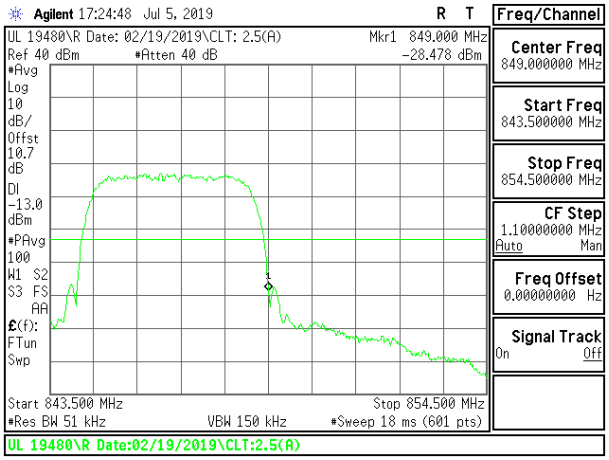
- Set the spectrum analyzer span to include the block edge frequency.
- Set a marker to point the corresponding band edge frequency in each test case.
- Set display line at -13 dBm
- Set resolution bandwidth to at least 1% of emission bandwidth.

RESULTS

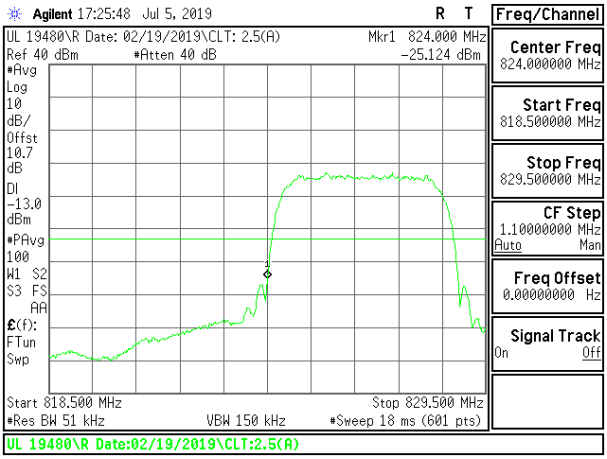
8.2.1. WCDMA BAND 5



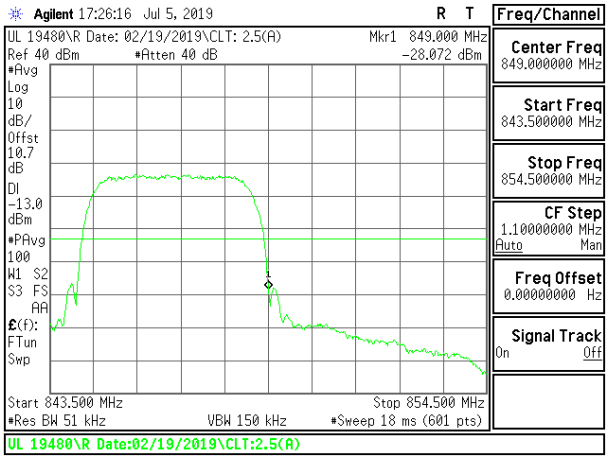
WCDMA Band 5 Rel 99 Low Channel



WCDMA Band 5 Rel 99 High Channel

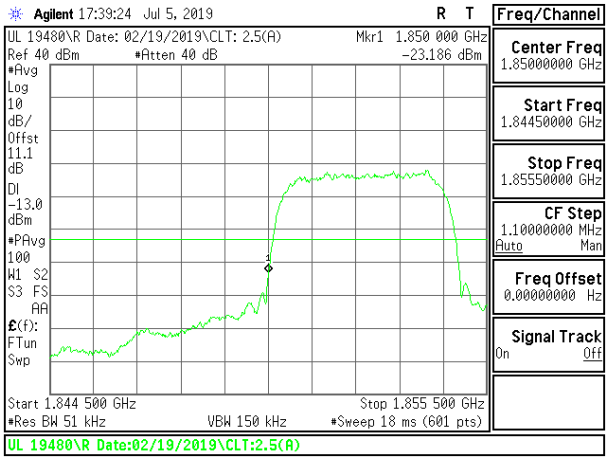


WCDMA Band 5 HSDPA Low Channel

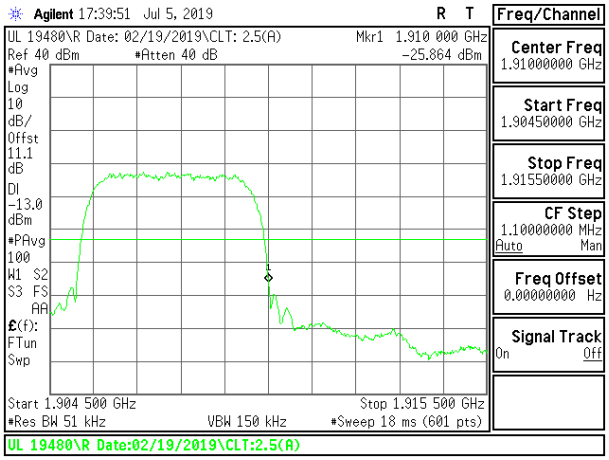


WCDMA Band 5 HSDPA High Channel

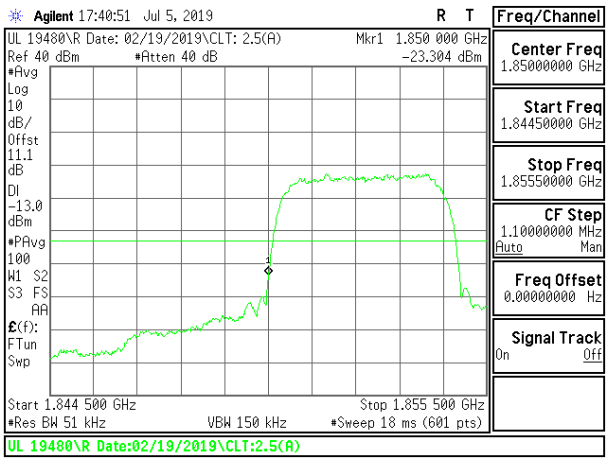
8.2.2. WCDMA BAND 2



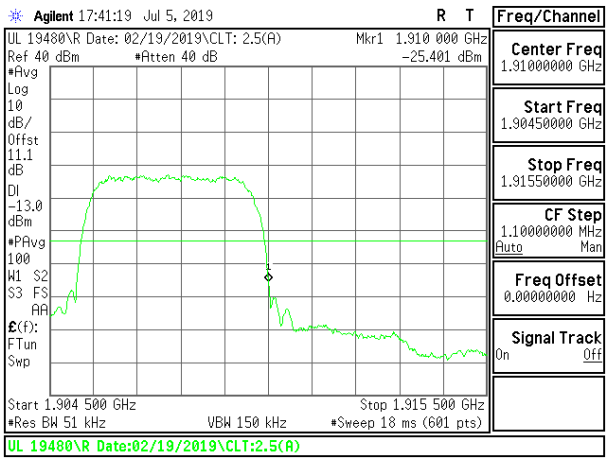
WCDMA Band 2 Rel 99 Low Channel



WCDMA Band 2 Rel 99 High Channel



WCDMA Band 2 HSDPA Low Channel



WCDMA Band 2 HSDPA High Channel

8.3. OUT OF BAND EMISSIONS

RULE PART(S)

FCC: §2.1051, §22.917, §24.238
IC: RSS132§5.5; RSS133§6.5

LIMITS

FCC: §22.917, §24.238
The minimum permissible attenuation level of any spurious emissions is 43 + 10 log (P) dB where transmitting power (P) in Watts.

RSS132§5.5, RSS133§6.5
The minimum permissible attenuation level of any spurious emissions is 43 + 10 log (P) dB where transmitting power (P) in Watts.

TEST PROCEDURE

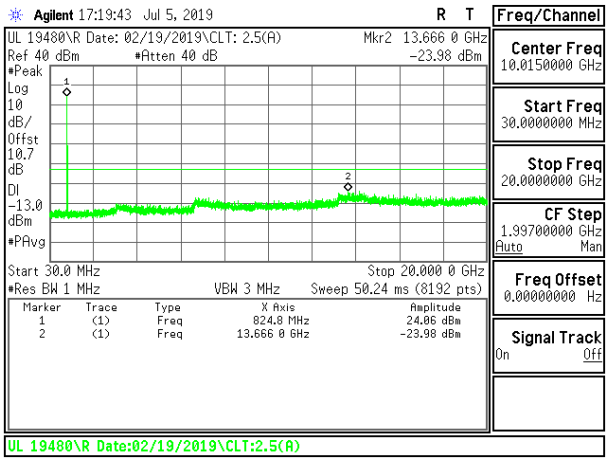
The RF output of the transmitter was connected to a spectrum analyzer through a calibrated coaxial cable. Sufficient scans were taken to show the out-of-band Emissions, if any, up to 10th harmonic. Multiple sweeps were recorded in maximum hold mode using a peak detector to ensure that the worst-case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

For each out of band emissions measurement:

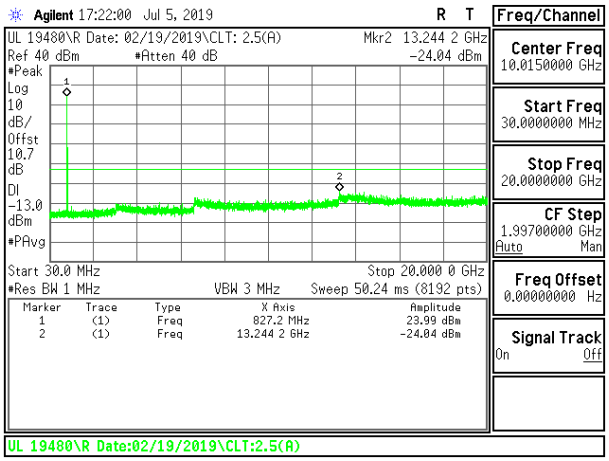
- Set display line at -13 dBm
- Set RBW & VBW to 100 kHz for the measurement below 1 GHz, and 1 MHz for the measurement above 1 GHz. (NOTE: Worst case set RBW/VBW to 1MHz/3MHz)

RESULTS

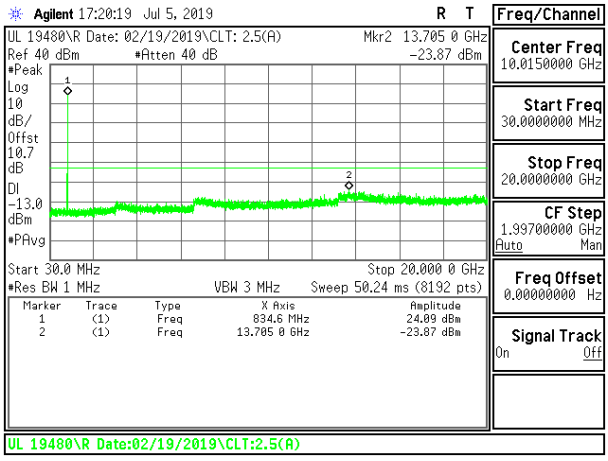
8.3.1. WCDMA BAND 5



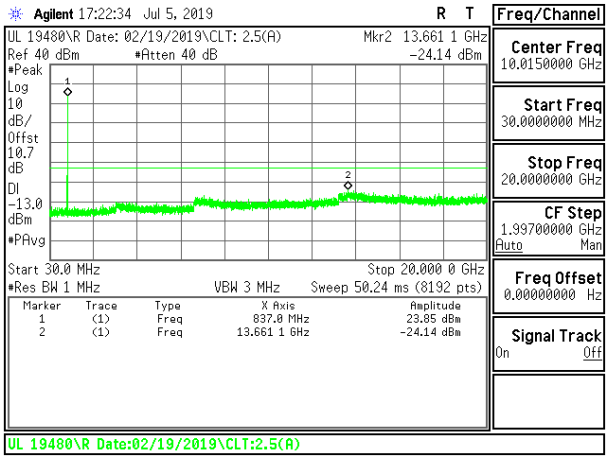
WCDMA Band 5 Rel 99 Low Channel



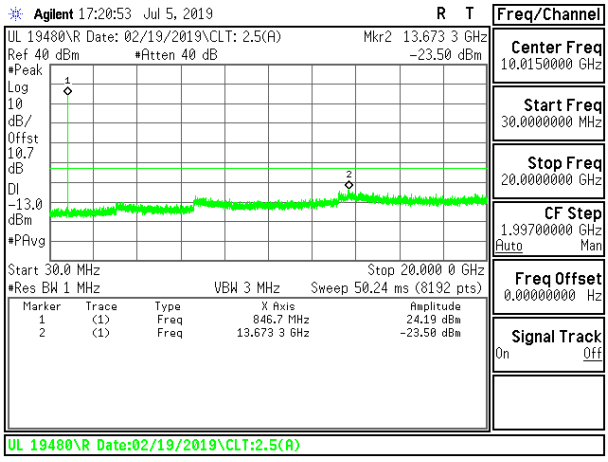
WCDMA Band 5 HSDPA Low Channel



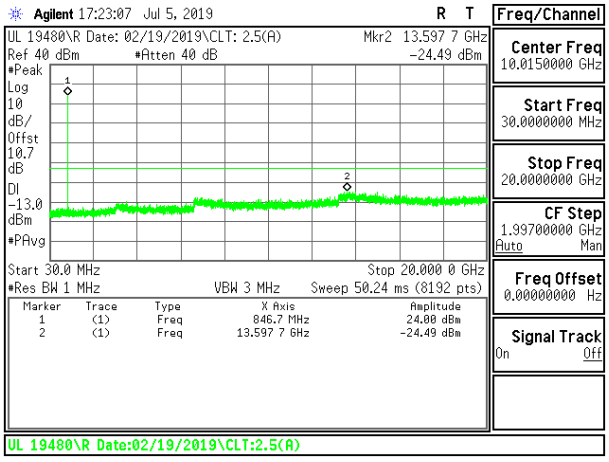
WCDMA Band 5 Rel 99 Middle Channel



WCDMA Band 5 HSDPA Middle Channel

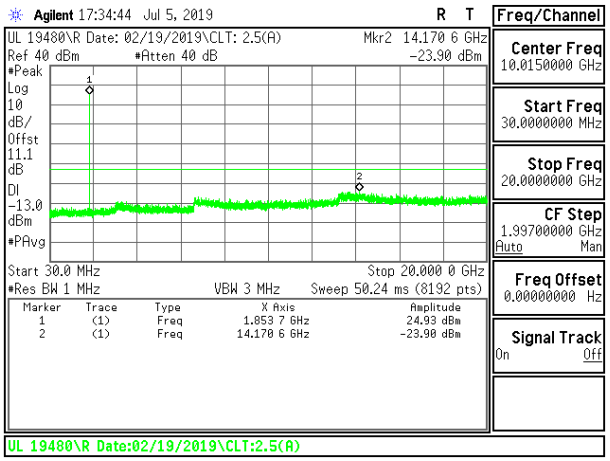


WCDMA Band 5 Rel 99 High Channel

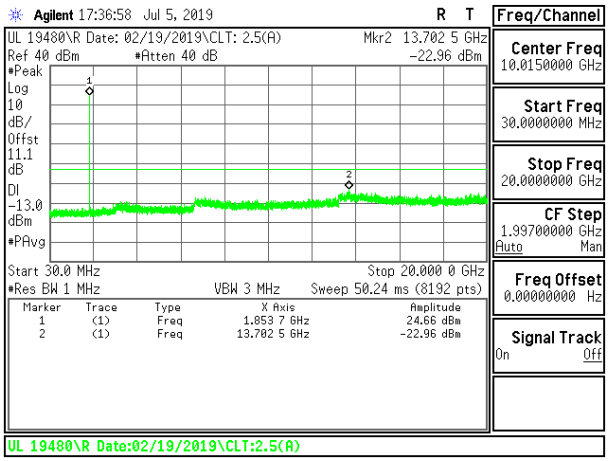


WCDMA Band 5 HSDPA High Channel

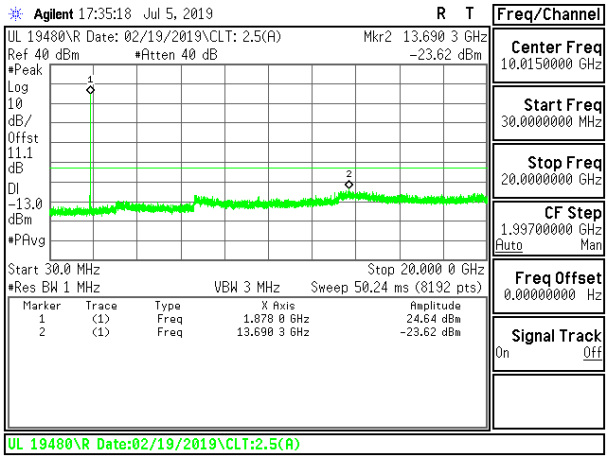
8.3.2. WCDMA BAND 2



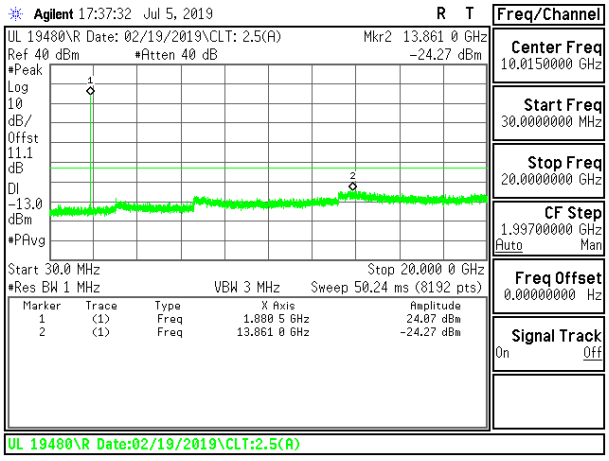
WCDMA Band 2 Rel 99 Low Channel



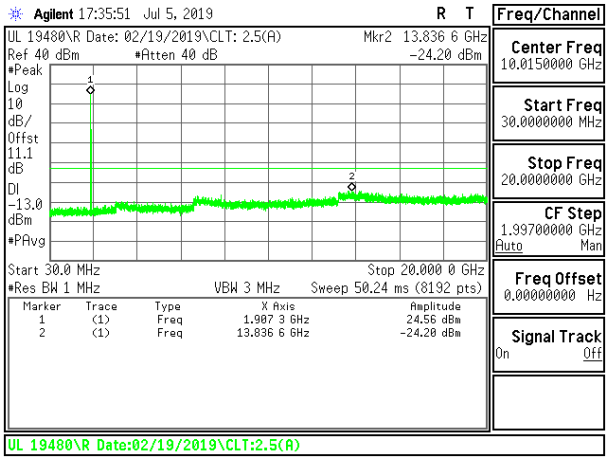
WCDMA Band 2 HSDPA Low Channel



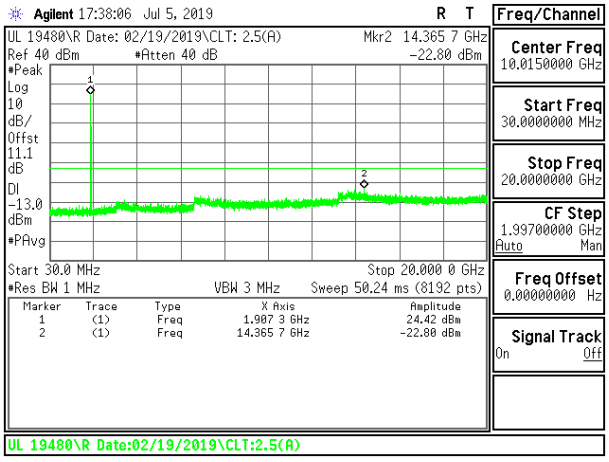
WCDMA Band 2 Rel 99 Middle Channel



WCDMA Band 2 HSDPA Middle Channel



WCDMA Band 2 Rel 99 High Channel



WCDMA Band 2 HSDPA High Channel

8.4. FREQUENCY STABILITY

RULE PART(S)

FCC: §2.1055, §22.355, §24.235
IC: RSS132§5.3; RSS133§6.3

LIMITS

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

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

RSS132§5.3
The carrier frequency shall not depart from the reference frequency in excess of ±2.5 SRSP for mobile stations and±1.5 ppm for base stations.
In lieu of meeting the above stability values, the test report may show that the frequency stability is sufficient to ensure that the occupied bandwidth stays within each of the sub-bands (see Section 5.1) when tested to the temperature and supply voltage variations specified in RSS-Gen.

RSS133§6.3
The carrier frequency shall not depart from the reference frequency, in excess of ±2.5 ppm for mobile stations and±1.0 ppm for base stations.
In lieu of meeting the above stability values, the test report may show that the frequency stability is sufficient to ensure that the emission bandwidth stays within the operating frequency block when tested to the temperature and supply voltage variations specified in RSS-Gen.

TEST PROCEDURE

Use CMW 500 with Frequency Error measurement capability.

- Temp. = −30°C to +50°C
- Voltage = (85% - 115%)

  Low voltage, 6.4VDC, Normal, 7.6VDC and High voltage, 8.7VDC.
  End Voltage, 5.1VDC.

Frequency Stability vs Temperature:
The EUT is place inside a temperature chamber. The temperature is set to 20ºC and allowed to stabilize. After sufficient soak time, the transmitting frequency error is measured. The temperature is increased by 10 degrees, allowed to stabilize and soak, and then the measurement is repeated. This is repeated until +50ºC is reached.

Frequency Stability vs Voltage:
The peak frequency error is recorded (worst-case).

RESULTS

See the following pages.

8.4.1. WCDMA

ID:	19498 ER	Date:	8/29/19

WCDMA REL 99 BAND 5

Limit		824	849	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ -13dBm	F high @ -13dBm		
Temperature	Voltage	(MHz)	(MHz)		
Normal (20C)	Normal	824.0667	848.9167		
Extreme (40C)		824.0667	848.9167	-5.1	-0.01
Extreme (30C)		824.0667	848.9167	-4.4	-0.01
Extreme (10C)		824.0667	848.9167	-4.8	-0.01
Extreme (0C)		824.0667	848.9167	-5.3	-0.01
Extreme (-10C)		824.0667	848.9167	-5.2	-0.01
Extreme (-20C)		824.0667	848.9167	-5.0	-0.01
20C	15%	824.0667	848.9167	-10.3	-0.01
	-15%	824.0667	848.9167	-11.0	-0.01
	End Point	824.0667	848.9167	-9.8	-0.01

WCDMA REL 99 BAND 2

Limit		1850	1910	Delta (Hz)	Frequency Stability (ppm)
Condition		F low @ -13dBm	F high @ -13dBm		
Temperature	Voltage	(MHz)	(MHz)		
Normal (20C)	Normal	1850.0774	1909.9233		
Extreme (40C)		1850.0774	1909.9233	8.6	0.00
Extreme (30C)		1850.0774	1909.9233	9.6	0.01
Extreme (10C)		1850.0774	1909.9233	9.3	0.00
Extreme (0C)		1850.0774	1909.9233	8.3	0.00
Extreme (-10C)		1850.0774	1909.9233	8.6	0.00
Extreme (-20C)		1850.0774	1909.9233	9.8	0.01
20C	15%	1850.0774	1909.9233	-12.3	-0.01
	-15%	1850.0774	1909.9233	-14.0	-0.01
	End Point	1850.0774	1909.9233	-11.0	-0.01

**EUT shuts down at temperature -30C and +50C, and no frequency error is reported at these two temperatures.

8.5. PEAK-TO-AVERAGE POWER RATIO

LIMIT

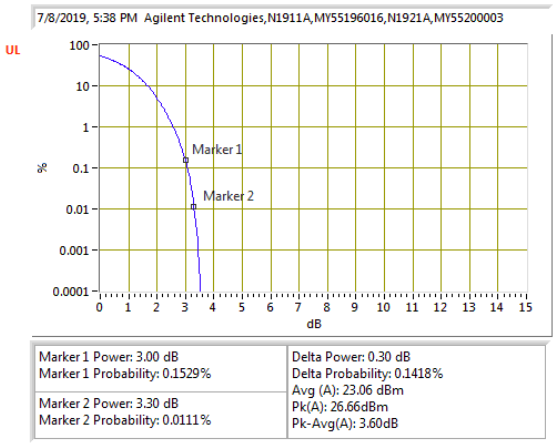
In addition, the peak-to-average power ratio (PAPR) of the transmitter shall not exceed 13 dB for more than 0.1% of the time and shall use a signal corresponding to the highest PAPR during periods of continuous transmission.

RESULT

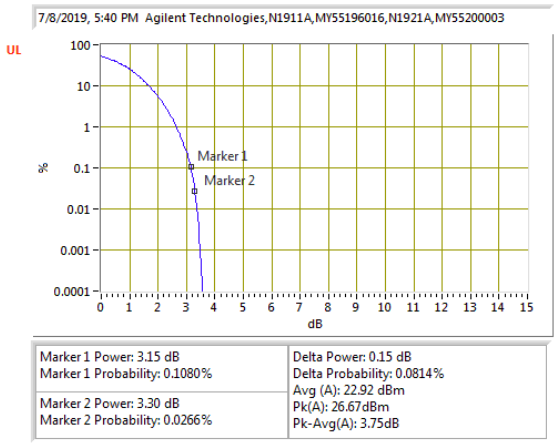
The results from all CCDF plots are passed with 13dB peak-to-average power ratio criteria.

ID:	19498ER	Date:	7/8/19

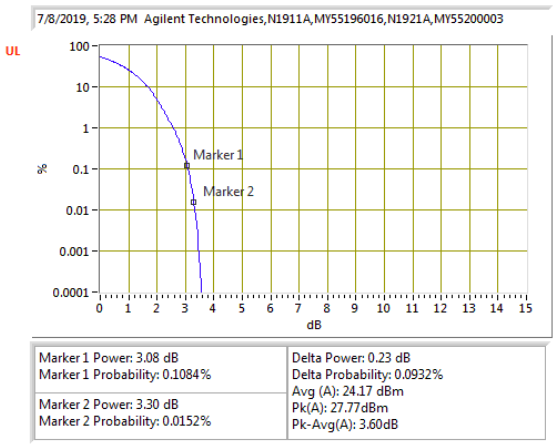
8.5.1. WCDMA



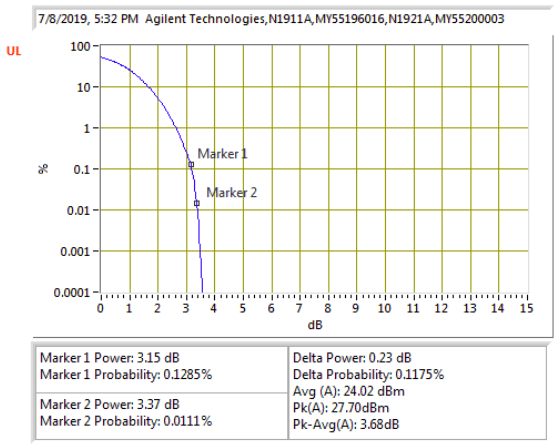
WCDMA Band 5 Rel 99 Middle Channel



WCDMA Band 5 HSDPA Middle Channel



WCDMA Band 2 Rel 99 Middle Channel



WCDMA Band 2 HSDPA Middle Channel

9. RADIATED TEST RESULTS

9.1. FIELD STRENGTH OF SPURIOUS RADIATION

RULE PART(S)

FCC: §2.1053, §22.917
IC: RSS132§5.5; RSS133§6.5

LIMIT

FCC: §22.917(a), §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.

RSS132§5.5
Mobile and base station equipment shall comply with the limits in (i) and (ii) below.

(i) In the first 1.0 MHz band immediately outside and adjacent to each of the sub-bands specified in Section 5.1, the power of emissions per any 1% of the occupied bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10p (watts).

(ii) After the first 1.0 MHz immediately outside and adjacent to each of the sub-bands, the power of emissions in any100 kHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least43 + 10 log10 p (watts). If the measurement is performed using 1% of the occupied bandwidth, power integration over 100 kHz is required.

RSS133§6.5
Equipment shall comply with the limits in (i) and (ii) below.

(i) In the 1.0 MHz bands immediately outside and adjacent to the equipment's operating frequency block, the emission power per any 1% of the emission bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10p(watts).

(ii) After the first 1.0 MHz, the emission power in any 1 MHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10p (watts). If the measurement is performed using 1% of the emission bandwidth, power integration over 1.0 MHz is required.

TEST PROCEDURE

KDB 971168 D01 v03r01/D02 v02/r01
TIA-603-E, Section 2.2.12.

RESULTS

9.1.1. WCDMA BAND 5

Company:	Microsoft
Project #:	12802195
Date:	7/16/19
Test Engineer:	19480 BS
Configuration:	EUT + Support Equipment
Mode	REL 99 Mode
Chamber #:	Chamber J

Marker	Frequency (GHz)	Meter Reading (dBm)	Det	AF PRE0189055 (dB/m)	Amp/Cbl (dB)	Amp/Cbl (dB)	Corrected Reading (dBm)	Limit	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
826.4MHz												
1	1.65078	-60.93	Pk	25.7	-35.8	12.4	-58.63	-13	-45.63	0-360	149	H
2	2.47953	-64.86	Pk	29.9	-35.5	11.7	-58.76	-13	-45.76	0-360	149	H
3	3.30456	-65.11	Pk	31.5	-34.5	11.9	-56.21	-13	-43.21	0-360	149	H
4	1.6545	-65.24	Pk	25.7	-35.8	11.3	-64.04	-13	-51.04	0-360	149	V
5	2.47528	-65.56	Pk	29.9	-35.5	11.5	-59.66	-13	-46.66	0-360	149	V
6	3.30031	-66.81	Pk	31.5	-34.5	11.7	-58.11	-13	-45.11	0-360	149	V
836.6Hz												
1	1.6715	-59.62	Pk	25.8	-35.8	12.2	-57.42	-13	-44.42	0-360	148	H
2	2.51353	-64.55	Pk	30	-35.5	11.9	-58.15	-13	-45.15	0-360	148	H
3	3.34866	-66.51	Pk	31.2	-34.4	11.9	-57.81	-13	-44.81	0-360	148	H
4	1.67416	-65.86	Pk	25.8	-35.8	11.8	-64.06	-13	-51.06	0-360	148	V
5	2.50928	-65.41	Pk	30	-35.5	11.7	-59.21	-13	-46.21	0-360	148	V
6	3.34759	-67.02	Pk	31.2	-34.4	11.7	-58.52	-13	-45.52	0-360	148	V
846.6MHz												
1	1.69488	-60.06	Pk	25.9	-35.8	11.4	-58.56	-13	-45.56	0-360	148	H
2	2.53903	-66.03	Pk	30.2	-35.4	12.6	-58.63	-13	-45.63	0-360	148	H
3	3.39116	-66.1	Pk	30.9	-34.4	11.7	-57.9	-13	-44.9	0-360	148	H
4	1.69594	-66.06	Pk	25.9	-35.8	12.5	-63.46	-13	-50.46	0-360	148	V
5	2.53372	-66.16	Pk	30.2	-35.4	11.6	-59.76	-13	-46.76	0-360	148	V
6	3.39169	-66.57	Pk	30.9	-34.4	11.9	-58.17	-13	-45.17	0-360	148	V

Company:	Microsoft
Project #:	12802195
Date:	7/16/19
Test Engineer:	19480 BS
Configuration:	EUT + Support Equipment
Mode	HSDPA Mode
Chamber #:	Chamber J

Marker	Frequency (GHz)	Meter Reading (dBm)	Det	AF PRE0189055 (dB/m)	Amp/Cbl (dB)	Amp/Cbl (dB)	Corrected Reading (dBm)	Limit	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
						826.4MHz						
1	1.65025	-60.9	Pk	25.7	-35.8	12.4	-58.6	-13	-45.6	0-360	149	H
2	2.48378	-66.15	Pk	29.9	-35.5	11.7	-60.05	-13	-47.05	0-360	149	H
3	3.30563	-67.21	Pk	31.4	-34.5	11.9	-58.41	-13	-45.41	0-360	149	H
4	1.65025	-64.93	Pk	25.7	-35.8	11.2	-63.83	-13	-50.83	0-360	149	V
5	2.48113	-65.78	Pk	29.9	-35.5	11.2	-60.18	-13	-47.18	0-360	149	V
6	3.3035	-66.51	Pk	31.5	-34.5	11.6	-57.91	-13	-44.91	0-360	149	V
						836.6Hz						
1	1.67097	-59.72	Pk	25.8	-35.8	12.2	-57.52	-13	-44.52	0-360	148	H
2	2.50663	-65.39	Pk	30	-35.5	12.1	-58.79	-13	-45.79	0-360	148	H
3	3.34122	-66.45	Pk	31.3	-34.5	11.7	-57.95	-13	-44.95	0-360	148	H
4	1.66725	-63.41	Pk	25.8	-35.8	11.4	-62.01	-13	-49.01	0-360	148	V
5	2.50663	-64.56	Pk	30	-35.5	11.6	-58.46	-13	-45.46	0-360	148	V
6	3.34653	-65.97	Pk	31.3	-34.4	11.7	-57.37	-13	-44.37	0-360	148	V
						846.6MHz						
1	1.69434	-60.86	Pk	25.9	-35.8	11.4	-59.36	-13	-46.36	0-360	148	H
2	2.54328	-66.09	Pk	30.2	-35.4	12.4	-58.89	-13	-45.89	0-360	148	H
3	3.38903	-66.68	Pk	30.9	-34.4	11.6	-58.58	-13	-45.58	0-360	148	H
4	1.69116	-64.78	Pk	25.9	-35.8	12.4	-62.28	-13	-49.28	0-360	148	V
5	2.53638	-66.06	Pk	30.2	-35.4	11.5	-59.76	-13	-46.76	0-360	148	V
6	3.38584	-66.15	Pk	31	-34.4	11.7	-57.85	-13	-44.85	0-360	148	V

9.1.2. WCDMA BAND 2

Company:	Microsoft
Project #:	12802195
Date:	7/16/19
Test Engineer:	19480 BS
Configuration:	EUT + Support Equipment
Mode	REL 99 Mode
Chamber #:	Chamber J

Marker	Frequency (GHz)	Meter Reading (dBm)	Det	AF PRE0189055 (dB/m)	Amp/Cbl (dB)	Amp/Cbl (dB)	Corrected Reading (dBm)	Limit	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1852.4MHz												
1	3.70778	-66.96	Pk	30.5	-33.4	12.1	-57.76	-13	-44.76	0-360	148	H
2	5.54431	-69.47	Pk	34.1	-30.4	12.2	-53.57	-13	-40.57	0-360	148	H
3	7.41325	-70.32	Pk	37.7	-27.8	11.9	-48.52	-13	-35.52	0-360	148	H
4	3.70725	-67.01	Pk	30.5	-33.4	11.9	-58.01	-13	-45.01	0-360	148	V
5	5.55919	-69.47	Pk	34.1	-30.5	11.9	-53.97	-13	-40.97	0-360	148	V
6	7.40847	-72.23	Pk	37.7	-27.8	12	-50.33	-13	-37.33	0-360	148	V
1880Hz												
1	3.75825	-67.03	Pk	30.7	-33.3	11.7	-57.93	-13	-44.93	0-360	148	H
2	5.62931	-69.68	Pk	34	-30.6	12.4	-53.88	-13	-40.88	0-360	148	H
3	7.52163	-72.25	Pk	37.5	-27.9	12	-50.65	-13	-37.65	0-360	148	H
4	3.754	-66.93	Pk	30.7	-33.3	11.7	-57.83	-13	-44.83	0-360	148	V
5	5.64472	-69.69	Pk	34	-30.4	12.2	-53.89	-13	-40.89	0-360	148	V
6	7.5195	-71.8	Pk	37.5	-27.9	11.8	-50.4	-13	-37.4	0-360	148	V
1907.6MHz												
1	3.8135	-66.76	Pk	31.1	-33	11.2	-57.46	-13	-44.46	0-360	148	H
2	5.73078	-69.05	Pk	34.1	-30.3	12.1	-53.15	-13	-40.15	0-360	148	H
3	7.61088	-70.68	Pk	37.3	-27.6	12.3	-48.68	-13	-35.68	0-360	148	H
4	3.81297	-66.98	Pk	31.1	-33	11.5	-57.38	-13	-44.38	0-360	148	V
5	5.72813	-69.93	Pk	34.1	-30.3	12	-54.13	-13	-41.13	0-360	148	V
6	7.63531	-72.38	Pk	37.3	-27.6	12	-50.68	-13	-37.68	0-360	148	V

Company:	Microsoft
Project #:	12802195
Date:	7/16/19
Test Engineer:	19480 BS
Configuration:	EUT + Support Equipment
Mode	HSDPA Mode
Chamber #:	Chamber J

Marker	Frequency (GHz)	Meter Reading (dBm)	Det	AF PRE0189055 (dB/m)	Amp/Cbl (dB)	Amp/Cbl (dB)	Corrected Reading (dBm)	Limit	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1852.4MHz												
1	3.70991	-66.61	Pk	30.5	-33.4	12.1	-57.41	-13	-44.41	0-360	148	H
2	5.54378	-67.84	Pk	34.1	-30.4	12.2	-51.94	-13	-38.94	0-360	148	H
3	7.41856	-71.54	Pk	37.7	-27.8	11.9	-49.74	-13	-36.74	0-360	148	H
4	3.70194	-66.94	Pk	30.5	-33.5	11.7	-58.24	-13	-45.24	0-360	148	V
5	5.56663	-69.56	Pk	34.1	-30.6	12	-54.06	-13	-41.06	0-360	148	V
6	7.40209	-72.29	Pk	37.8	-27.8	12	-50.29	-13	-37.29	0-360	148	V
1880Hz												
1	3.75666	-66.92	Pk	30.7	-33.3	11.7	-57.82	-13	-44.82	0-360	148	H
2	5.62559	-69.37	Pk	34	-30.6	12.1	-53.87	-13	-40.87	0-360	148	H
3	7.53969	-72.1	Pk	37.5	-27.9	12	-50.5	-13	-37.5	0-360	148	H
4	3.7625	-66	Pk	30.7	-33.3	11.8	-56.8	-13	-43.8	0-360	148	V
5	5.63622	-70.65	Pk	34	-30.5	12.3	-54.85	-13	-41.85	0-360	148	V
6	7.51206	-72.11	Pk	37.5	-27.9	12	-50.51	-13	-37.51	0-360	148	V
1907.6MHz												
1	3.81934	-66.27	Pk	31.2	-33.1	11.2	-56.97	-13	-43.97	0-360	148	H
2	5.73344	-69.21	Pk	34.1	-30.4	12.1	-53.41	-13	-40.41	0-360	148	H
3	7.62416	-72.55	Pk	37.3	-27.6	12.3	-50.55	-13	-37.55	0-360	148	H
4	3.81244	-67.64	Pk	31.1	-33	11.5	-58.04	-13	-45.04	0-360	148	V
5	5.73291	-69.44	Pk	34.1	-30.4	12.1	-53.64	-13	-40.64	0-360	148	V
6	7.63053	-71.89	Pk	37.3	-27.6	12.1	-50.09	-13	-37.09	0-360	148	V