

TEST REPORT

FCC ID. :	2AAS9-L0006
Test Report No..... :	TCT211208E041
Date of issue..... :	Jan. 12, 2022
Testing laboratory	SHENZHEN TONGCE TESTING LAB
Testing location/ address:	TCT Testing Industrial Park Fuqiao 5th Industrial Zone, Fuhai Street, Bao'an District Shenzhen, Guangdong, 518103, People's Republic of China
Applicant's name..... :	BROWAN COMMUNICATIONS INCORPORATION
Address..... :	No.15-1, Zhonghua Rd., Hsinchu Industrial Park, Hukou, Hsinchu Hsien, Taiwan, 303
Manufacturer's name ... :	BROWAN COMMUNICATIONS INCORPORATION
Address..... :	No.15-1, Zhonghua Rd., Hsinchu Industrial Park, Hukou, Hsinchu Hsien, Taiwan, 303
Standard(s)	FCC CFR Title 47 Part 2 FCC CFR Title 47 Part22 FCC CFR Title 47 Part24 FCC CFR Title 47 Part27
Test item description	Pico Next Indoor Gateway
Trade Mark	BROWAN
Model/Type reference..... :	L0006, L0006-1, L0006-2, L0006-3, L0006-5, L0006-6, L0006-7, L0006-9, L0006-10, L0006-11, L0006-12, L0006-13
Rating(s)..... :	Adapter Information: Model: MS-V1500R120-018H0-US Input: AC 100-240V, 50/60Hz, 0.6A max Output: DC 12.0V, 1.5A
Date of receipt of test item	Dec. 08, 2021
Date (s) of performance of test..... :	Dec. 08, 2021 ~ Jan. 12, 2022
Tested by (+signature) ... :	Brews XU
Check by (+signature).... :	Beryl ZHAO
Approved by (+signature):	Tomsin



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1. General Product Information

1.1. EUT description

Test item description	Pico Next Indoor Gateway
Model/Type reference.....	L0006
Sample Number.....	TCT211208E004-0101
3G Version	WCDMA: R99 HSDPA: Release 5 HSUPA: Release 6
Tx Frequency	WCDMA Band V: 826.4MHz ~ 846.6MHz WCDMA Band IV: 1712.4MHz ~ 1752.6MHz WCDMA Band II: 1852.4MHz ~ 1907.6MHz
Rx Frequency	WCDMA Band V: 871.4MHz ~ 891.6MHz WCDMA Band IV: 2112.4MHz ~ 2152.6MHz WCDMA Band II: 1932.4MHz ~ 1987.6MHz
Maximum Output Power to Antenna.....	WCDMA Band V: 23.16dBm WCDMA Band IV: 23.18dBm WCDMA Band II: 23.07dBm
99% Occupied Bandwidth.....	WCDMA Band V: 4M15F9W WCDMA Band IV: 4M14F9W WCDMA Band II: 4M14F9W
Type of Modulation.....	WCDMA/HSDPA/HSUPA: QPSK
Antenna Type.....	External Antenna
Antenna Gain.....	WCDMA Band V: -0.43dBi WCDMA Band IV: 0.75dBi WCDMA Band II: 1.64dBi
Rating(s).....	Adapter Information: Model: MS-V1500R120-018H0-US Input: AC 100-240V, 50/60Hz, 0.6A max Output: DC 12.0V, 1.5A

Note: The antenna gain listed in this report is provided by applicant, and the test laboratory is not responsible for this parameter.

1.2. Model(s) list

No.	Model No.	Tested with
1	L0006	☒
Other models	L0006-1, L0006-2, L0006-3, L0006-5, L0006-6, L0006-7, L0006-9, L0006-10, L0006-11, L0006-12, L0006-13	☐

Note: L0006 is tested model, other models are derivative models. The models are identical in circuit and PCB layout, only different on the model names. So the test data of L0006 can represent the remaining models.

1.3. Operation Frequency

WCDMA Band IV		WCDMA Band V		WCDMA Band II	
Channel:	Frequency (MHz)	Channel:	Frequency (MHz)	Channel:	Frequency (MHz)
1312	1712.4	4132	826.40	9262	1852.40
....		4133	826.60	9263	1852.60
....					
....		4182	836.40	9399	1879.80
1413	1732.6	4182	836.60	9400	1880.00
....		4184	836.80	9401	1880.20
....		...	...	...	...
1513	1752.6	4233	846.60	9538	1907.60

2. Test Result Summary

Requirement	CFR 47 Section	Result
Conducted Output Power	§22.913; §2.1046 §24.232; §27.50(d)	PASS
Peak-to-Average Ratio	§2.1046; §24.232(d) §22.913; §27.50(d)	PASS
Effective Radiated Power	§2.1046; §22.913(a) §24.232; §27.50(d)	PASS
Equivalent Isotropic Radiated Power	§2.1046; §22.913(a) §24.232; §27.50(d)	PASS
Occupied Bandwidth	§2.1049	PASS
Band Edge	§2.1051 §22.917(a) §24.238(a) §27.53(g)	PASS
Conducted Spurious Emission	§2.1051; §22.917 §24.238; §27.53(h)	PASS
Field Strength of Spurious Radiation	§2.1053; §22.917(a) §24.238; §27.53(g)	PASS
Frequency Stability for Temperature & Voltage	§2.1055; §22.355 §24.235; §27.54	PASS

Note:

1. PASS: Test item meets the requirement.
2. Fail: Test item does not meet the requirement.
3. N/A: Test case does not apply to the test object.
4. The test result judgment is decided by the limit of test standard.

3. General Information

3.1. Test environment and mode

Operating Environment:	
Temperature:	25.0 °C
Humidity:	56 % RH
Atmospheric Pressure:	1010 mbar

Keep the EUT in communication with CMU200 and select channel with modulation All modes and data rates and positions were investigated.
Test modes are chosen to be reported as the worst case configuration below:

Test Mode		
Band	Radiated TCs	Conducted TCs
WCDMA Band V	RMC 12.2Kbps Link	RMC 12.2Kbps Link
WCDMA Band IV	RMC 12.2Kbps Link	RMC 12.2Kbps Link
WCDM Band II	RMC 12.2Kbps Link	RMC 12.2Kbps Link

Antenna port conducted and radiated test items were performed according to KDB 971168 D01 Power Meas. License Digital Systems v03r01 with maximum output power. Radiated measurements were performed with rotating EUT in different three orthogonal test planes to find the maximum emission. The sample was placed (0.8m below 1GHz, 1.5m above 1GHz) above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarization. The emissions worst-case (Z axis) are shown in Test Results of the following pages.

3.2. Description of Support Units

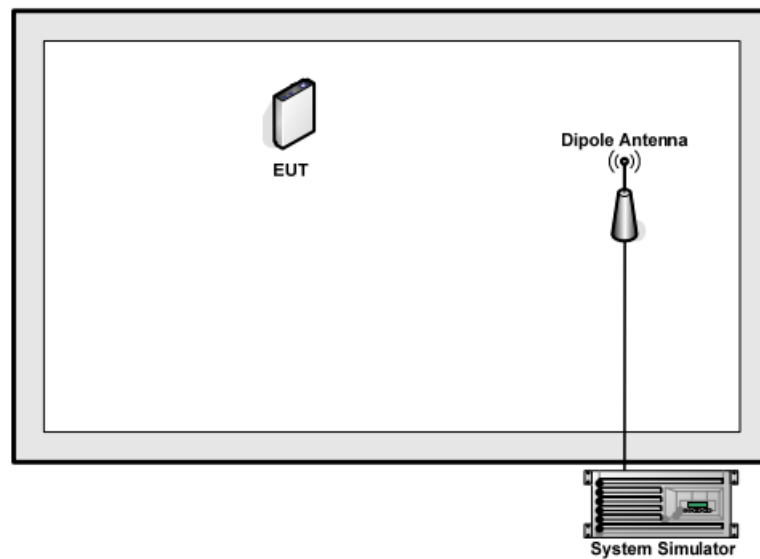
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Equipment	Model No.	Serial No.	FCC ID	Trade Name
/	/	/	/	/

Note:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

3.3. Configuration of Tested System



3.4. Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between RF conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level will be exactly the RF output level. The spectrum analyzer offset is derived from RF cable loss and attenuator factor.
Offset = RF cable loss + attenuator factor.

The following shows an offset computation example with RF cable loss 3 dB and a 5dB attenuator.

Example: *Offset (dB) = RF cable loss (dB) + attenuator factor (dB).*
= 8(dB)

4. Facilities and Accreditations

4.1. Facilities

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

- FCC - Registration No.: 645098

SHENZHEN TONGCE TESTING LAB

Designation Number: CN1205

The testing lab has been registered and fully described in a report with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files.

- IC - Registration No.: 10668A-1

SHENZHEN TONGCE TESTING LAB

CAB identifier: CN0031

The testing lab has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing.

4.2. Location

SHENZHEN TONGCE TESTING LAB

Address: TCT Testing Industrial Park Fuqiao 5th Industrial Zone, Fuhai Street, Bao'an District Shenzhen, Guangdong, 518103, People's Republic of China

TEL: +86-755-27673339

4.3. Measurement Uncertainty

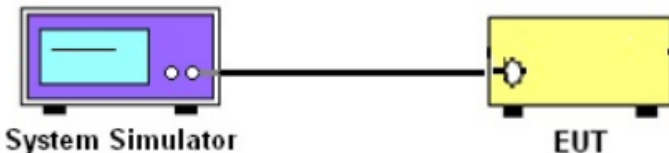
The reported uncertainty of measurement $y \pm U$, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95 %.

No.	Item	MU
1	Conducted Emission	± 3.10 dB
2	RF power, conducted	± 0.12 dB
3	Spurious emissions, conducted	± 0.11 dB
4	All emissions, radiated(<1 GHz)	± 4.56 dB
5	All emissions, radiated(1 GHz - 18 GHz)	± 4.22 dB
6	All emissions, radiated(18 GHz- 40 GHz)	± 4.36 dB
7	Temperature	$\pm 0.1^{\circ}\text{C}$
8	Humidity	$\pm 1.0\%$

5. Test Results and Measurement Data

5.1. Conducted Output Power Measurement

5.1.1. Test Specification

Test Requirement:	FCC part 22.913(a) and FCC part 24.232(b) FCC part 27.50(d);
Test Method:	FCC KDB 971168 D01 v03r01
Operation mode:	Refer to item 3.1
Limits:	WCDMA Band V:7W WCDMA Band II: 2W WCDMA Band IV:1W
Test Setup:	 The diagram illustrates the test setup. On the left is a purple box labeled 'System Simulator' with a screen and two buttons. A black cable connects it to a yellow box on the right labeled 'EUT' (Equipment Under Test), which has a single port on its side.
Test Procedure:	1. The transmitter output port was connected to the system simulator. 2. Set EUT at maximum power through system simulator. 3. Select lowest, middle, and highest channels for each band and different modulation.
Test Result:	PASS

5.1.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Due
Universal Radio Communication Tester	R&S	CMU200	110188	Jul. 07, 2022
RF cable (9kHz-40GHz)	TCT	RE-05	N/A	Jul. 07, 2022
Antenna Connector	TCT	RFC-02	N/A	Jul. 07, 2022

5.1.3. Test data

Conducted Power Measurement Results:

Average Conducted Power (*Unit: dBm)						
Band	WCDMA Band V			WCDMA Band II		
Channel	4132	4182	4233	9262	9400	9538
Frequency(MHz)	826.4	836.4	846.6	1852.4	1880.0	1907.6
WCDMA RMC 12.2K	23.10	23.16	23.12	23.01	23.07	23.02
HSDPA Subtest-1	22.12	22.20	22.22	22.04	22.08	21.97
HSDPA Subtest-2	21.88	21.98	22.06	22.01	22.05	21.96
HSDPA Subtest-3	21.54	21.22	21.56	21.62	21.39	21.67
HSDPA Subtest-4	21.38	21.34	21.39	21.24	21.50	21.21
HSUPA Subtest-1	21.62	21.75	21.73	22.04	22.06	21.83
HSUPA Subtest-2	21.34	21.32	21.35	21.34	21.26	21.39
HSUPA Subtest-3	22.32	22.29	21.94	22.13	22.22	21.79
HSUPA Subtest-4	21.72	21.61	21.64	21.89	21.98	21.88
HSUPA Subtest-5	22.18	22.02	22.06	22.00	22.08	21.83

Conducted Power (*Unit: dBm)			
Band	WCDMA Band IV		
Channel	1312	1413	1513
Frequency(MHz)	1712.4	1732.6	1752.6
WCDMA RMC 12.2K	23.14	23.18	23.01
HSDPA Subtest-1	21.78	22.26	21.70
HSDPA Subtest-2	22.14	21.73	21.88
HSDPA Subtest-3	21.19	21.47	21.51
HSDPA Subtest-4	21.27	21.55	21.01
HSUPA Subtest-1	21.89	21.91	21.80
HSUPA Subtest-2	21.12	21.34	21.29
HSUPA Subtest-3	21.67	21.76	21.61
HSUPA Subtest-4	22.01	21.86	21.88
HSUPA Subtest-5	22.05	22.14	21.80

5.2. Peak to Average Ratio

5.2.1. Test Specification

Test Requirement:	FCC part 24.232(d) ; FCC part 22.913; FCC part 27.50(d);
Test Method:	ANSI C63.26:2013
Operation mode:	Refer to item 3.1
Limit:	The peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.
Test Setup:	The diagram shows a System Simulator (purple) and a Spectrum Analyzer (green) connected to a Power Divider (black). The Power Divider is connected to the EUT (yellow). The System Simulator and Spectrum Analyzer are connected to the Power Divider via cables.
Test Procedure:	1. The testing follows FCC KDB 971168 D01v03r01 Section 5.7.1. 2. The EUT was connected to spectrum analyzer and system simulator via a power divider. 3. Set EUT to transmit at maximum output power. 4. Set the CCDF (Complementary Cumulative Distribution Function) option of the spectrum analyzer. Record the maximum PAPR level associated with a probability of 0.1%.
Test Result:	PASS

5.2.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Due
Universal Radio Communication Tester	R&S	CMU200	110188	Jul. 07, 2022
Spectrum Analyzer	R&S	FSU	200054	Jul. 18, 2022
RF cable (9kHz-40GHz)	TCT	RE-05	N/A	Jul. 07, 2022
Antenna Connector	TCT	RFC-02	N/A	Jul. 07, 2022

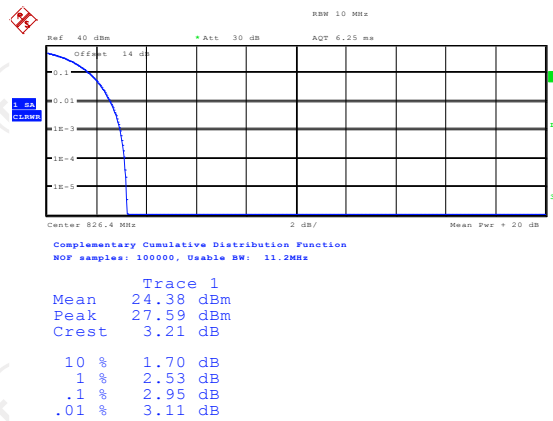
5.2.3. Test Data

Cellular Band									
Mode	WCDMA Band V (HSUPA)			WCDMA Band IV (HSUPA)			WCDMA Band II (HSUPA)		
Channel	4132	4182	4233	1312	1413	1513	9262	9400	9538
Frequency (MHz)	826.4	836.4	846.6	1712.4	1732.6	1752.6	1852.4	1880	1907.6
Peak-to- Average Ratio (dB)	2.95	3.53	3.43	2.56	2.56	2.79	2.72	3.40	3.43

Test plots as follows:

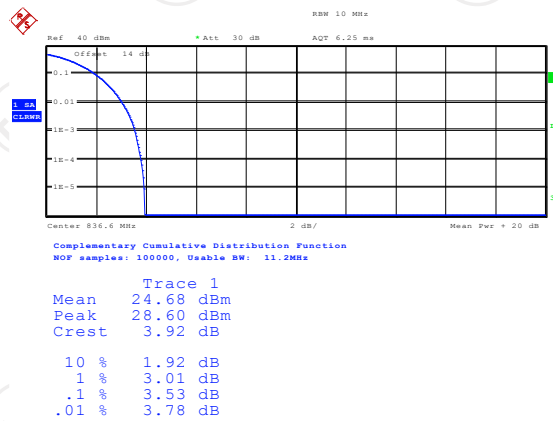
WCDMA Band V 12.2K

Peak-to-Average Ratio on Channel 4132



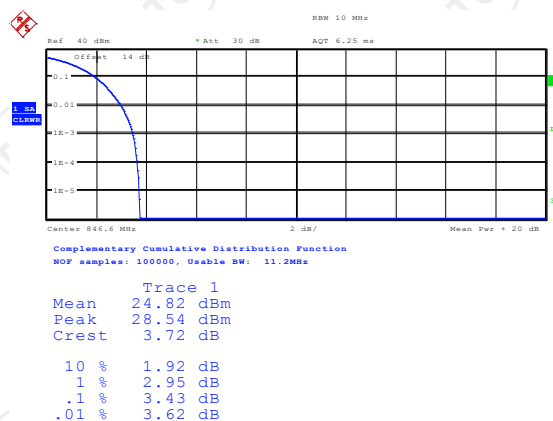
Date: 10.JAN.2022 14:40:13

Peak-to-Average Ratio on Channel 4182



Date: 10.JAN.2022 14:39:48

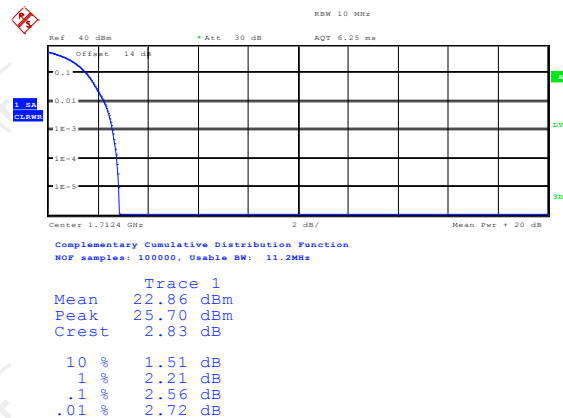
Peak-to-Average Ratio on Channel 4233



Date: 10.JAN.2022 14:39:25

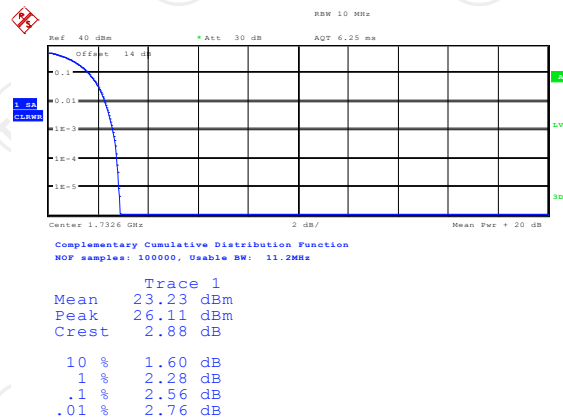
WCDMA Band IV 12.2Kbps

Peak-to-Average Ratio on Channel 1312



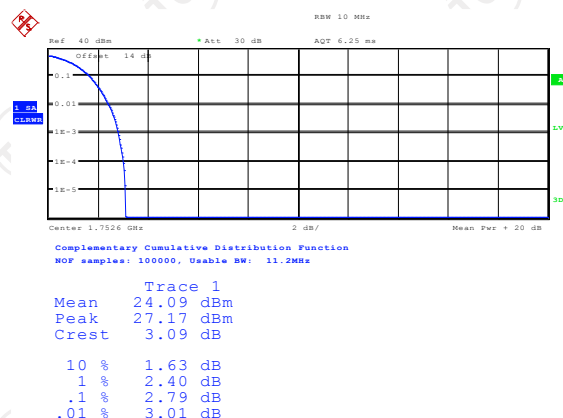
Date: 10.JAN.2022 14:42:24

Peak-to-Average Ratio on Channel 1413



Date: 10.JAN.2022 14:41:43

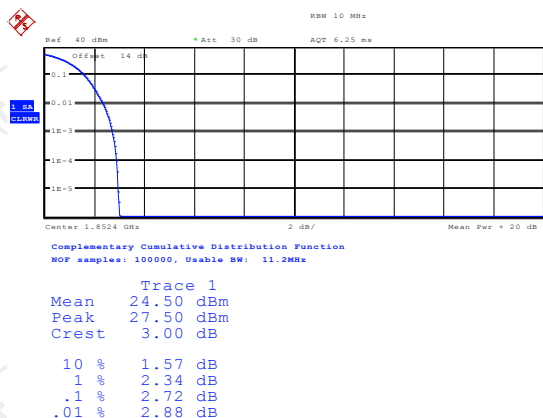
Peak-to-Average Ratio on Channel 1513



Date: 10.JAN.2022 14:41:16

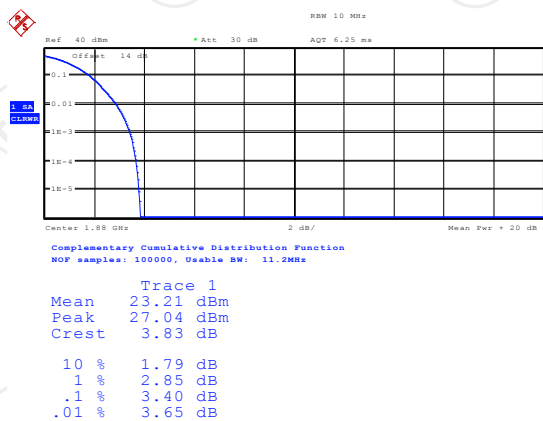
WCDMA Band II 12.2Kbps

Peak-to-Average Ratio on Channel 9262



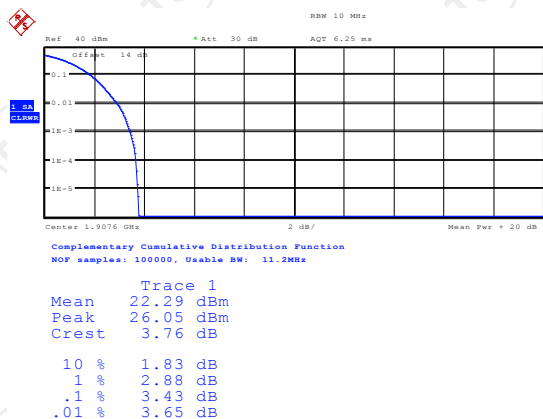
Date: 10.JAN.2022 14:45:06

Peak-to-Average Ratio on Channel 9400



Date: 10.JAN.2022 14:44:39

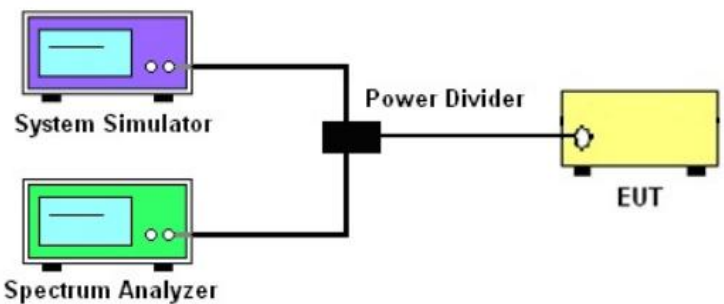
Peak-to-Average Ratio on Channel 9538



Date: 10.JAN.2022 14:44:16

5.3. 99% Occupied Bandwidth and 26dB Bandwidth Measurement

5.3.1. Test Specification

Test Requirement:	FCC part 2.1049
Test Method:	FCC KDB 971168 D01v03r01
Operation mode:	Refer to item 3.1
Limit:	N/A
Test Setup:	 The diagram shows a System Simulator (purple box) and a Spectrum Analyzer (green box) connected to a Power Divider (black box). The Power Divider is connected to the EUT (yellow box). The System Simulator and Spectrum Analyzer are connected to the Power Divider via RF cables.
Test Procedure:	1. The testing follows FCC KDB 971168 D01v03r01 Section 4.2. 2. The EUT was connected to the spectrum analyzer and system simulator via a power divider. 3. The RF output of the EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement. 4. The 99% occupied bandwidth were measured, set RBW= 1% of span, VBW= 3*RBW, sample detector, trace maximum hold. 5. The 26dB bandwidth were measured, set RBW= 1% of EBW, VBW= 3*RBW, peak detector, trace maximum hold.
Test Result:	PASS

5.3.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Due
Universal Radio Communication Tester	R&S	CMU200	110188	Jul. 07, 2022
Spectrum Analyzer	R&S	FSU	200054	Jul. 18, 2022
RF cable (9kHz-40GHz)	TCT	RE-05	N/A	Jul. 07, 2022
Antenna Connector	TCT	RFC-02	N/A	Jul. 07, 2022

5.3.3. Test data

Cellular Band			
Mode	WCDMA Band V (HSUPA)		
Channel	4132	4182	4233
Frequency (MHz)	826.4	836.4	846.6
99% OBW (MHz)	4.12	4.11	4.15
26dB BW (MHz)	4.70	4.68	4.70

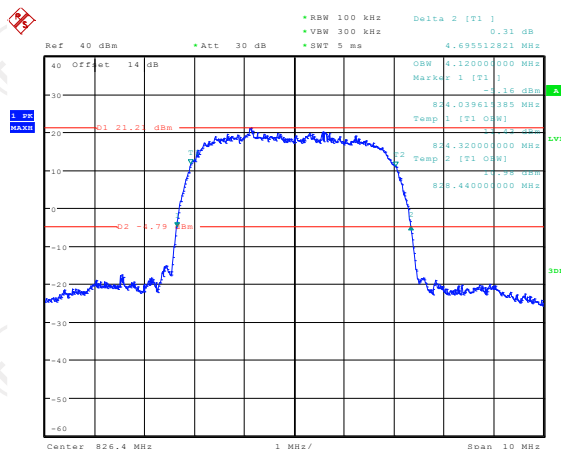
Cellular Band			
Mode	WCDMA Band IV (HSUPA)		
Channel	1312	1413	1513
Frequency (MHz)	1712.4	1732.6	1752.6
99% OBW (MHz)	4.14	4.13	4.12
26dB BW (MHz)	4.74	4.74	4.73

Cellular Band			
Mode	WCDMA Band II (HSUPA)		
Channel	9262	9400	9538
Frequency (MHz)	1852.4	1880	1907.6
99% OBW (MHz)	4.14	4.13	4.12
26dB BW (MHz)	4.74	4.71	4.68

Test plots as follows:

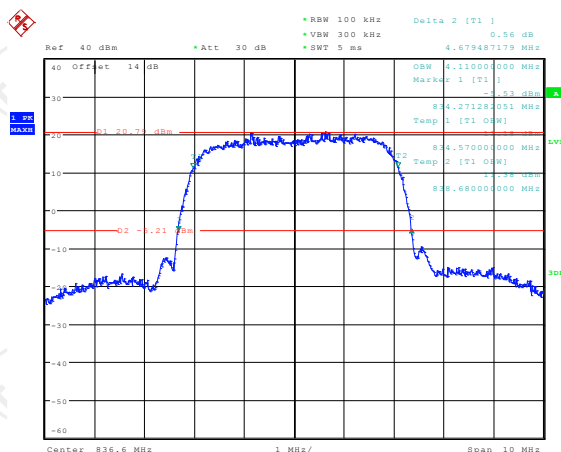
Band:	WCDMA Band V	Test Mode:	HSUPA Link (QPSK)
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26dB&99% Occupied Bandwidth Plot on Channel 4132



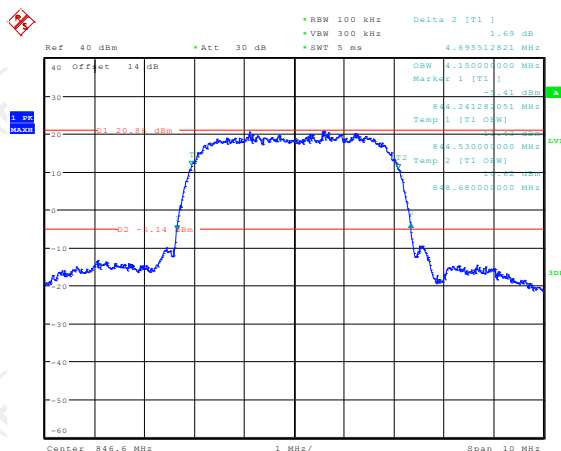
Date: 10.JAN.2022 14:34:13

26dB&99% Occupied Bandwidth Plot on Channel 4182



Date: 10.JAN.2022 14:36:21

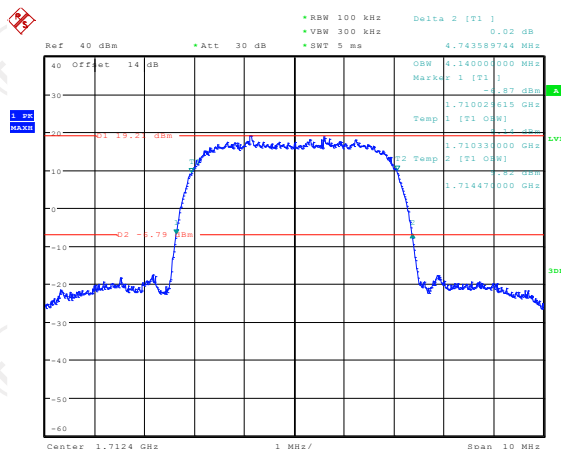
26dB&99% Occupied Bandwidth Plot on Channel 4233



Date: 10.JAN.2022 14:38:18

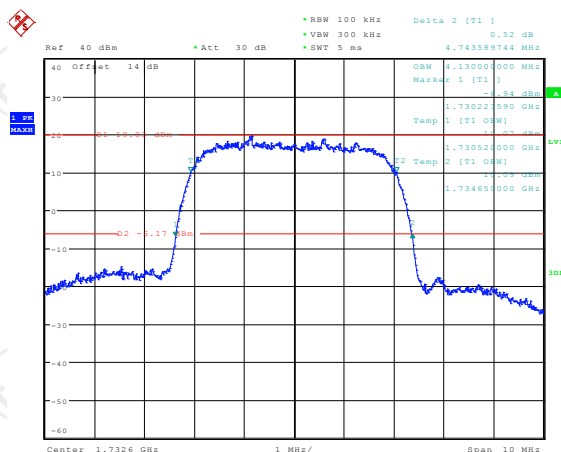
Band:	WCDMA Band IV	Test Mode:	HSUPA Link (QPSK)
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26dB&99% Occupied Bandwidth Plot on Channel 1312



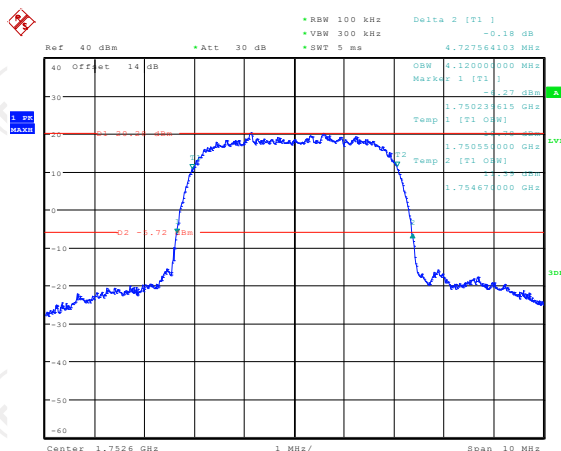
Date: 10.JAN.2022 14:27:04

26dB&99% Occupied Bandwidth Plot on Channel 1413



Date: 10.JAN.2022 14:28:09

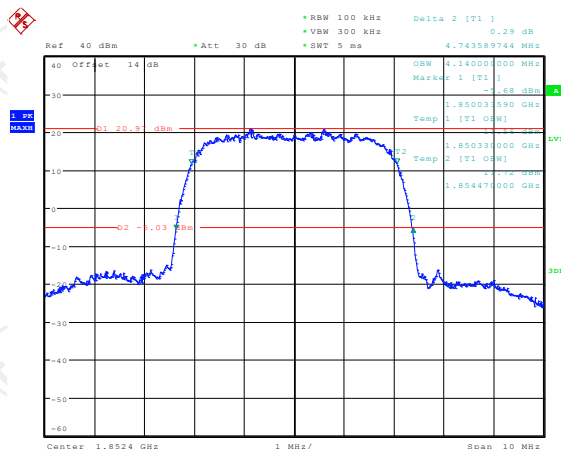
26dB&99% Occupied Bandwidth Plot on Channel 1513



Date: 10.JAN.2022 14:30:38

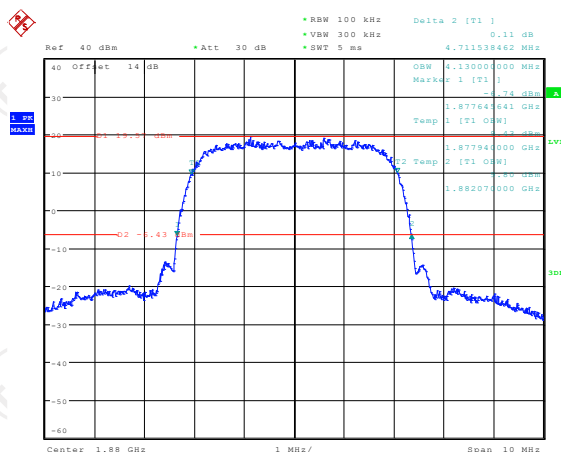
Band:	WCDMA Band II	Test Mode:	HSUPA Link (QPSK)
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26dB&99% Occupied Bandwidth Plot on Channel 9262



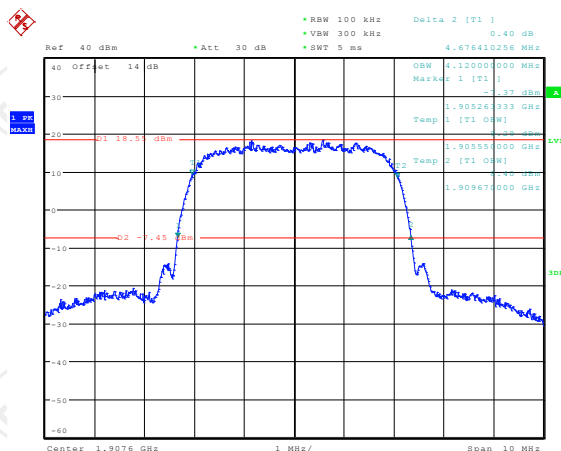
Date: 10.JAN.2022 14:18:58

26dB&99% Occupied Bandwidth Plot on Channel 9400



Date: 10.JAN.2022 14:20:22

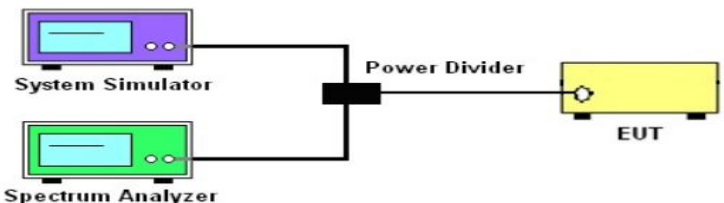
26dB&99% Occupied Bandwidth Plot on Channel 9538



Date: 10.JAN.2022 14:22:32

5.4. Band Edge and Conducted Spurious Emission Measurement

5.4.1. Test Specification

Test Requirement:	FCC part22.917(a) and FCC part24.238(a) FCC part27.53(h)
Test Method:	FCC KDB 971168 D01v03r01
Operation mode:	Refer to item 3.1
Limit:	-13dBm
Test Setup:	 The diagram shows a System Simulator (purple box) and a Spectrum Analyzer (green box) connected to a Power Divider (black box). The Power Divider is connected to the EUT (yellow box).
Test Procedure:	1. The testing follows FCC KDB 971168 D01v03r01 Section 6.0. 2. The EUT was connected to the spectrum analyzer and system simulator via a power divider. 3. The RF output of EUT was connected to the spectrum analyzer by an RF cable and attenuator. The path loss was compensated to the results for each measurement. 4. The band edges of low and high channels for the highest RF powers were measured. 5. The conducted spurious emission for the whole frequency range was taken. 6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band. 7. The limit line is derived from $43 + 10\log(P)$ dB below the transmitter power $P(\text{Watts}) = P(W) - [43 + 10\log(P)] (\text{dB}) = [30 + 10\log(P)] (\text{dBm}) - [43 + 10\log(P)] (\text{dB}) = -13\text{dBm}.$
Test Result:	PASS

5.4.2. Test Instruments

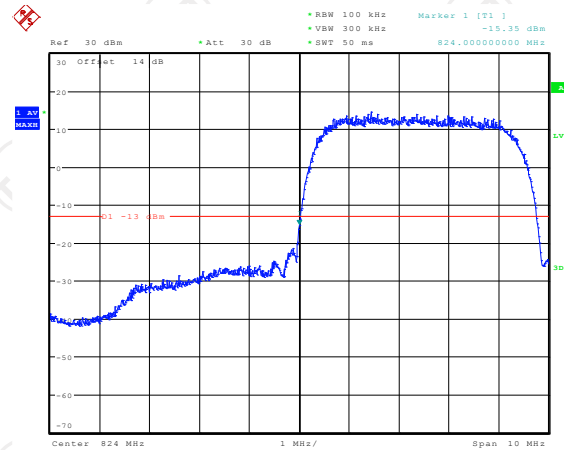
Equipment	Manufacturer	Model	Serial Number	Calibration Due
Universal Radio Communication Tester	R&S	CMU200	110188	Jul. 07, 2022
Spectrum Analyzer	R&S	FSU	200054	Jul. 18, 2022
RF cable (9kHz-40GHz)	TCT	RE-05	N/A	Jul. 07, 2022
Antenna Connector	TCT	RFC-02	N/A	Jul. 07, 2022

5.4.3. Test data

Test plots as follows:

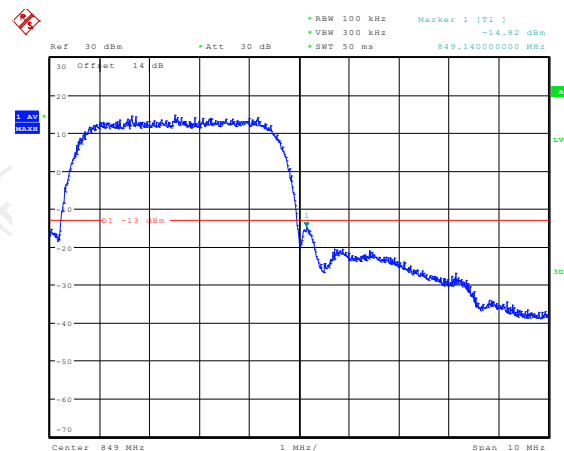
Band:	WCDMA Band V	Test Mode:	HSUPA Link (QPSK)
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Lower Band Edge Plot on Channel 4132



Date: 10.JAN.2022 14:54:20

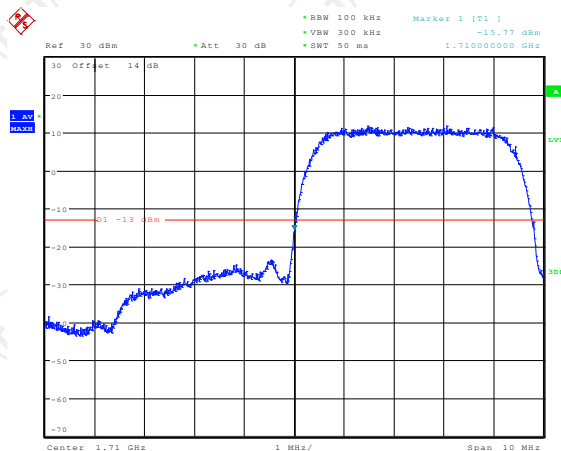
Higher Band Edge Plot on Channel 4233



Date: 10.JAN.2022 14:55:07

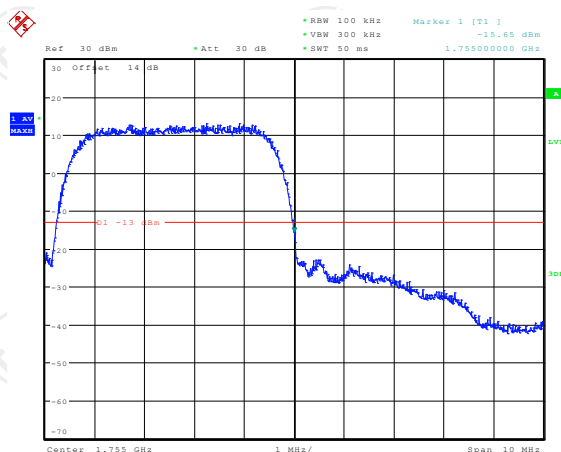
HSUPA Link (QPSK)

Lower Band Edge Plot on Channel 1312



Date: 10 JAN 2022 14:53:30

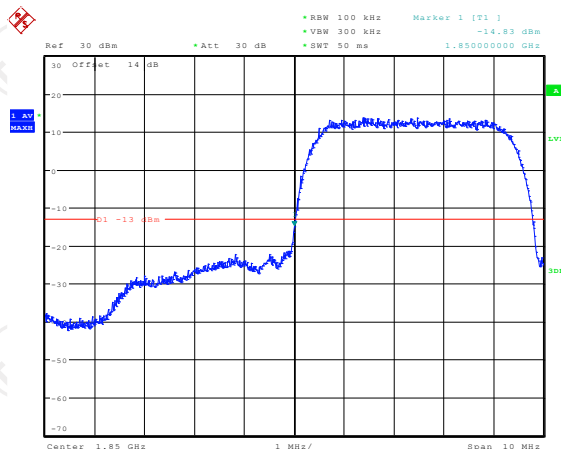
Higher Band Edge Plot on Channel 1513



Date: 10.JAN.2022 14:53:53

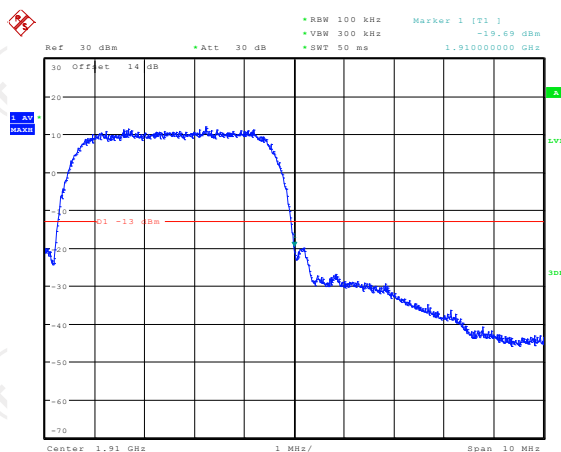
Band:	WCDMA Band II	Test Mode:	HSUPA Link (QPSK)
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Lower Band Edge Plot on Channel 9262



Date: 10.JAN.2022 14:52:13

Higher Band Edge Plot on Channel 9538



Date: 10.JAN.2022 14:53:03

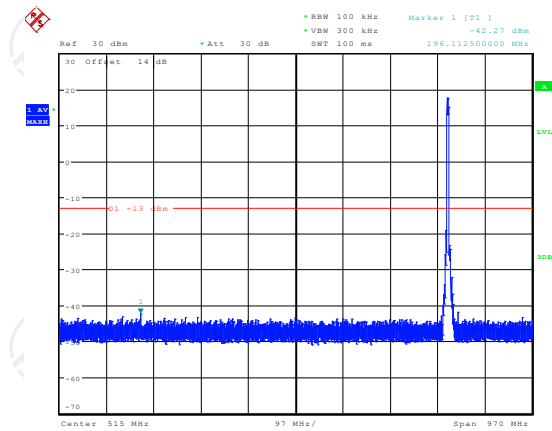
Band:

WCDMA Band V

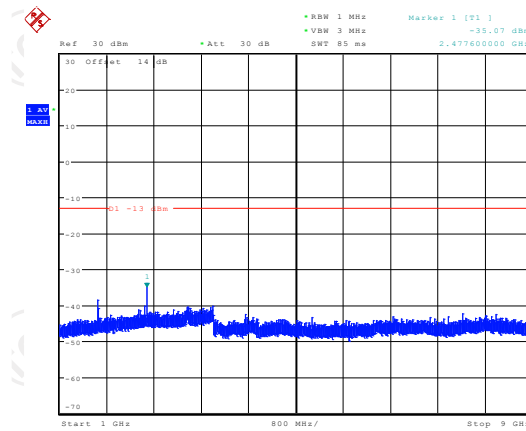
Test Mode:

HSUPA Link (QPSK)

Conducted Spurious Emission on Channel 4132

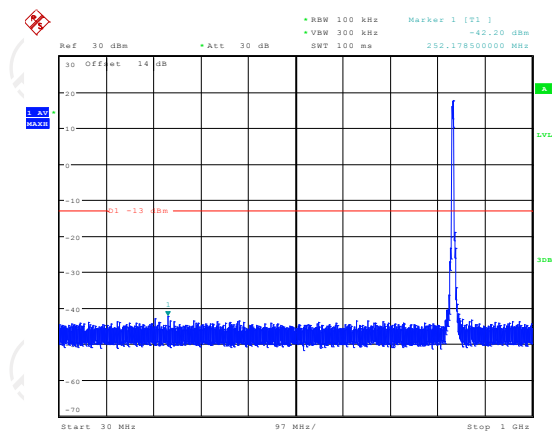


Date: 10.JAN.2022 14:58:02

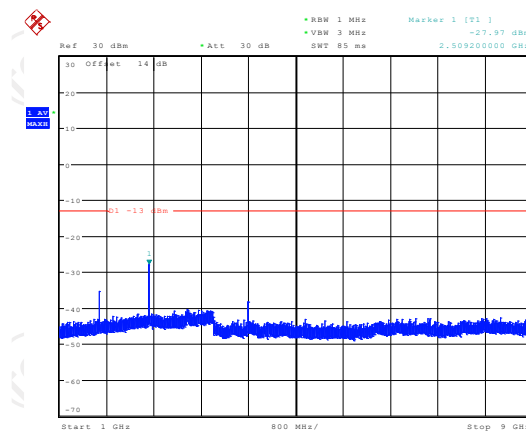


Date: 10.JAN.2022 14:58:26

Conducted Spurious Emission on Channel 4182

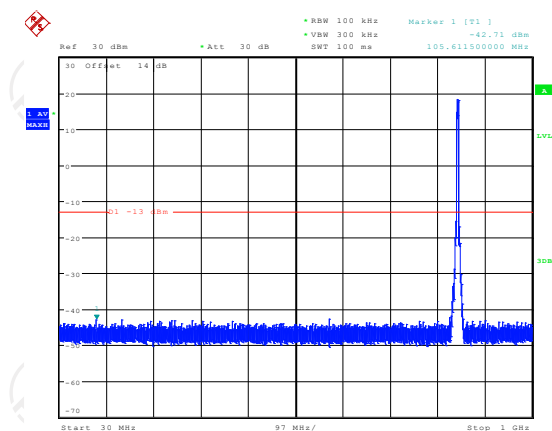


Date: 10.JAN.2022 14:57:18

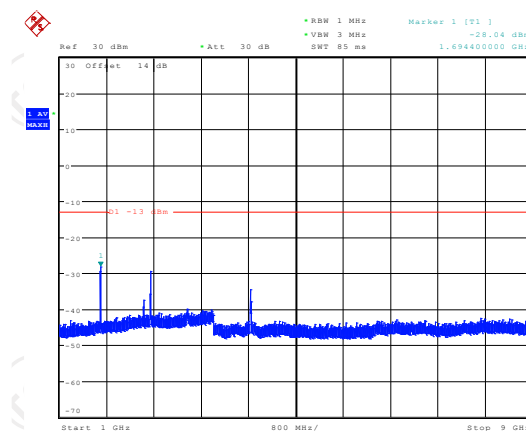


Date: 10.JAN.2022 14:59:11

Conducted Spurious Emission on Channel 4233



Date: 10.JAN.2022 14:56:22



Date: 10.JAN.2022 15:00:09

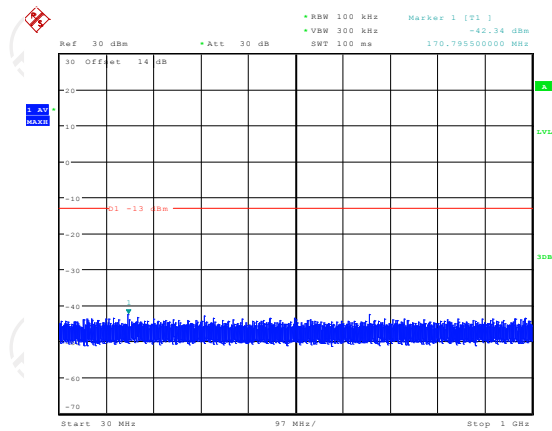
Band:

WCDMA Band IV

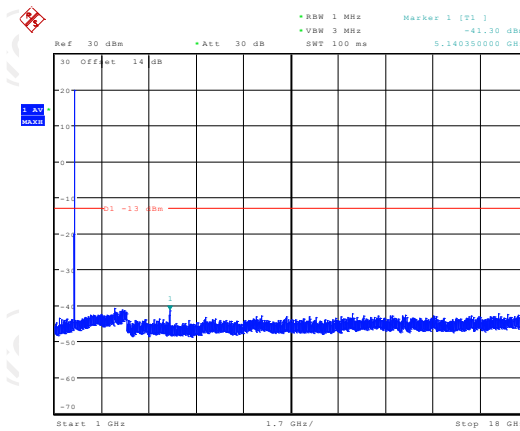
Test Mode:

HSUPA Link (QPSK)

Conducted Spurious Emission on Channel 1312

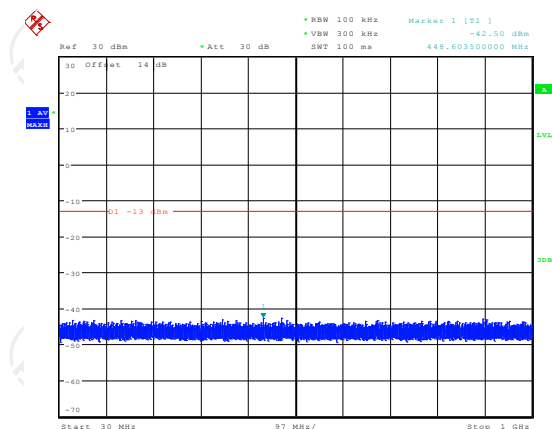


Date: 10.JAN.2022 15:03:12

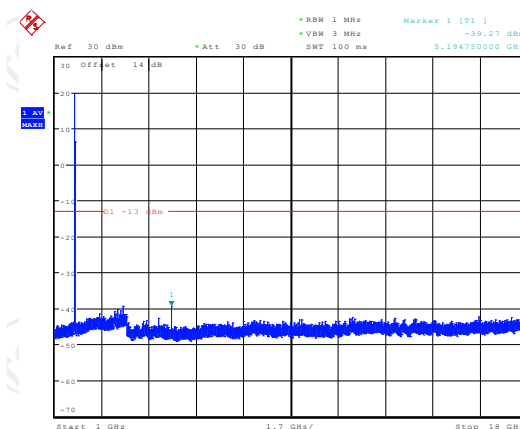


Date: 10.JAN.2022 15:03:51

Conducted Spurious Emission on Channel 1413

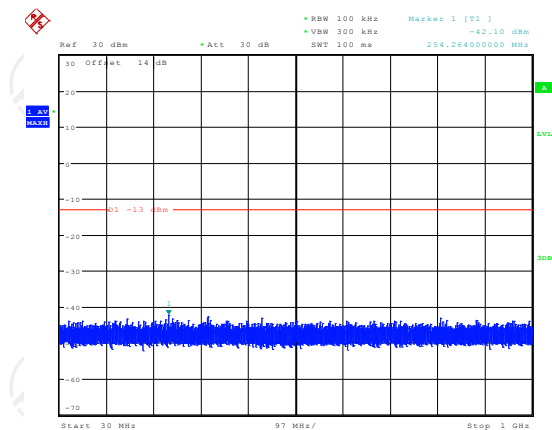


Date: 10.JAN.2022 15:02:43

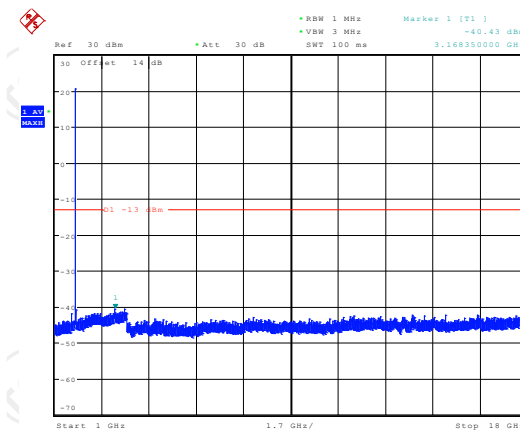


Date: 10.JAN.2022 15:04:40

Conducted Spurious Emission on Channel 1513



Date: 10.JAN.2022 15:01:14



Date: 10.JAN.2022 15:07:02

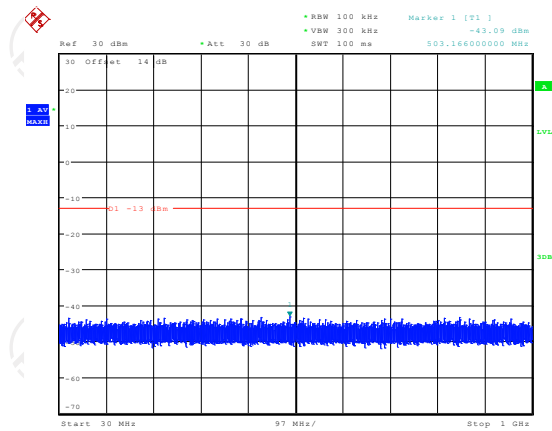
Band:

WCDMA Band II

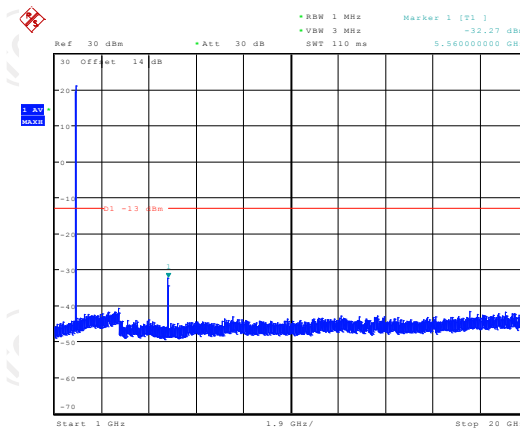
Test Mode:

HSUPA Link (QPSK)

Conducted Spurious Emission on Channel 9262

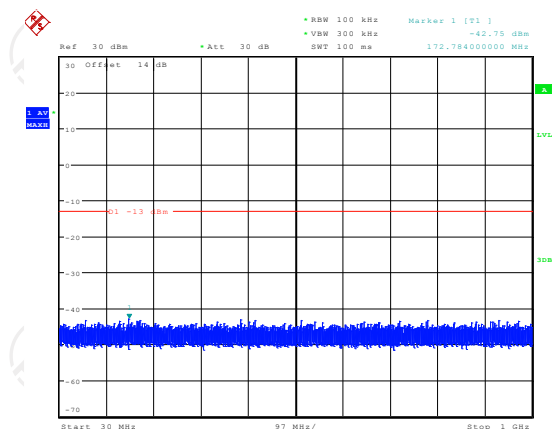


Date: 10.JAN.2022 15:08:45

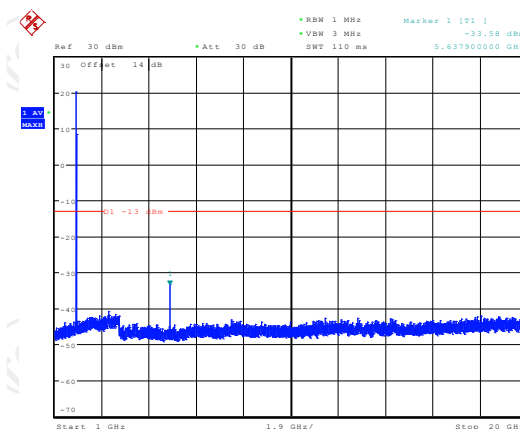


Date: 10.JAN.2022 15:09:35

Conducted Spurious Emission on Channel 9400

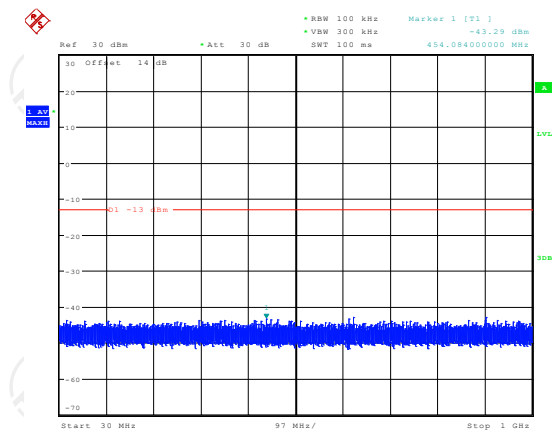


Date: 10.JAN.2022 15:08:18

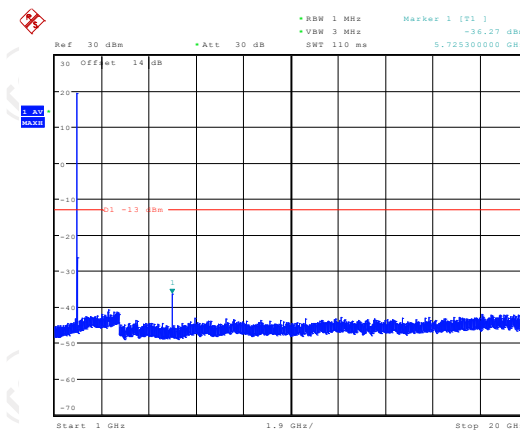


Date: 10.JAN.2022 15:10:06

Conducted Spurious Emission on Channel 9538



Date: 10.JAN.2022 15:07:49



Date: 10.JAN.2022 15:10:39

WCDMA Band II Conducted Spurious Emission for Below 1G

Channel	RBW (KHz)	Test result (dBm)	RBW (MHz)	Calculate result (dBm)	Limit (-13dBm)
9262	100	-43.09	1	-33.09	Pass
9400	100	-42.75	1	-32.75	Pass
9538	100	-43.29	1	-33.29	Pass

WCDMA Band IV Conducted Spurious Emission for Below 1G

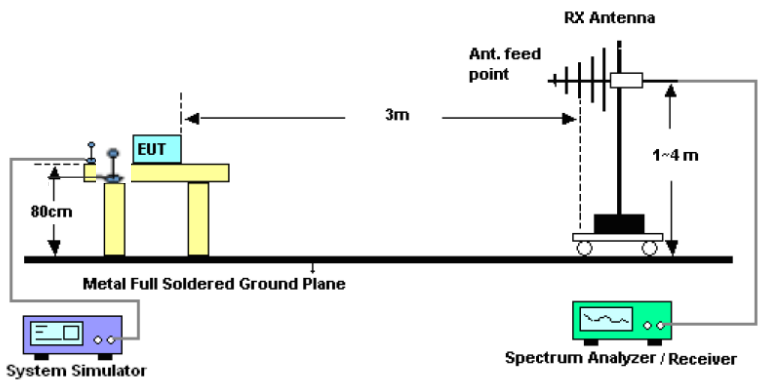
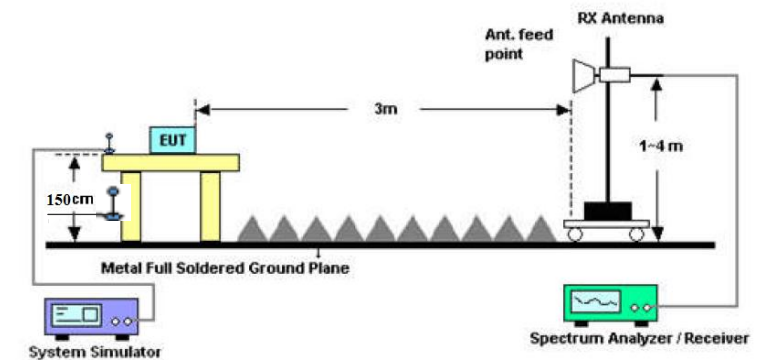
Channel	RBW (KHz)	Test result (dBm)	RBW (MHz)	Calculate result (dBm)	Limit (-13dBm)
1312	100	-42.34	1	-32.34	Pass
1413	100	-42.50	1	-32.50	Pass
1513	100	-42.10	1	-32.10	Pass

Compensate 10dB is for Exchange rate of RBW

Exchange rate of RBW = $10 \cdot \log_{10}(\text{Reference bandwidth} / \text{RBW at measurement}) = 10[\text{dB}]$
where Reference bandwidth = 1 MHz

5.5. Effective Radiated Power and Effective Isotropic Radiated Power Measurement

5.5.1. Test Specification

Test Requirement:	FCC part 22.913(a) and FCC part 24.232(c) FCC part 27.50(d)																
Test Method:	FCC KDB 971168 D01v03r01																
Receiver Setup:	<table border="1"> <tr> <td></td><td>WCDMA/HSPA</td></tr> <tr> <td>SPAN</td><td>10MHz</td></tr> <tr> <td>RBW</td><td>100kHz</td></tr> <tr> <td>VBW</td><td>300kHz</td></tr> <tr> <td>Detector</td><td>RMS</td></tr> <tr> <td>Trace</td><td>Average</td></tr> <tr> <td>Average Type</td><td>Power</td></tr> <tr> <td>Sweep Count</td><td>100</td></tr> </table>		WCDMA/HSPA	SPAN	10MHz	RBW	100kHz	VBW	300kHz	Detector	RMS	Trace	Average	Average Type	Power	Sweep Count	100
	WCDMA/HSPA																
SPAN	10MHz																
RBW	100kHz																
VBW	300kHz																
Detector	RMS																
Trace	Average																
Average Type	Power																
Sweep Count	100																
Limit:	WCDMA Band V: 7W ERP WCDMA Band II: 2W EIRP WCDMA Band IV: 1W EIRP																
Test Setup:	From 30MHz to 1GHz  Above 1GHz 																
Test Procedure:	1. The testing follows FCC KDB 971168 D01v03r01 Section 5.8. and ANSI / TIA-603-D-2010 Section																

	2.2.17. - The EUT was placed on a non-conductive rotating platform 0.8 meters high in a semi-anechoic chamber. The radiated emission at the fundamental frequency was measured at 3 m with a test antenna and a spectrum analyzer with RMS detector per section 5. of KDB 971168 D01v03. - Key the transmitter, then rotate the EUT 360° azimuthally and record spectrum analyzer power level (LVL) measurements at angular increments that are sufficiently small to permit resolution of all peaks. If a standard radiation test site is used, raise and lower the test antenna to obtain a maximum reading at each angular increment. - Replace the transmitter under test with a substitution antenna. The center of the antenna should be at the same location as the center of the antenna under test. - Connect the antenna to a signal generator with a known output power and record the path loss (in dB) as LOSS. If a standard radiation test site is used, raise and lower the test antenna to obtain a maximum reading. $\text{LOSS} = \text{Generator Output Power (dBm)} - \text{Analyzer reading (dBm)}$ - Determine the effective radiated output power at each angular position from the readings in steps 3) and 5) using the following equation: $\text{ERP (dBm)} = \text{LVL (dBm)} + \text{LOSS (dB)}$ - The maximum ERP is the maximum value determined in the preceding step. - Calculating ERP: $\text{ERP (dBm)} = \text{Output Power (dBm)} - \text{Losses (dB)} + \text{Antenna Gain (dBd)}$ $\text{Antenna Gain (dBd)} = \text{Antenna Gain (dBi)} - 2.15$ $\text{EIRP} = \text{ERP} + 2.15$
Test results:	PASS

5.5.2. Test Instruments

Radiated Emission Test Site (966)				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Universal Radio Communication Tester	R&S	CMU200	110188	Jul. 07, 2022
Spectrum Analyzer	R&S	FSQ40	200061	Jul. 07, 2022
Signal Generator	HP	83623B	3614A00396	Jul. 18, 2022
Broadband Antenna	Schwarzbeck	VULB9163	340	Sep. 04, 2022
Horn Antenna	Schwarzbeck	BBHA 9120D	631	Sep. 04, 2022
Broadband Antenna	Schwarzbeck	VULB9163	412	Sep. 04, 2022
Horn Antenna	Schwarzbeck	BBHA 9120D	1201	Sep. 04, 2022
Horn Antenna	Schwarzbeck	BBHA 9170	00956	Apr. 10, 2023
Coaxial cable	SKET	RC_DC18G-N	N/A	Apr. 08, 2022
Coaxial cable	SKET	RC-DC18G-N	N/A	Apr. 08, 2022
Coaxial cable	SKET	RC-DC40G-N	N/A	Jul. 07, 2022
Antenna Mast	Keleto	RE-AM	N/A	N/A
EMI Test Software	Shurple Technology	EZ-EMC	N/A	N/A

5.5.3. Test Data

Test Result of ERP

WCDMA Band V (HSUPA) Radiated Power ERP					
Horizontal Polarization (Antenna Pol.)					
Frequency (MHz)	(EUT Pol.)	LVL (dBm)	Correction Factor (dB)	ERP (dBm)	ERP (W)
826.4	H	0.67	21.62	20.14	0.10
836.4	H	0.85	21.54	20.24	0.11
846.6	H	1.02	21.44	20.31	0.11
Vertical Polarization (Antenna Pol.)					
Frequency (MHz)	(EUT Pol.)	LVL (dBm)	Correction Factor (dB)	ERP (dBm)	ERP (W)
826.4	H	0.58	21.62	20.05	0.10
836.4	H	1.07	21.54	20.46	0.11
846.6	H	1.23	21.44	20.52	0.11

* ERP = LVL (dBm) + Correction Factor (dB) – 2.15

Correction Factor= S.G. Power - Cable loss + Antenna Gain- SPA. Reading

Test Result of EIRP

WCDMA Band IV (HSUPA) Radiated Power EIRP					
Horizontal Polarization (Antenna Pol.)					
Frequency (MHz)	(EUT Pol.)	LVL (dBm)	Correction Factor (dB)	EIRP (dBm)	EIRP (W)
1712.4	H	3.06	18.33	21.39	0.14
1732.6	H	3.31	18.15	21.46	0.14
1752.6	H	3.54	18.24	21.78	0.15
Vertical Polarization (Antenna Pol.)					
Frequency (MHz)	(EUT Pol.)	LVL (dBm)	Correction Factor (dB)	EIRP (dBm)	EIRP (W)
1712.4	H	2.97	18.33	21.30	0.13
1732.6	H	3.14	18.15	21.29	0.13
1752.6	H	3.25	18.24	21.49	0.14

* EIRP = LVL (dBm) + Correction Factor (dB)

Correction Factor= S.G. Power - Cable loss + Antenna Gain- SPA. Reading

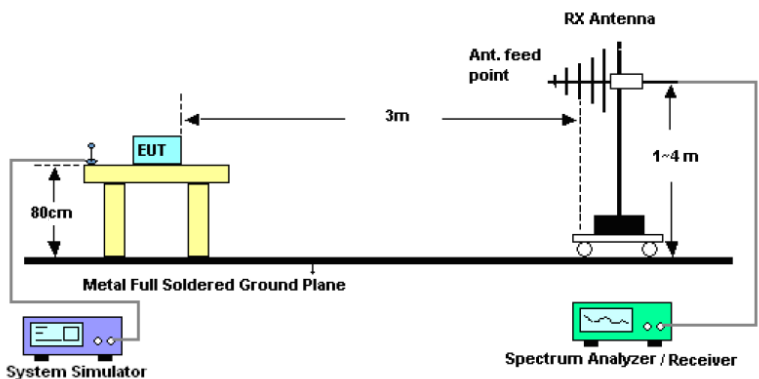
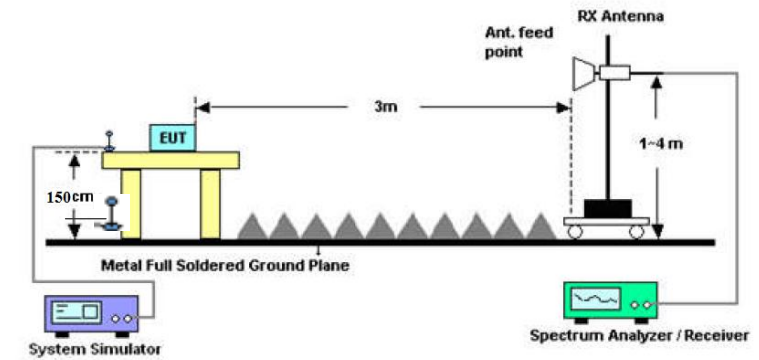
WCDMA Band II (HSUPA) Radiated Power EIRP					
Horizontal Polarization (Antenna Pol.)					
Frequency (MHz)	(EUT Pol.)	LVL (dBm)	Correction Factor (dB)	EIRP (dBm)	EIRP (W)
1852.4	H	0.15	21.62	21.77	0.15
1880.0	H	0.02	21.54	21.56	0.14
1907.6	H	-0.08	21.48	21.40	0.14
Vertical Polarization (Antenna Pol.)					
Frequency (MHz)	(EUT Pol.)	LVL (dBm)	Correction Factor (dB)	EIRP (dBm)	EIRP (W)
1852.4	H	0.07	21.62	21.69	0.15
1880.0	H	-0.04	21.54	21.50	0.14
1907.6	H	-0.16	21.48	21.32	0.14

* EIRP = LVL (dBm) + Correction Factor (dB)

Correction Factor= S.G. Power - Cable loss + Substitution Antenna Gain- SPA. Reading

5.6. Field Strength of Spurious Radiation Measurement

5.6.1. Test Specification

Test Requirement:	FCC part 22.917(a) and FCC part 24.238(a) FCC part 27.53(h)
Test Method:	FCC KDB 971168 D01v03r01
Operation mode:	Refer to item 3.1
Limit:	-13dBm
Test setup:	For 30MHz~1GHz  Above 1GHz 
Test Procedure:	1. The testing follows FCC KDB 971168 D01v03r01 Section 6 and ANSI / TIA-603-D-2010 Section 2.2.12. 2. The EUT was placed on a rotatable wooden table 0.8 meters above the ground. 3. The EUT was set 3 meters from the receiving antenna, which was mounted on the antenna tower. 4. The table was rotated 360 degrees to determine the position of the highest spurious emission. 5. The height of the receiving antenna is varied between one meter and four meters to search for the maximum spurious emission for both horizontal and vertical polarizations. 6. Make the measurement with the spectrum analyzer's

	RBW = 1MHz, VBW = 3MHz, taking record of maximum spurious emission. 7. A horn antenna was substituted in place of the EUT and was driven by a signal generator. 8. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission. 9. Taking the record of output power at antenna port. 10. Repeat step 7 to step 8 for another polarization. 11. EIRP (dBm) = S.G. Power – Tx Cable Loss + Tx Antenna Gain 12. ERP (dBm) = EIRP - 2.15 13. The RF fundamental frequency should be excluded against the limit line in the operating frequency band. 14. The limit line is derived from 43 + 10log(P) dB below the transmitter power P(Watts) = P(W) - [43 + 10log(P)] (dB) = [30 + 10log(P)] (dBm) - [43 + 10log(P)] (dB) = -13dBm.
Test results:	PASS
Remark:	All modulations have been tested, but only the worst modulation show in this test item.

5.6.2. Test Instruments

Radiated Emission Test Site (966)				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Universal Radio Communication Tester	R&S	CMU200	110188	Jul. 07, 2022
Spectrum Analyzer	R&S	FSQ40	200061	Jul. 07, 2022
Signal Generator	HP	83623B	3614A00396	Jul. 18, 2022
Broadband Antenna	Schwarzbeck	VULB9163	340	Sep. 04, 2022
Horn Antenna	Schwarzbeck	BBHA 9120D	631	Sep. 04, 2022
Broadband Antenna	Schwarzbeck	VULB9163	412	Sep. 04, 2022
Horn Antenna	Schwarzbeck	BBHA 9120D	1201	Sep. 04, 2022
Horn Antenna	Schwarzbeck	BBHA 9170	00956	Apr. 10, 2023
Coaxial cable	SKET	RC_DC18G-N	N/A	Apr. 08, 2022
Coaxial cable	SKET	RC-DC18G-N	N/A	Apr. 08, 2022
Coaxial cable	SKET	RC-DC40G-N	N/A	Jul. 07, 2022
Antenna Mast	Keleto	RE-AM	N/A	N/A
EMI Test Software	Shurple Technology	EZ-EMC	N/A	N/A

5.6.3. Test Data

Frequency Range (9 kHz-30MHz)

Frequency (MHz)	Level@3m (dBμV/m)	Limit@3m (dBμV/m)
--	--	--
--	--	--
--	--	--
--	--	--

Note: 1. Emission Level=Reading+ Cable loss+ Antenna factor-Amp factor

2. The emission levels are 20 dB below the limit value, which are not reported. It is deemed to comply with the requirement

Band	WCDMA Band V	Test channel:	Lowest
Test mode:	RMC 12.2Kbps Link (QPSK)	Temperature :	25°C
		Relative Humidity:	56%

Note: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

Frequency (MHz)	Spurious Emission				Limit (dBm)	Result
	Polarization	Level (dBm)	Correction Factor (dB)	Spurious emissions (dBm)		
1652.8	Vertical	-68.11	23.14	-44.97	-13.00	PASS
2479.2	V	-77.50	23.23	-54.27		
3305.6	V	-76.75	23.34	-53.41		
1652.8	Horizontal	-66.99	23.14	-43.85		
2479.2	H	-76.54	23.23	-53.31		
3305.6	H	-78.52	23.34	-55.18		

Band	WCDMA Band V	Test channel:	Middle
Test mode:	RMC 12.2Kbps Link (QPSK)	Temperature :	25°C
		Relative Humidity:	56%

Note: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

Frequency (MHz)	Spurious Emission				Limit (dBm)	Result
	Polarization	Level (dBm)	Correction Factor (dB)	Spurious emissions (dBm)		
1673.2	Vertical	-67.21	23.17	-44.04	-13.00	PASS
2509.8	V	-76.48	23.26	-53.22		
3346.4	V	-77.34	23.38	-53.96		
1673.2	Horizontal	-65.80	23.17	-42.63		
2509.8	H	-79.57	23.26	-56.31		
3346.4	H	-77.25	23.38	-53.87		

Band	WCDMA Band V	Test channel:	Highest
Test mode:	RMC 12.2Kbps Link (QPSK)	Temperature :	25°C
		Relative Humidity:	56%

Note: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

Frequency (MHz)	Spurious Emission				Limit (dBm)	Result
	Polarization	Level (dBm)	Correction Factor (dB)	Spurious emissions (dBm)		
1693.2	Vertical	-70.67	23.20	-47.47	-13.00	PASS
2539.8	V	-77.40	23.29	-54.11		
3386.4	V	-80.67	23.42	-57.25		
1693.2	Horizontal	-67.35	23.20	-44.15		
2539.8	H	-77.21	23.29	-53.92		
3386.4	H	-80.06	23.42	-56.64		

Band	WCDMA Band IV	Test channel:	Lowest
Test mode:	RMC 12.2Kbps Link (QPSK)	Temperature :	25°C
		Relative Humidity:	56%

Note: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

Frequency (MHz)	Spurious Emission				Limit (dBm)	Result
	Polarization	Level (dBm)	Correction Factor (dB)	Spurious emissions (dBm)		
2452.3	Vertical	-78.19	23.16	-55.03	-13.00	PASS
3424.8	V	-77.26	23.37	-53.89		
5137.2	V	-80.22	23.65	-56.57		
2452.3	Horizontal	-77.29	23.16	-54.13		
3424.8	H	-78.68	23.37	-55.31		
5137.2	H	-77.31	23.65	-53.66		

Band	WCDMA Band IV	Test channel:	Middle
Test mode:	RMC 12.2Kbps Link (QPSK)	Temperature :	25°C
		Relative Humidity:	56%

Note: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

Frequency (MHz)	Spurious Emission				Limit (dBm)	Result
	Polarization	Level (dBm)	Correction Factor (dB)	Spurious emissions (dBm)		
2641.3	Vertical	-79.02	23.30	-55.72	-13.00	PASS
3465.2	V	-75.88	23.42	-52.46		
5197.8	V	-79.81	23.73	-56.08		
2641.3	Horizontal	-76.73	23.30	-53.43		
3465.2	H	-79.88	23.42	-56.46		
5197.8	H	-79.26	23.73	-55.53		

Band	WCDMA Band IV	Test channel:	Highest
Test mode:	RMC 12.2Kbps Link (QPSK)	Temperature :	25°C
		Relative Humidity:	56%

Note: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

Frequency (MHz)	Spurious Emission				Limit (dBm)	Result
	Polarization	Level (dBm)	Correction Factor (dB)	Spurious emissions (dBm)		
3102.2	Vertical	-76.93	23.35	-53.58	-13.00	PASS
3505.2	V	-78.15	23.45	-54.70		
5257.8	V	-75.45	23.82	-51.63		
3102.2	Horizontal	-78.28	23.35	-54.93		
3505.2	H	-77.80	23.45	-54.35		
5257.8	H	-81.09	23.82	-57.27		

Band	WCDMA Band II	Test channel:	Lowest
Test mode:	RMC 12.2Kbps Link (QPSK)	Temperature :	25°C
		Relative Humidity:	56%

Note: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

Frequency (MHz)	Spurious Emission				Limit (dBm)	Result
	Polarization	Level (dBm)	Correction Factor (dB)	Spurious emissions (dBm)		
3704.8	Vertical	-66.68	23.53	-43.15	-13.00	PASS
5557.2	V	-78.77	23.78	-54.99		
7409.6	V	-81.14	23.92	-57.22		
3704.8	Horizontal	-69.27	23.53	-45.74		
5557.2	H	-77.89	23.78	-54.11		
7409.6	H	-80.96	23.92	-57.04		

Band	WCDMA Band II	Test channel:	Middle
Test mode:	RMC 12.2Kbps Link (QPSK)	Temperature :	25°C
		Relative Humidity:	56%

Note: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

Frequency (MHz)	Spurious Emission				Limit (dBm)	Result
	Polarization	Level (dBm)	Correction Factor (dB)	Spurious emissions (dBm)		
3760.0	Vertical	-68.84	23.58	-45.26	-13.00	PASS
5640.0	V	-78.55	23.85	-54.70		
7520.0	V	-81.47	23.99	-57.48		
3760.0	Horizontal	-70.14	23.58	-46.56		
5640.0	H	-76.28	23.85	-52.43		
7520.0	H	-80.42	23.99	-56.43		

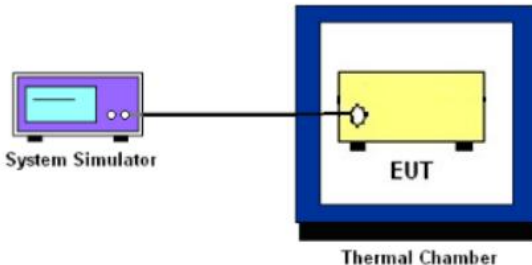
Band	WCDMA Band II	Test channel:	Highest
Test mode:	RMC 12.2Kbps Link (QPSK)	Temperature :	25°C
		Relative Humidity:	56%

Note: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

Frequency (MHz)	Spurious Emission				Limit (dBm)	Result
	Polarization	Level (dBm)	Correction Factor (dB)	Spurious emissions (dBm)		
3815.2	Vertical	-70.42	23.62	-46.80	-13.00	PASS
5722.8	V	-80.99	23.90	-57.09		
7630.4	V	-81.88	24.05	-57.83		
3815.2	Horizontal	-68.66	23.62	-45.04		
5722.8	H	-76.97	23.90	-53.07		
7630.4	H	-81.96	24.05	-57.91		

5.7. Frequency Stability Measurement

5.7.1. Test Specification

Test Requirement:	FCC Part 2.1055 ; FCC Part 22.355 ; FCC Part 24.235 FCC Part 27.54
Test Method:	FCC KDB 971168 D01v03r01
Operation mode:	Refer to item 3.1
Limit:	FCC Part 22.355 : ± 2.5 ppm FCC Part 24.235 : The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.
Test Setup:	 The diagram shows a 'System Simulator' (a purple box with a screen) connected by a black line to a yellow box labeled 'EUT'. The 'EUT' is positioned inside a blue square frame labeled 'Thermal Chamber'.
Test Procedure:	Test Procedures for Temperature Variation 1. The testing follows FCC KDB 971168 D01v03r01 Section 9.0. 2. The EUT was set up in the thermal chamber and connected with the system simulator. 3. With power OFF, the temperature was decreased to -30°C and the EUT was stabilized before testing. Power was applied and the maximum change in frequency was recorded within one minute. 4. With power OFF, the temperature was raised in 10°C steps up to 50°C. The EUT was stabilized at each step for at least half an hour. Power was applied and the maximum frequency change was recorded within one minute. Test Procedures for Voltage Variation 1. The testing follows FCC KDB 971168 D01v03r01 Section 9.0. 2. The EUT was placed in a temperature chamber at $25 \pm 5^{\circ}\text{C}$ and connected with the system simulator. 3. The power supply voltage to the EUT was varied from BEP to 115% of the nominal value measured at the input to the EUT. 4. The variation in frequency was measured for the worst case.
Test Result:	PASS
Remark:	All three channels of all modulations have been tested, but only the worst channel and the worst modulation show in this test item.

5.7.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Due
Universal Radio Communication Tester	R&S	CMU200	110188	Jul. 07, 2022
Programable tempratuce and humidity chamber	JQ	MHU-80L	N/A	Jul. 18, 2022
DC power supply	Kingrang	KR3005K	N/A	Jul. 18, 2022
RF cable (9kHz-40GHz)	TCT	RE-04	N/A	Jul. 18, 2022
Antenna Connector	TCT	RFC-03	N/A	Jul. 18, 2022

5.7.3. Test Data

Test Result of Temperature Variation

Band :	WCDMA Band V	Channel:	4182
Limit (ppm) :	2.5ppm	Frequency:	836.4MHz
Temperature (°C)	HSUPA Deviation (ppm)	Result	
50	0.015	PASS	
40	0.014		
30	0.010		
20	0.016		
10	0.014		
0	0.013		
-10	0.013		
-20	0.015		
-30	0.014		

Band :	WCDMA Band IV	Channel:	1413
Limit (ppm) :	Note1	Frequency:	1732.6
Temperature (°C)	HSUPA Deviation (ppm)	Result	
50	0.017	PASS	
40	0.018		
30	0.019		
20	0.012		
10	0.013		
0	0.015		
-10	0.016		
-20	0.017		
-30	0.019		

Band :	WCDMA Band II	Channel:	9400
Limit (ppm) :	Note1	Frequency:	1880MHz
Temperature (°C)	HSUPA Deviation (ppm)	Result	
50	0.014	PASS	
40	0.013		
30	0.014		
20	0.015		
10	0.016		
0	0.018		
-10	0.017		
-20	0.015		
-30	0.013		

Note1: The frequency fundamental emissions stay within the authorized frequency block based on the frequency deviation measured is small.

Test Result of Voltage Variation

Band & Channel	Mode	Voltage (Volt)	Deviation (ppm)	Limit (ppm)	Result
WCDMA Band IV CH1413	RMC 12.2Kbps	13.2	-0.010	2.5	PASS
		12	-0.014		
		BEP	-0.013		
WCDMA Band V CH4182	RMC 12.2Kbps	13.2	-0.016		
		12	-0.018		
		BEP	-0.015		
WCDMA Band II CH9400	RMC 12.2Kbps	13.2	-0.017	(Note 3.)	
		12	-0.014		
		BEP	-0.016		

Note:

1. Normal Voltage = 12V.
2. Battery End Point (BEP) = 10.8V.
3. The frequency fundamental emissions stay within the authorized frequency block based on the frequency deviation measured is small.

Appendix A: Photographs of Test Setup

Refer to the test report No. TCT211208E004

Appendix B: Photographs of EUT

Refer to the test report No. TCT211208E004

*******END OF REPORT*******