



Product Name: LTE Module	Report No: FCC022022-05502RF12(b)
Product Model: TOBY-L3414	Security Classification: Open
Version: V1.0	Total Page: 52

Testing Report

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FCC Radio Test Report

FCC ID: 2A3Z6TOBYL3414

According to

**47 CFR FCC Part 24E
47 CFR FCC Part 27
47 CFR FCC Part 2
ANSI C63.26**

Equipment : LTE Module
Model No. : TOBY-L3414
Trademark : TASHANG
Product No. : 20220820018527
Applicant : Tashang Semiconductor(Shanghai) Co., Ltd.
Room 818, Building 4, No.89, Sanshahong Road, Chengqiao Town,
Chongming District, Shanghai

- The test result referred exclusively to the presented test model /sample.
- Without written approval of TIRT Inc. the test report shall not reproduced except in full.
- Date of Receipt: 2022.09.05
- Date of Test: 2022.09.06-2022.09.30
- Issued Date: 2022.11.03

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History of this test report

Report Version	Description	Issued Date
R00	Original Issue.	Oct. 20, 2022
R01	Revised issue	Nov. 03, 2022

1. GENERAL SUMMARY

Equipment : LTE Module
Brand Name : TASHANG
Test Model : TOBY-L3414
Series Model : /
Applicant : Tashang Semiconductor(Shanghai) Co., Ltd.
Address : Room 818, Building 4, No.89, Sanshahong Road, Chengqiao Town,
Chongming District, Shanghai
Manufacturer : Tashang Semiconductor(Shanghai) Co., Ltd.
Address : Room 818, Building 4, No.89, Sanshahong Road, Chengqiao Town,
Chongming District, Shanghai
Standard(s) : 47 CFR FCC Part 24 Subpart E
47 CFR FCC Part 27
47 CFR FCC Part 2
ANSI C63.26:2015
FCC KDB 971168 D01 Power Meas License Digital Systems v03r01

The above equipment has been tested and found compliance with the requirement of the relative standards by TIRT Inc.

2. SUMMARY OF TEST RESULTS

Test procedures according to the technical standard(s):

FCC Rules	Description of Test	Result
Section 15.207	N/A	N/A
§ 2.1046; § 24.232; § 27.50(d)	RF Output Power	Compliant
§ 2.1049;	99% & -26 dB Occupied Bandwidth	Compliant
§ 2.1051; § 24.238; § 27.53(h)	Spurious Emissions at Antenna Terminal	Compliant
§ 2.1053; § 24.238; § 27.53(h)	Field Strength of Spurious Radiation	Compliant
§ 2.1051; § 24.238; § 27.53(h)	Out of band emission, Band Edge	Compliant
§ 2.1055 § 24.235 § 27.54	Frequency stability vs. temperature Frequency stability vs. voltage	Compliant
§ 2.1046; § 24.232; § 27.50(d)	Peak to average ratio	Compliant

2.1 TEST FACILITY

Company:	Beijing TIRT Technology Service Co.,Ltd Shenzhen
Address:	101, 3 # Factory Building, Gongjin Electronics Shatin Community, Kengzi Street, Pingshan District, Shenzhen, China
CNAS Registration Number:	CNAS L14158
A2LA Registration Number:	6049.01
FCC Accredited Lab. Designation Number:	CN1309
FCC Test Firm Registration Number:	825524
Telephone:	+86-0755-27087573

2.2 MEASUREMENT UNCERTAINTY

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2))

The TIRT measurement uncertainty as below table:

Uncertainty	
Parameter	Uncertainty
Occupied Channel Bandwidth	$\pm 142.12\text{kHz}$
RF power conducted	$\pm 0.74\text{dB}$
RF power radiated	$\pm 3.25\text{dB}$
Spurious emissions, conducted	$\pm 1.78\text{dB}$
Spurious emissions, radiated (30MHz ~ 1GHz)	$\pm 4.6\text{dB}$
Spurious emissions, radiated (1GHz ~ 18GHz)	$\pm 4.9\text{dB}$
Conduction Emissions(150kHz~30MHz)	$\pm 3.1\text{dB}$
Humidity	$\pm 4.6\%$
Temperature	$\pm 0.7^\circ\text{C}$
Time	$\pm 1.25\%$

Note: Unless specifically mentioned, the uncertainty of measurement has not been taken into account to declare the compliance or non-compliance to the specification.

3. GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

Equipment	LTE Module	
Brand Name	TASHANG	
Test Model	TOBY-L3414	
Series Model	/	
Model Difference(s)	/	
Software Version	M31.04.11.01.01	
Hardware Version	V1.0	
Antenna Type	External Antenna	
Antenna Gain	WCDMA BAND2	0.43 dBi
	WCDMA BAND4	3.05 dBi
Modulation Type	QPSK, 16QAM	
Operation Frequency	WCDMA BAND2: 1850-1910MHz(TX); 1930-1990MHz(RX)	
	WCDMA BAND4: 1710-1755MHz(TX); 2110-2155MHz(RX)	
Max. EIRP Power	WCDMA BAND2: 23.46 dBm	
	WCDMA BAND4: 27.06 dBm	
Normal Test Voltage	3.8Vdc	
Extreme Test Voltage	3.3 to 4.2Vdc	
Operating Temperature	-40 °C to 85 °C	

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.

3.2 DESCRIPTION OF TEST MODES AND TEST CONDITION

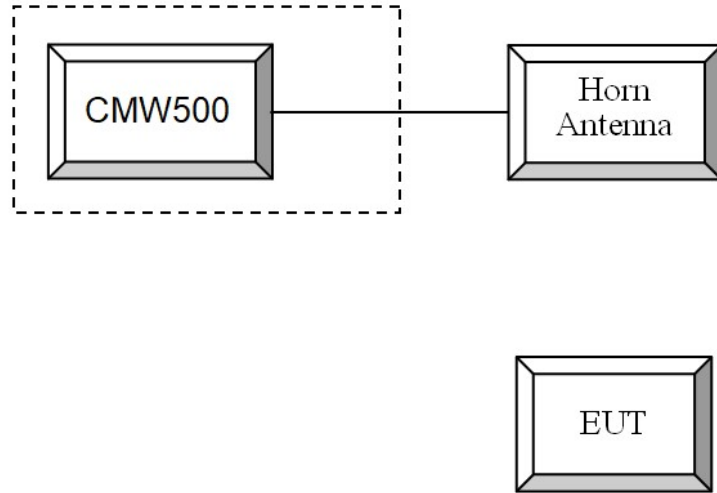
Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis and antenna ports. The worst case was found when positioned on X-plane for EIRP and X-axis for radiated emission. Following channel(s) was (were) selected for the final test as listed below:

Test Item	Test Channel	Test Mode
EIRP	WCDMA BAND2: 9262, 9400, 9538 WCDMA BAND4: 1312, 1413, 1513	RMC, HSDPA+, HSUPA
RF Output Power	WCDMA BAND2: 9262, 9400, 9538 WCDMA BAND4: 1312, 1413, 1513	RMC, HSDPA+, HSUPA
Conducted Emission	WCDMA BAND2: 9262, 9400, 9538 WCDMA BAND4: 1312, 1413, 1513	RMC, HSDPA+, HSUPA
Radiated Emission	WCDMA BAND2: 9262, 9400, 9538 WCDMA BAND4: 1312, 1413, 1513	RMC, HSDPA+, HSUPA
Band Edge	WCDMA BAND2: 9262, 9538 WCDMA BAND4: 1312, 1513	RMC, HSDPA+, HSUPA
Peak to Average Ratio	WCDMA BAND2: 9262, 9400, 9538 WCDMA BAND4: 1312, 1413, 1513	RMC, HSDPA+, HSUPA
Frequency Stability	WCDMA BAND2: 9262, 9400, 9538 WCDMA BAND4: 1312, 1413, 1513	RMC, HSDPA+, HSUPA

3.3 EUT TEST CONDITIONS

Test Item	Temperature	Humidity	Test Voltage	Tested By
EIRP	24.2°C	56%	3.8V DC	Stone Tang
RF Output Power	24.6°C	55%	3.8V DC	Stone Tang
Occupied Bandwidth	24.6°C	55%	3.8V DC	Stone Tang
Conducted Emission	24.6°C	55%	3.8V DC	Stone Tang
Radiated Emission	24.2°C	55%	3.8V DC	Stone Tang
Band Edge	24.2°C	55%	3.8V DC	Stone Tang
Peak to Average Ratio	24.6°C	55%	3.8V DC	Stone Tang
Frequency Stability	Normal and Extreme	Normal and Extreme	Normal and Extreme	Stone Tang

3.4 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED



3.4 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.

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.
1	Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	1201.0002K50-116064

4. TEST RESULT

4.1 RFOUTPUT POWER MEASUREMENT

4.1.1 DESCRIPTION OF TESTS

Conducted Output Power:

Measurement Procedure: FCC KDB 971168 D01 V03r01

The transmitter output was connected to a calibrated coaxial cable, attenuator and power meter, the other end of which was connected to a Base Station Simulator. The Base Station Simulator was set to force the EUT to its maximum power setting. The power output at the transmitter antenna port was determined by adding the value of the cable insertion loss to the power reading. The tests were performed at three frequencies (low channel, middle channel and high channel) and on the highest power levels, which can be setup on the transmitters. Description of Tests

Effective (Isotropic) Radiated Power of Transmitter

Measurement Procedure: FCC KDB 971168 D01 V03r01 ; ANSI/ C63.10

The measurements procedures specified in ANSI/TIA-603-E-2016 were applied.

In an anechoic antenna test chamber, a half-wave dipole antenna for the frequency band of interest is placed at the reference centre of the chamber. An RF Signal source for the frequency band of interest is connected to the dipole with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A known (measured) power (P_{in}) is applied to the input of the dipole, and the power received (P_r) at the chamber's probe antenna is recorded.

The relevant equation for determining the ERP or EIRP from the conducted RF output power measured using the guidance provided above is:

$$ERP/EIRP = SGLevel - P_{cl} + G_a$$

where:

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

SGLevel = Signal generator output power or PSD, in dBm or dBW;

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

P_{cl} = signal attenuation in the connecting cable between the transmitter and antenna.

The EUT is substituted for the dipole at the reference centre of the chamber and a scan is performed to obtain the radiation pattern.

From the radiation pattern, the co-ordinates where the maximum antenna gain occurs are identified.

The EUT is then put into continuously transmitting mode at its maximum power level. Power mode measurements are performed with the receiving antenna placed at the coordinates determined in Step 3 to determine the output power as defined in Rule 24.232 (b) and (c). The "reference path loss" from Step1 is added to this result.

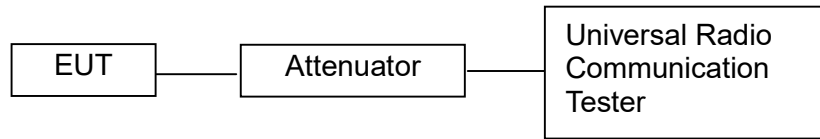
This value is EIRP since the measurement is calibrated using a half-wave dipole antenna of known gain (2.15 dBi) and known input power (P_{in}).

ERP can be calculated from EIRP by subtracting the gain of the dipole, $ERP = EIRP - 2.15dBi$.

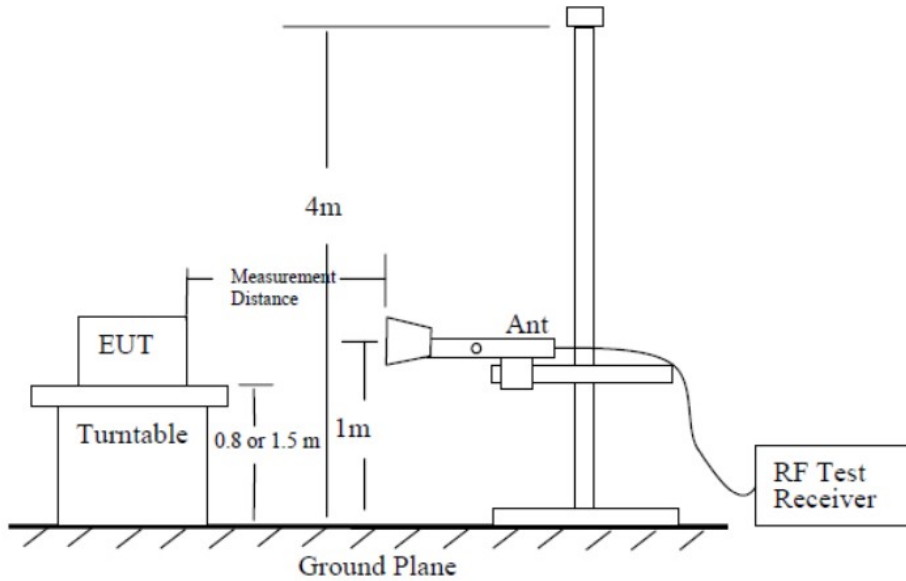
Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported.

4.1.2 TEST SETUP LAYOUT

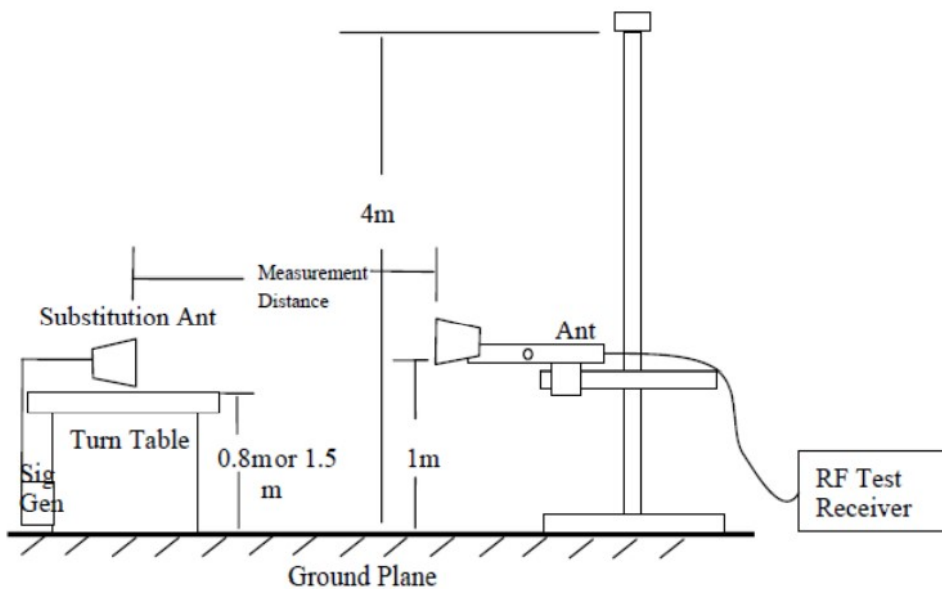
Conducted method:



Radiated method:



Test site-up for radiated ERP and/or EIRP measurements



Substitution method set-up for radiated emission

4.1.3 TEST DEVIATION

No deviation

4.1.4 TEST RESULTS

Please refer to the Appendix A.

4.2 OCCUPIED BANDWIDTH MEASUREMENT

4.2.1 DESCRIPTION OF TESTS

Measurement Procedure: FCC KDB 971168 D01 V03r01 Section 4.2

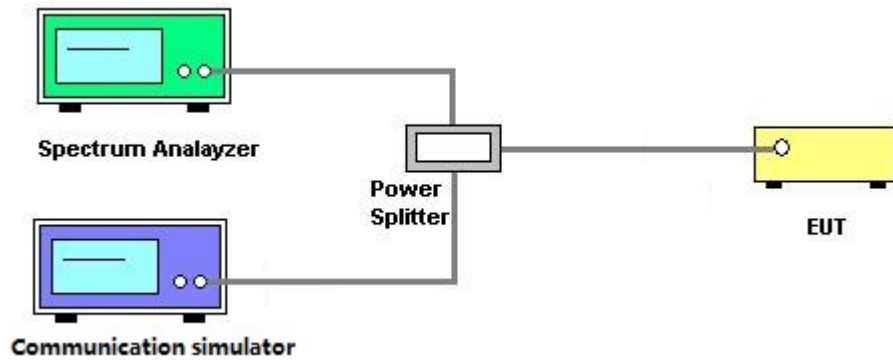
The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured. The transmitter output was connected to a calibrated coaxial cable, attenuator and Spectrum analyser, the other end of which was connected to a Base Station Simulator. The Base Station Simulator was set to force the EUT to its maximum power setting. The tests were performed at three frequencies (low channel, middle channel and high channel). The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1 percent of the selected span as is possible without being below 1 percent. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used since a peak or, peak hold, may produce a wider bandwidth than actual. The trace data points are recovered and are directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 percent of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is recorded. The span between the two recorded frequencies is the occupied bandwidth.

The EUT makes a call to the communication simulator. All measurements were done at low, middle and high operational frequency range. The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency. Use OBW measurement function of Spectrum analyzer to measure 99 % occupied bandwidth and 26dB bandwidth.

99% occupied bandwidth & -26dB occupied bandwidth test:

1. Set the resolution bandwidth (RBW) = 10 kHz.
2. Set the video bandwidth (VBW) = 30 kHz.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measurements are to be performed with the EUT set to the low, middle and high channel of each frequency band.

4.2.2 TEST SETUP LAYOUT



4.2.3 TEST DEVIATION

No deviation

4.2.4 TEST RESULTS

Please refer to the Appendix B.

4.3 CONDUCTED EMISSIONS MEASUREMENT

4.3.1 DESCRIPTION OF TESTS

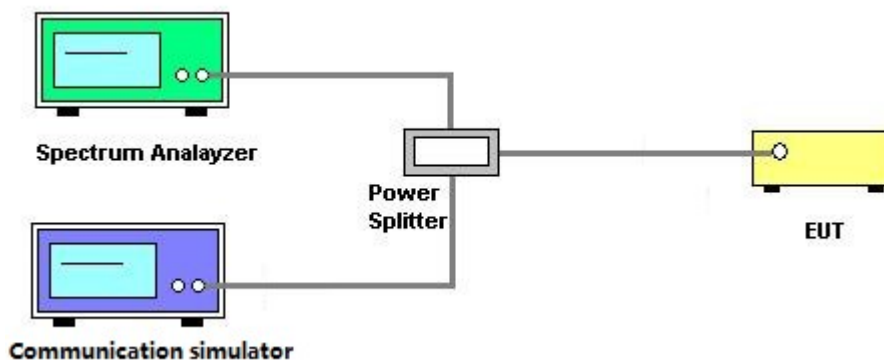
Measurement Procedure: FCC KDB 971168 D01 V03r01

The transmitter output was connected to a calibrated coaxial cable, attenuator and Spectrum analyzer, the other end of which was connected to a Base Station Simulator. The Base Station Simulator was set to force the EUT to its maximum power setting. The tests were performed at three frequencies (low channel and high channel). The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least $43 + 10 \log(P)$ dB. Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB below the transmitter power.

4.3.2 TEST PROCEDURES

1. The testing follows FCC KDB 971168 v03r01 Section 6.0.
2. The EUT was connected to spectrum analyzer and system simulator via a power divider.
3. The band edges of low and high channels for the highest RF powers were measured. Set $RBW \geq 1\% EBW$ in the 1MHz band immediately outside and adjacent to the band edge.
4. Set spectrum analyzer with RMS detector.
5. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

4.3.3 TEST SETUP LAYOUT



4.3.4 TEST DEVIATION

No deviation

4.3.5 TEST RESULTS

Please refer to the Appendix C.

4.4 RADIATED EMISSIONS MEASUREMENT

4.4.1 LIMIT

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB. The emission limit equal to -13dBm.

4.4.2 TEST PROCEDURES

1. Substitution method is used for E.I.R.P measurement. In the semi-anechoic chamber, EUT placed on the 0.8m height of Turn Table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1m to 4m to find the maximum polar radiated power. The "Read Value" is the spectrum reading the maximum power value.
2. The substitution horn antenna is substituted for EUT at the same position and signals generator export the CW signal to the substitution antenna via a TX cable. Rotated the Turn Table and moved receiving antenna to find the maximum radiation power. Adjust output power level of S.G to get a Value of spectrum reading equal to "Read Value " of step a. Record the power level of S.G
3. The bandwidth of test receiver is set at 9kHz in below 30MHz. and set at 120kHz in 30-1000MHz, and 1MHz in above 1000MHz.

The frequency range from 9kHz to 20GHz is checked.

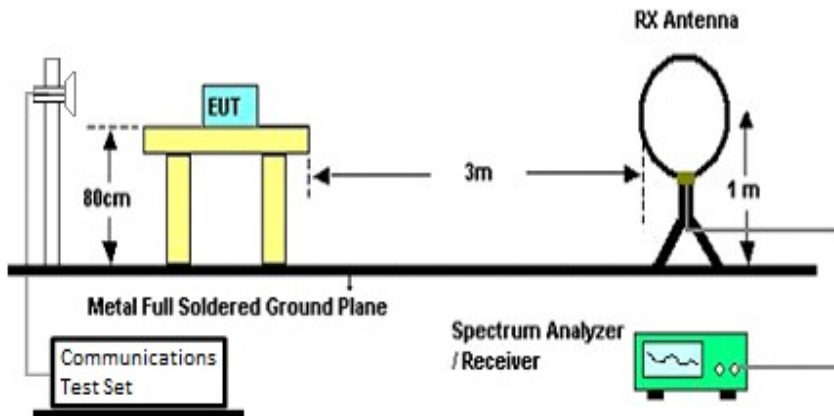
The final measurement in band 9-90kHz, 110-490kHz and above 1000MHz is performed with Average detector. Except those frequency bands mention above, the final measurement for frequencies below 1000MHz is performed with Quasi Peak detector.

Spurious emissions in dB = $10 \lg(\text{TXpwr in Watts}/0.001)$ – the absolute level

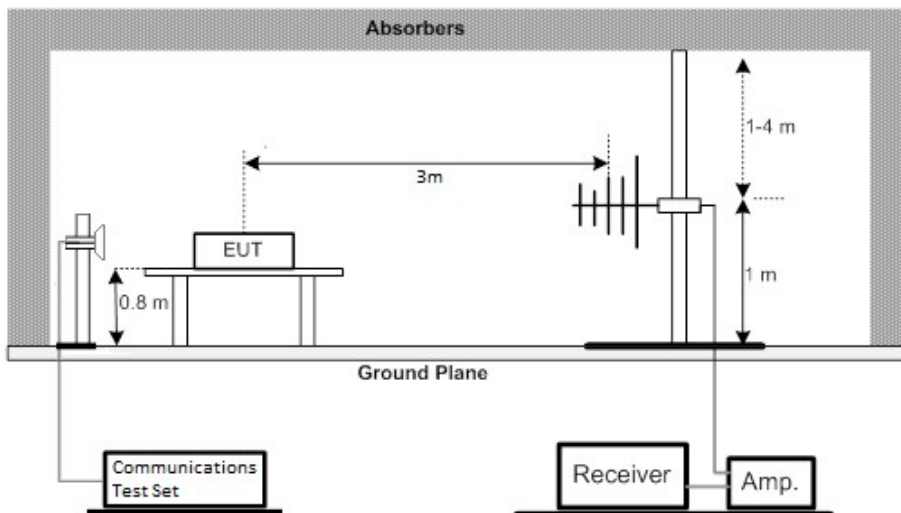
Spurious attenuation limit in dB = $43 + 10 \log(P)$ (power out in Watts)

4.4.3 TEST SETUP LAYOUT

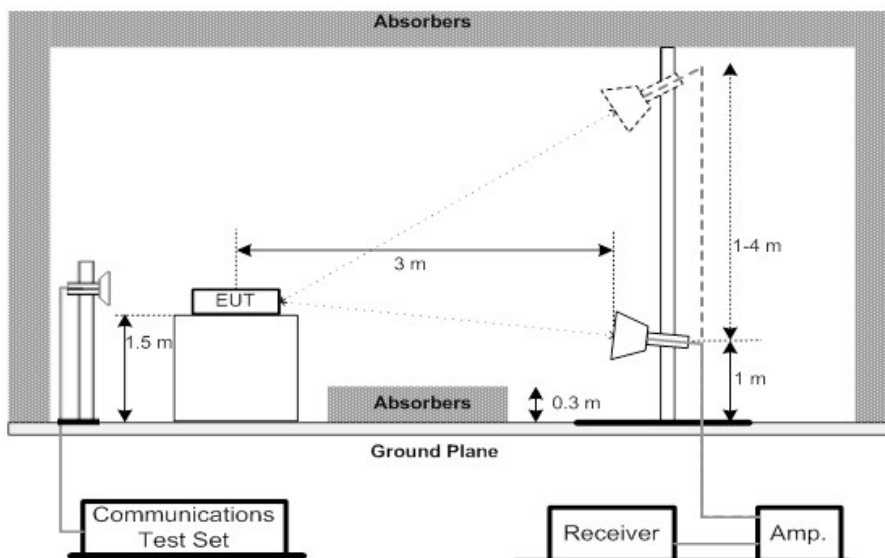
Below 30MHz



30MHz to 1GHz



Above 1GHz



4.4.4 TEST DEVIATION

No deviation

4.4.5 TEST RESULTS

Please refer to the Appendix D, E, F.

4.5 BAND EDGE MEASUREMENT

4.5.1 DESCRIPTION OF TESTS

Measurement Procedure: FCC KDB 971168 D01 V03r01 Section 6.0

The transmitter output was connected to a calibrated coaxial cable, attenuator and Spectrum analyser, the other end of which was connected to a Base Station Simulator. The Base Station Simulator was set to force the EUT to its maximum power setting. The tests were performed at three frequencies (low channel and high channel).in the 1MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of 100kHz or 1% of the emission bandwidth of the fundamental emission of the transmitter may be employed. The EUT emission bandwidth is measured as the width of the signal between two points, outside of which all emission are attenuated at least 26dB below the transmitter power. The video bandwidth of the spectrum analyzer was set at thrice the resolution bandwidth. Detector Mode was set to peak or peak hold power.

4.5.2 TEST PROCEDURES

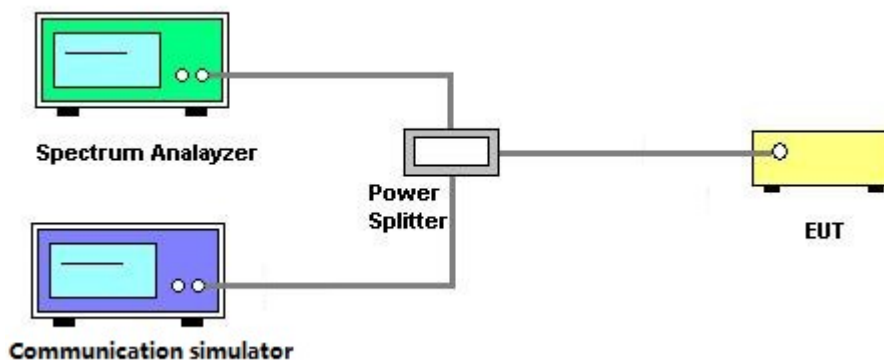
All measurements were done at low and high operational frequency range.

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

Test Settings

1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. $RBW \geq 1\%$ of the emission bandwidth
4. $VBW \geq 3 \times RBW$
5. Detector = RMS
6. Number of sweep points $\geq 2 \times \text{Span}/RBW$
7. Trace mode = trace average for continuous emissions, max hold for pulse emissions
8. Sweep time = auto couple
9. The trace was allowed to stabilize

4.5.3 TEST SETUP LAYOUT



4.5.4 TEST DEVIATION

No deviation

4.5.5 TEST RESULTS

Please refer to the Appendix G.

4.6 PEAK TO AVERAGE RATIO MEASUREMENT

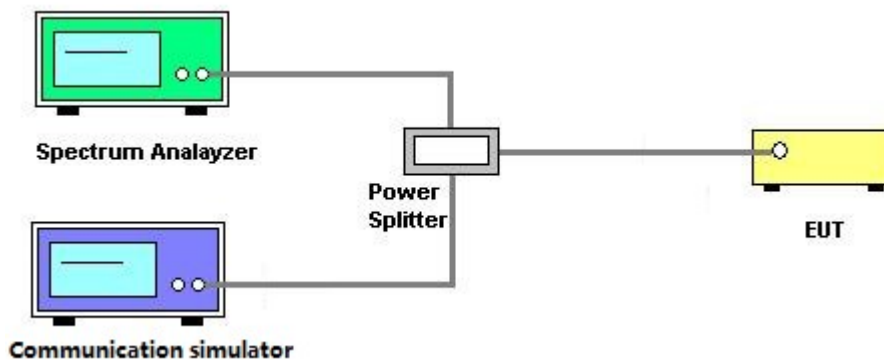
4.6.1 LIMIT

In measuring transmissions in this band using an average power technique, the peak to-average ratio (PAR) of the transmission may not exceed 13 dB.

4.6.2 TEST PROCEDURES

1. Set resolution/measurement bandwidth \geq signal's occupied bandwidth;
2. Set the number of counts to a value that stabilizes the measured CCDF curve;
3. Record the maximum PAPR level associated with a probability of 0.1%.

4.6.3 TEST SETUP LAYOUT



4.6.4 TEST DEVIATION

No deviation

4.6.5 TEST RESULTS

Please refer to the Appendix H.

4.7 FREQUENCY STABILITY MEASUREMENT

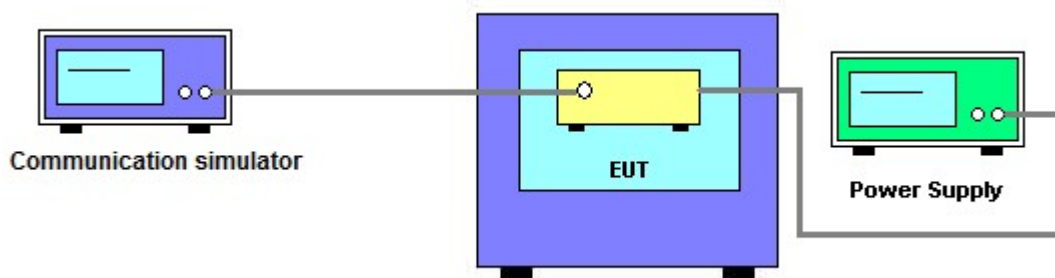
4.7.1 LIMIT

± 1.5 ppm is for base and fixed station. ± 2.5 ppm is for mobile station.

4.7.2 TEST PROCEDURES

1. Device is placed at the oven room. The oven room could control the temperatures and humidity. Power warm up is at least 15 min and power applied should perform before recording frequency error.
2. EUT is connected the external power supply to control the DC input power. The test voltage range is from minimum to maximum working voltage. Each step shall be record the frequency error rate.
3. The temperature range step is 10 degrees in this test items. All temperature levels shall be hold the $\pm 0.5^{\circ}\text{C}$ during the measurement testing. The each temperature step shall be at least 0.5 hours, consider the EUT could be test under the stability condition.
4. The frequency error was recorded frequency error from the communication simulator.

4.7.3 TEST SETUP LAYOUT



4.7.4 TEST DEVIATION

No deviation

4.7.5 TEST RESULTS

Please refer to the Appendix I.

5. LIST OF MEASUREMENT EQUIPMENTS

Radiated Emission Measurement(9kHz-30MHz)						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated date	Calibrated until
1	Loop Antenna	SCHWARZBECK	FMZB1519B	00029	2021/11/10	2022/11/09
2	EMI Test Receiver	Rohde&Schwarz	ESR7	102013	2021/11/10	2022/11/09
3	ECSI RF IN RF Cable	Rohde&Schwarz	AP-X1	\	2021/11/10	2022/11/09
4	Measurement Software	Farad	EZ-EMC Ver.TW-03A2	N/A	N/A	N/A
5	Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	1201.0002K50-116064	2021/11/03	2022/11/02

Radiated Emission Measurement(30MHz-1GHz)						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated date	Calibrated until
1	Integral Antenna	Schwarzbeck	VULB 9163	VULB 9163-361	2021/11/10	2022/11/09
2	EMI Test Receiver	Rohde&Schwarz	ESR7	102013	2021/11/10	2022/11/09
3	Preamplifier	CD Systems Inc	PAP-03036-30	85060000	2021/11/10	2022/11/09
4	ECSI RF IN RF Cable	Rohde&Schwarz	AP-X1	\	2021/11/10	2022/11/09
5	Measurement Software	Farad	EZ-EMC Ver.TW-03A2	N/A	N/A	N/A
6	Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	1201.0002K50-116064	2021/11/03	2022/11/02

Radiated Emission Measurement(Above 1GHz)						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated date	Calibrated until
1	Preamplifier	emci	EMC012645SE	980417	2021/11/10	2022/11/09
2	Preamplifier	Schwarzbeck	BBV9721	9721-019	2021/11/10	2022/11/09
3	Horn Antenna	Schwarzbeck	BBHA 9170	9170#685	2021/11/10	2022/11/09
4	Integral Antenna	Schwarzbeck	BBHA 9120D	BBHA 9120D 1201	2021/11/10	2022/11/09
5	Spectrum analyzer	Agilent	N9010A	MY52221119	2021/11/10	2022/11/09
6	Measurement Software	Farad	EZ-EMC Ver.TW-03A2	N/A	N/A	N/A
7	ECSI RF IN RF Cable	Rohde&Schwarz	AP-X1	\	2021/11/10	2022/11/09
8	Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	1201.0002K50-116064	2021/11/03	2022/11/02

Conducted Emission & Band Edge & Occupied Bandwidth Measurement						
	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated date	Calibrated until
1	Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	1201.0002K50-116064	2021/11/03	2022/11/02
2	Spectrum Analyzer	KEYSIGHT	N9020B	MY57463781	2021/11/10	2022/11/09

Frequency Stability Measurement						
	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated date	Calibrated until
1	Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	1201.0002K50-116064	2021/11/03	2022/11/02
2	Spectrum Analyzer	KEYSIGHT	N9020B	MY57463781	2021/11/10	2022/11/09
3	Temp&Humidity Chamber	ETMOA	NTH1100-30A	16080628	2021/11/10	2022/11/09

Remark: "N/A" denotes no model name, serial no. or calibration specified.

APPENDIX A - OUTPUT POWER

TEST DATA:

WCDMA Band2	Max. Tune-up Power	Conducted power			EIRP		
Tx Channel		9262	9400	9538	9262	9400	9538
Frequency		1852.4MHZ	1880MHz	1907.6MHz	1852.4MHZ	1880MHz	1907.6MHz
RMC 12.2K	24+1/-3	22.58	23.03	22.95	23.01	23.46	23.38
RMC 64K	24+1/-3	22.63	22.98	22.96	23.06	23.41	23.39
RMC 144K	24+1/-3	22.62	22.97	22.93	23.05	23.40	23.36
RMC 384K	24+1/-3	22.63	22.96	22.98	23.06	23.39	23.41
HSDPA+ Subtest-1	24+1/-3	22.30	22.28	22.32	22.73	22.71	22.75
HSDPA+ Subtest-2	24+1/-3	22.30	22.31	22.33	22.73	22.74	22.76
HSDPA+ Subtest-3	24+1/-3	21.84	21.83	21.90	22.27	22.26	22.33
HSDPA+ Subtest-4	24+1/-3	21.83	21.82	21.91	22.26	22.25	22.34
HSUPA Subtest-1	24+1/-3	22.21	22.25	22.23	22.64	22.68	22.66
HSUPA Subtest-2	24+1/-3	21.74	21.71	21.73	22.17	22.14	22.16
HSUPA Subtest-3	24+1/-3	22.41	22.34	22.32	22.84	22.77	22.75
HSUPA Subtest-4	24+1/-3	22.23	22.30	22.33	22.66	22.73	22.76
HSUPA Subtest-5	24+1/-3	22.41	22.28	22.40	22.84	22.71	22.83

WCDMA Band4	Max. Tune-up Power	Conducted power			EIRP		
Tx Channel		1312	1413	1513	1312	1413	1513
Frequency		1712.4 MHz	1732.6 MHz	1752.6 MHz	1712.4 MHz	1732.6 MHz	1752.6 MHz
RMC 12.2K	24+1/-3	23.98	23.32	24.01	27.03	26.37	27.06
RMC 64K	24+1/-3	23.53	23.22	23.97	26.58	26.27	27.02
RMC 144K	24+1/-3	23.46	23.16	23.95	26.51	26.21	27.00
RMC 384K	24+1/-3	23.46	23.13	23.95	26.51	26.18	27.00
HSDPA+ Subtest-1	24+1/-3	23.10	23.15	22.99	26.15	26.20	26.04
HSDPA+ Subtest-2	24+1/-3	23.20	23.31	23.17	26.25	26.36	26.22
HSDPA+ Subtest-3	24+1/-3	22.73	22.79	22.73	25.78	25.84	25.78
HSDPA+ Subtest-4	24+1/-3	22.73	22.80	22.60	25.78	25.85	25.65
HSUPA Subtest-1	24+1/-3	23.94	23.82	23.93	26.99	26.87	26.98
HSUPA Subtest-2	24+1/-3	23.91	23.90	23.92	26.96	26.95	26.97
HSUPA Subtest-3	24+1/-3	23.90	23.84	23.89	26.95	26.89	26.94
HSUPA Subtest-4	24+1/-3	23.90	23.91	23.87	26.95	26.96	26.92
HSUPA Subtest-5	24+1/-3	23.91	23.85	23.87	26.96	26.90	26.92

APPENDIX B - OCCUPIED BANDWIDTH

TEST DATA:

WCDMA BAND2 (Part 24E)			
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)	-26dB occupied bandwidth (MHz)
9262	1852.4	4.130	4.687
9400	1880.0	4.127	4.707
9538	1907.6	4.126	4.682

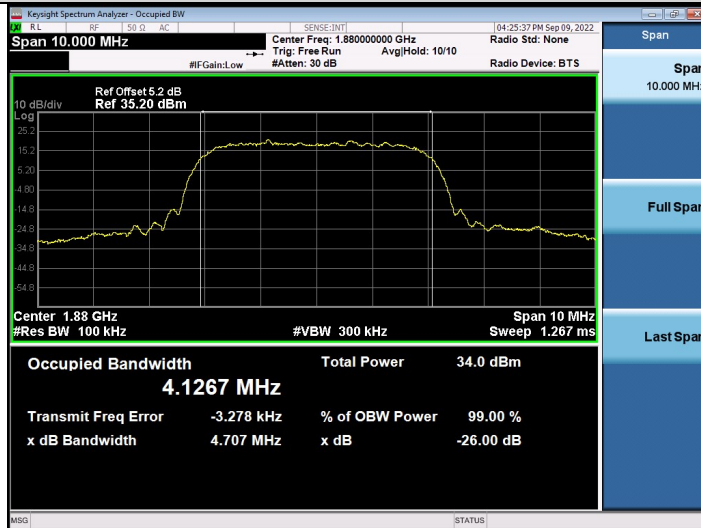
WCDMA BAND4 (Part 27)			
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)	-26dB occupied bandwidth (MHz)
1312	1712.4	4.122	4.705
1413	1732.6	4.116	4.688
1513	1752.6	4.126	4.706

TEST GRAPHS

WCDMA BAND2-Channel 9262



WCDMA BAND2-Channel 9400



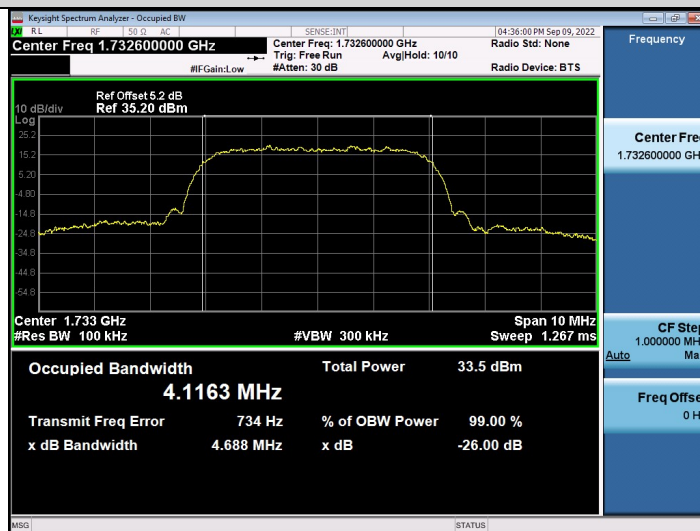
WCDMA BAND2-Channel 9538



WCDMA BAND4-Channel 1312



WCDMA BAND4-Channel 1413



WCDMA BAND4-Channel 1513



APPENDIX C - CONDUCTED EMISSIONS

TEST DATA:

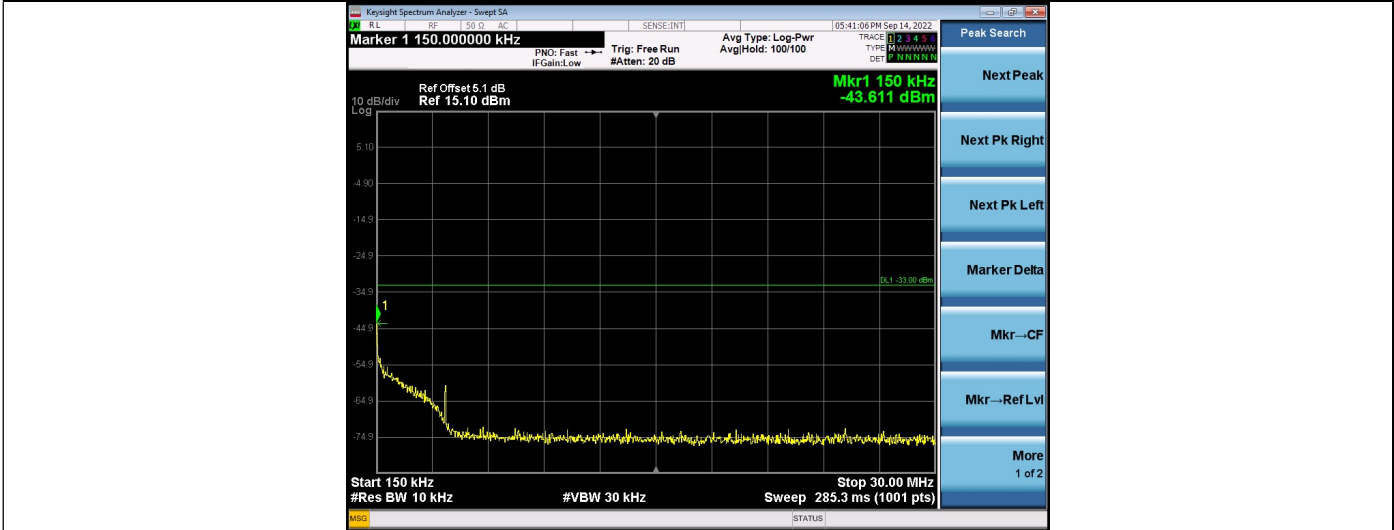
Band	Channel	Frequency Range	Frequency (MHz)	Result (dBm)	Limit (dBm)	Verdict
WCDMA BAND2	9400	0.009~0.15MHz	0.0193	-50.687	-43	PASS
WCDMA BAND2	9400	0.15~30MHz	0.15	-43.611	-33	PASS
WCDMA BAND2	9400	30~20000MHz	17843.0	-39.313	-13	PASS
WCDMA BAND4	1413	0.009~0.15MHz	0.038	-49.207	-43	PASS
WCDMA BAND4	1413	0.15~30MHz	0.15	-45.384	-33	PASS
WCDMA BAND4	1413	30~20000MHz	3465.0	-38.292	-13	PASS

TEST GRAPHS

WCDMA BAND2 Channel 9400-0.009~0.15MHz



WCDMA BAND2 Channel 9400-0.15~30MHz



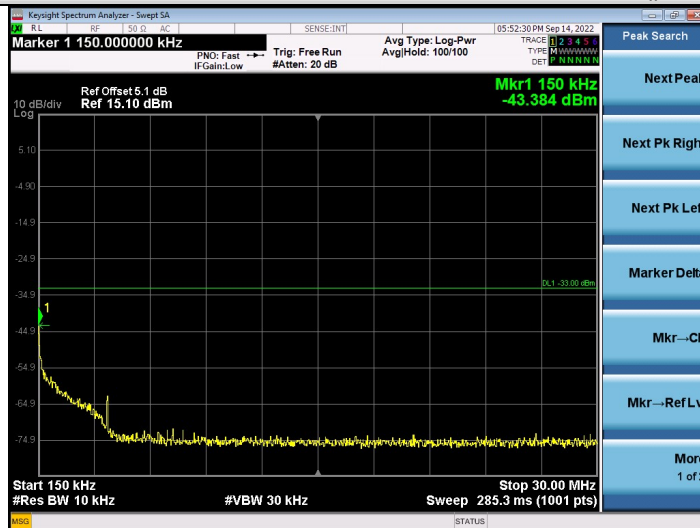
WCDMA BAND2 Channel 9400-30~20000MHz



WCDMA BAND4 Channel 1413-0.009~0.15MHz



WCDMA BAND4 Channel 1413-0.15~30MHz()



WCDMA BAND4 Channel 1413-30~20000MHz



APPENDIX D - RADIATED EMISSION (9KHz TO 30MHz)

Test Mode:	WCDMA TX Mode
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The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

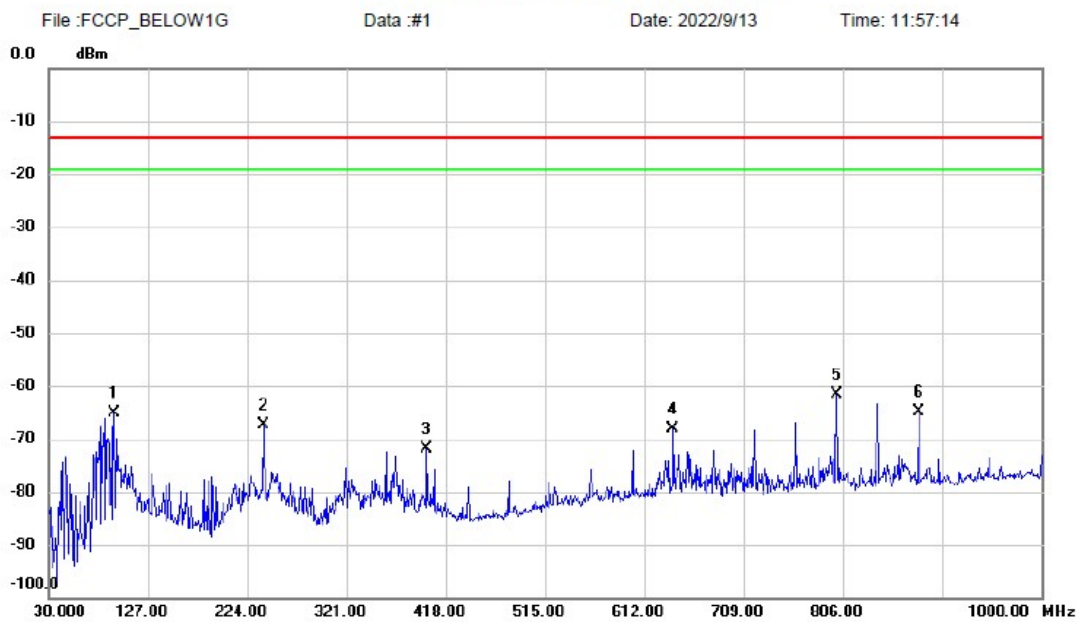
APPENDIX E - RADIATED EMISSION (30MHZ-1GHZ)

- Note: 1. Emissions attenuated more than 20 dB below the permissible value are not reported.
- 2. The EUT is tested radiation emission at each test mode in three axes. The worst emissions are reported in all test mode and channels.
- 3. Measurement = Reading + Correct Factor
Over = Measurement – Limit.
- 4. The EUT is tested radiation emission at each test mode (RMC mode, HSDPA+ mode and HSUPA mode) in three axes. The worst case emission(the RMC mode) are reflected in the following form.

Test Mode:	WCDMA BAND2 TX Mode
------------	---------------------

Site: SH-CB02	Polarization: Vertical	Temperature: 24 (C)
Limit: FCC PART 24 EMISSION	Power: DC 3.8V	Humidity: 58 %
EUT: LTE Module	Distance: 3m	
M/N: TOBY-L3414	Mode: TX_WCDMA_B2	
Note:		

Radiated Emission Measurement

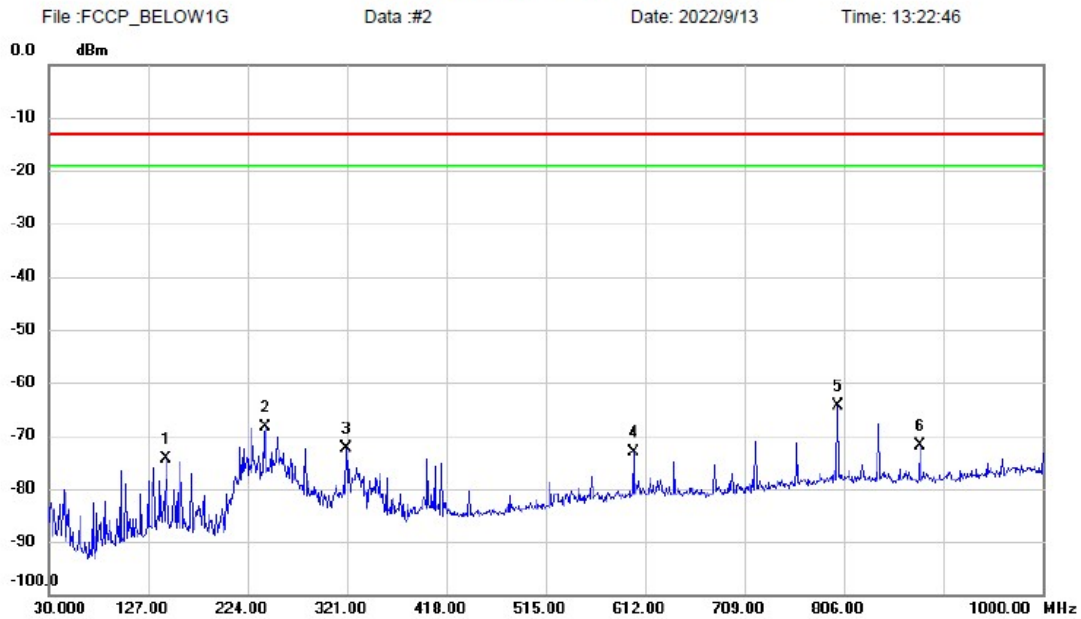


No.	Mk.	Freq. MHz	Reading Level dBm	Correct Factor dB	Measure- ment dBm	Limit dBm	Margin dB	Detector	Comment
1		94.0200	-63.24	-2.00	-65.24	-13.00	-52.24	RMS	
2		239.5200	-61.77	-5.49	-67.26	-13.00	-54.26	RMS	
3		399.5700	-70.30	-1.55	-71.85	-13.00	-58.85	RMS	
4		640.1300	-69.97	1.95	-68.02	-13.00	-55.02	RMS	
5	*	800.1800	-65.15	3.44	-61.71	-13.00	-48.71	RMS	
6		879.7200	-68.81	3.99	-64.82	-13.00	-51.82	RMS	

Test Mode:	WCDMA BAND2 TX Mode
------------	---------------------

Site: SH-CB02	Polarization: Horizontal	Temperature: 24 (C)
Limit: FCC PART 24 EMISSION	Power: DC 3.8V	Humidity: 58 %
EUT: LTE Module	Distance: 3m	
M/N: TOBY-L3414	Mode: TX_WCDMA_B2	
Note:		

Radiated Emission Measurement

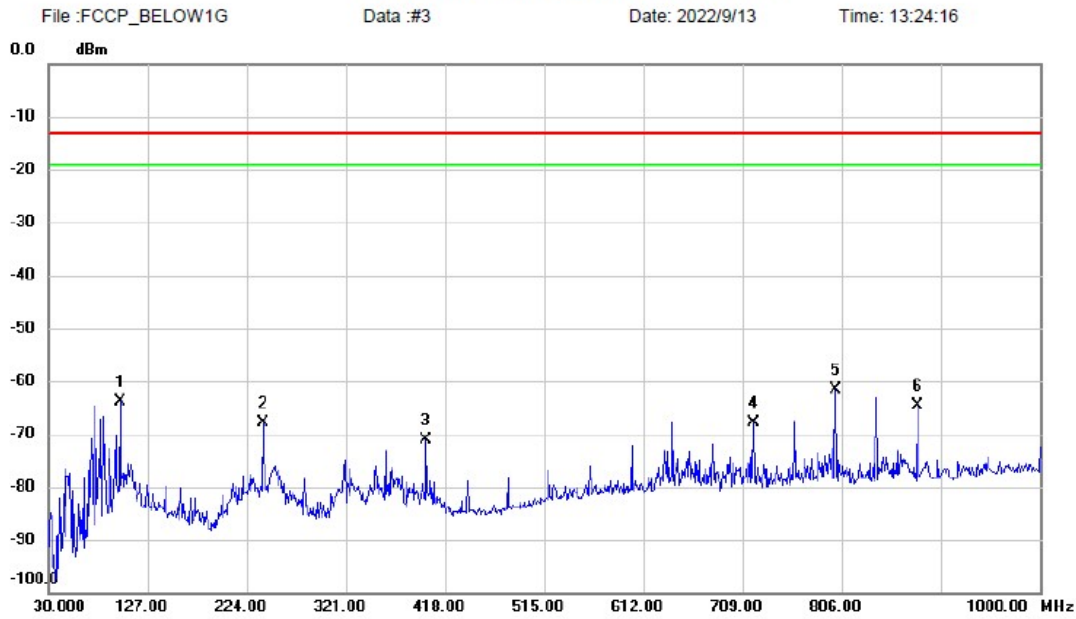


No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Margin	Detector	Comment
		MHz	dBm	dB	dBm	dBm	dB		
1		144.4600	-69.05	-5.41	-74.46	-13.00	-61.46	RMS	
2		241.4600	-64.57	-3.91	-68.48	-13.00	-55.48	RMS	
3		320.0300	-69.61	-2.81	-72.42	-13.00	-59.42	RMS	
4		600.3600	-74.99	1.95	-73.04	-13.00	-60.04	RMS	
5	*	800.1800	-68.67	4.28	-64.39	-13.00	-51.39	RMS	
6		879.7200	-76.13	4.24	-71.89	-13.00	-58.89	RMS	

Test Mode: WCDMA BAND4 TX Mode

Site: SH-CB02 Polarization: *Vertical* Temperature: 24 (C)
 Limit: FCC PART 27 EMISSION Power: DC 3.8V Humidity: 58 %
 EUT: LTE Module Distance: 3m
 M/N: TOBY-L3414 Mode: TX_WCDMA_B4
 Note:

Radiated Emission Measurement

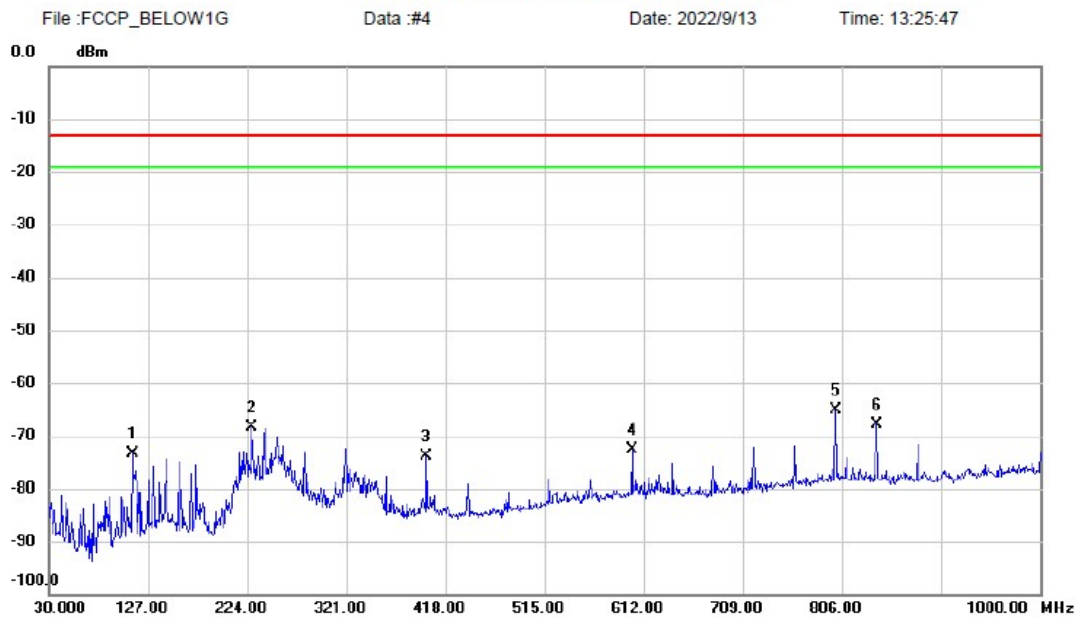


No.	Mk.	Freq. MHz	Reading Level dBm	Correct Factor dB	Measure- ment dBm	Limit dBm	Margin dB	Detector	Comment
1		99.8400	-64.26	0.38	-63.88	-13.00	-50.88	RMS	
2		239.5200	-62.43	-5.49	-67.92	-13.00	-54.92	RMS	
3		399.5700	-69.64	-1.55	-71.19	-13.00	-58.19	RMS	
4		719.6700	-70.53	2.61	-67.92	-13.00	-54.92	RMS	
5	*	800.1800	-65.00	3.44	-61.56	-13.00	-48.56	RMS	
6		879.7200	-68.56	3.99	-64.57	-13.00	-51.57	RMS	

Test Mode: WCDMA BAND4 TX Mode

Site: SH-CB02 Polarization: *Horizontal* Temperature: 24 (C)
 Limit: FCC PART 27 EMISSION Power: DC 3.8V Humidity: 58 %
 EUT: LTE Module Distance: 3m
 M/N: TOBY-L3414 Mode: TX_WCDMA_B4
 Note:

Radiated Emission Measurement



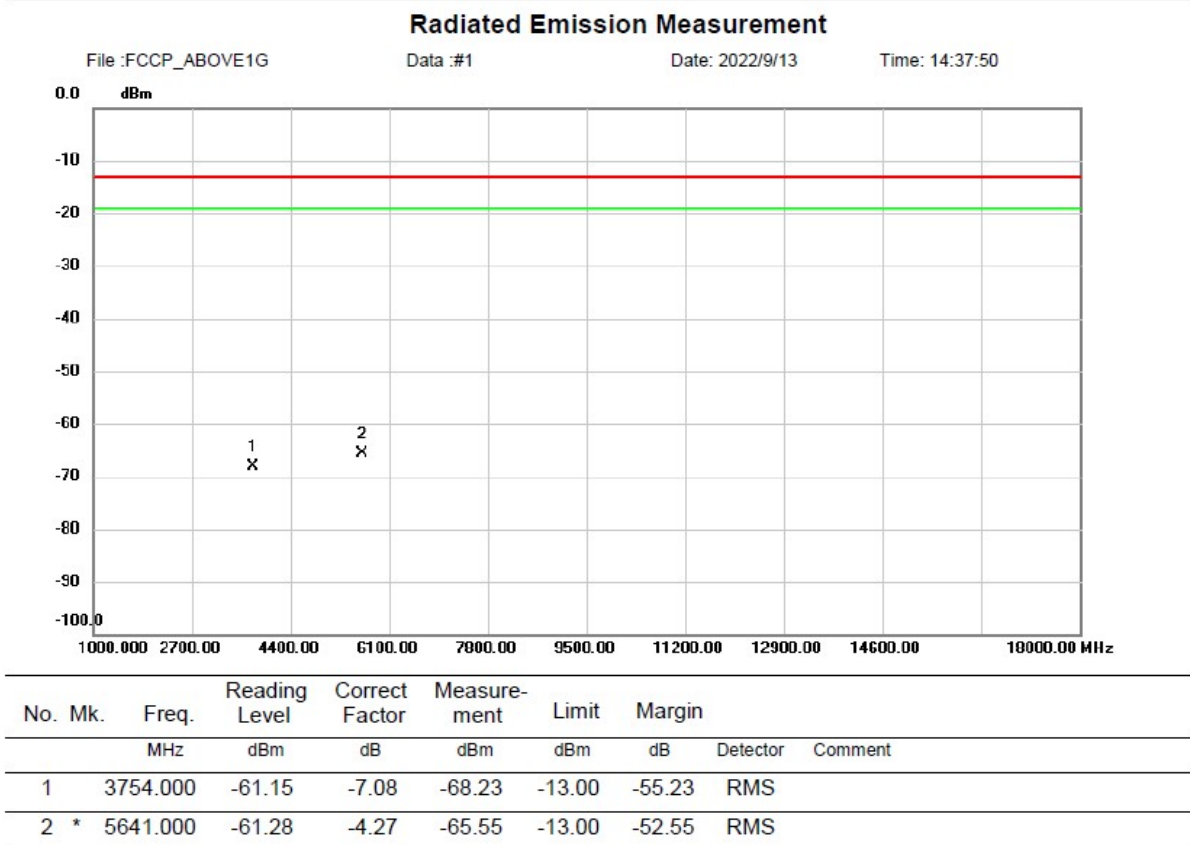
No.	Mk.	Freq. MHz	Reading Level dBm	Correct Factor dB	Measure- ment dBm	Limit dBm	Margin dB	Detector	Comment
1		111.4800	-65.16	-8.10	-73.26	-13.00	-60.26	RMS	
2		228.8500	-63.70	-4.66	-68.36	-13.00	-55.36	RMS	
3		399.5700	-72.15	-1.76	-73.91	-13.00	-60.91	RMS	
4		600.3600	-74.67	1.95	-72.72	-13.00	-59.72	RMS	
5	*	800.1800	-69.32	4.28	-65.04	-13.00	-52.04	RMS	
6		839.9500	-72.12	4.22	-67.90	-13.00	-54.90	RMS	

APPENDIX F - RADIATED EMISSION (ABOVE 1GHZ)

- Note: 1. Emissions attenuated more than 20 dB below the permissible value are not reported (For example: 18-20GHz).
2. The EUT is tested radiation emission at each test mode in three axes. The worst emissions are reported in all test mode and channels.
3. Measurement = Reading + Correct Factor
 Over = Measurement – Limit.
4. The EUT is tested radiation emission at each test mode (RMC mode, HSDPA+ mode and HSUPA mode) in three axes. The worst case emission(the RMC mode) are reflected in the following form.

Test Mode:	WCDMA BAND2 TX Mode
------------	---------------------

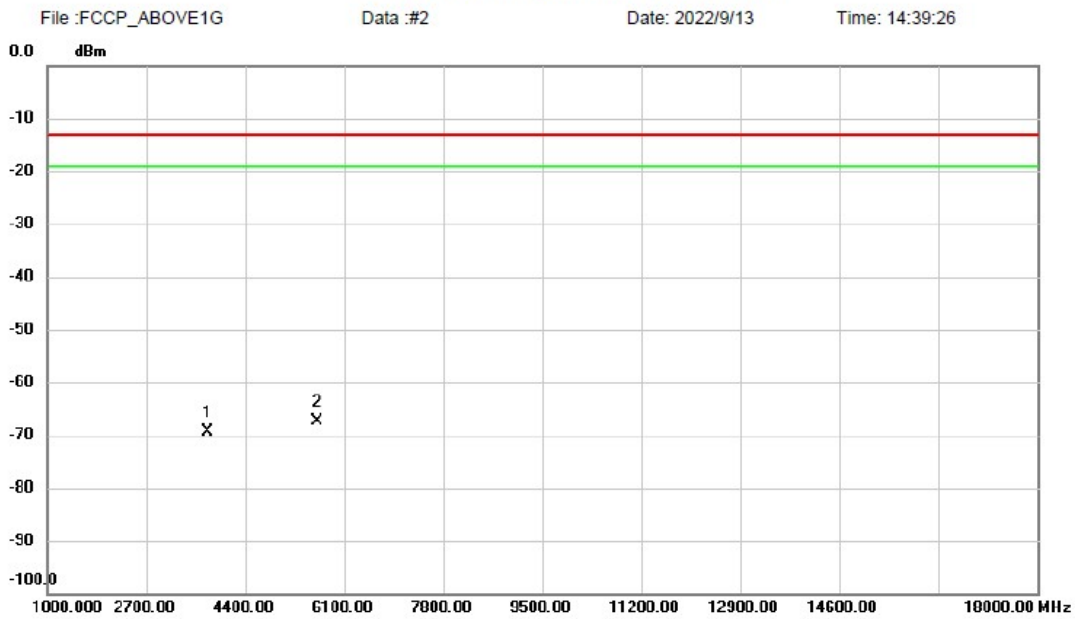
Site: SH-CB02	Polarization: Vertical	Temperature: 24 (C)
Limit: FCC PART 24 EMISSION	Power: DC 3.8V	Humidity: 58 %
EUT: LTE Module	Distance: 3m	
M/N: TOBY-L3414	Mode: TX_WCDMA_B2	
Note:		



Test Mode: WCDMA BAND2 TX Mode

Site: SH-CB02 Polarization: *Horizontal* Temperature: 24 (C)
 Limit: FCC PART 24 EMISSION Power: DC 3.8V Humidity: 58 %
 EUT: LTE Module Distance: 3m
 M/N: TOBY-L3414 Mode: TX_WCDMA_B2
 Note:

Radiated Emission Measurement

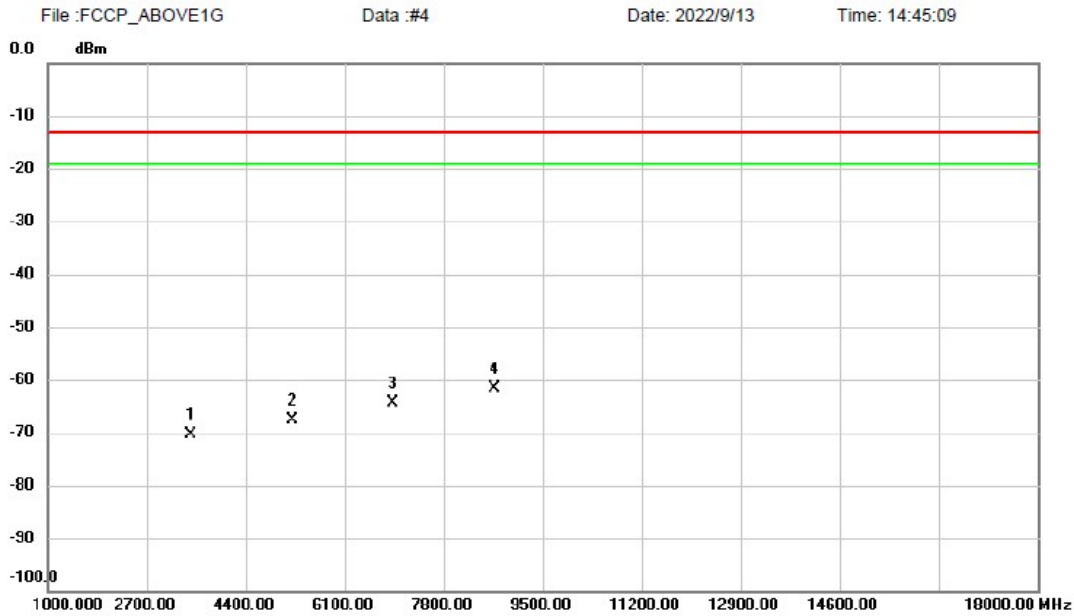


No. Mk.	Freq. MHz	Reading Level dBm	Correct Factor dB	Measurement dBm	Limit dBm	Margin dB	Detector	Comment
1	3754.000	-62.56	-6.89	-69.45	-13.00	-56.45	RMS	
2 *	5641.000	-63.25	-4.19	-67.44	-13.00	-54.44	RMS	

Test Mode:	WCDMA BAND4 TX Mode
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Site: SH-CB02	Polarization: <i>Horizontal</i>	Temperature: 24 (C)
Limit: FCC PART 27 EMISSION	Power: DC 3.8V	Humidity: 58 %
EUT: LTE Module	Distance: 3m	
M/N: TOBY-L3414	Mode: TX_WCDMA_B4	
Note:		

Radiated Emission Measurement



No. Mk.	Freq. MHz	Reading Level dBm	Correct Factor dB	Measurement dBm	Limit dBm	Margin dB	Detector	Comment
1	3465.000	-62.17	-8.12	-70.29	-13.00	-57.29	RMS	
2	5199.000	-63.29	-4.23	-67.52	-13.00	-54.52	RMS	
3	6933.000	-63.29	-1.12	-64.41	-13.00	-51.41	RMS	
4 *	8667.000	-61.88	0.20	-61.68	-13.00	-48.68	RMS	

APPENDIX G - BAND EDGE

WCDMA BAND2 (Part 24E)

Mode	Frequency (MHz)	Emission (dBm)	Limit (dBm)	Verdict
WCDMA BAND2	1852.400	-14.065	-13	PASS
	1907.600	-14.293	-13	PASS

WCDMA BAND4 (Part 27)

Mode	Frequency (MHz)	Emission (dBm)	Limit (dBm)	Verdict
WCDMA BAND4	1712.4	-14.331	-13	PASS
	1752.600	-13.949	-13	PASS

Note: The offset on the picture below = The loss of test cable+Splitter.

TEST GRAPHS

WCDMA BAND2 Low Channel



WCDMA BAND2 High Channel



WCDMA BAND4 Low Channel



WCDMA BAND4 High Channel

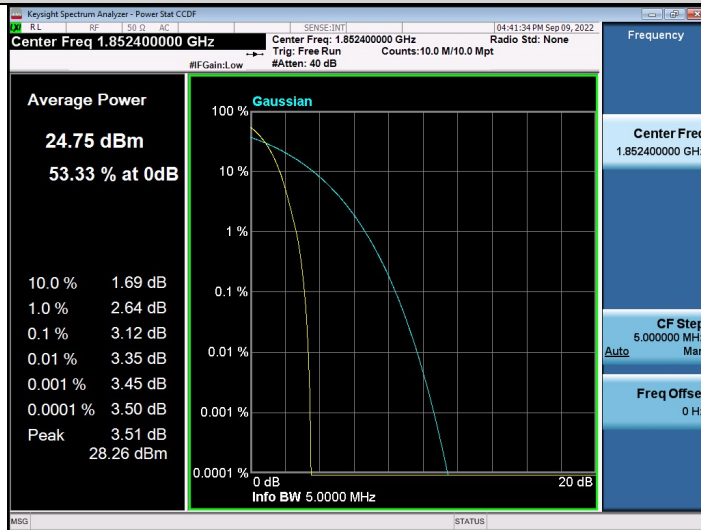


APPENDIX H - PEAK TO AVERAGE RATIO

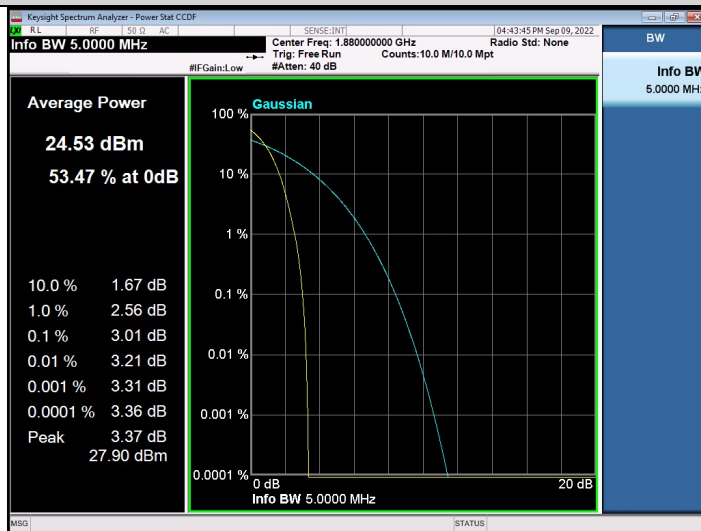
Mode	CHANNEL	Frequency (MHz)	PEAK TO AVERAGE RATIO (dB)	Limit(dB)	Verdict
WCDMA BAND2	9262	1852.4	3.12	13	PASS
WCDMA BAND2	9400	1880	3.01	13	PASS
WCDMA BAND2	9538	1907.6	3.17	13	PASS
WCDMA BAND4	1312	1712.4	3.12	13	PASS
WCDMA BAND4	1413	1732.6	3.38	13	PASS
WCDMA BAND4	1513	1752.6	3.28	13	PASS

TEST GRAPHS

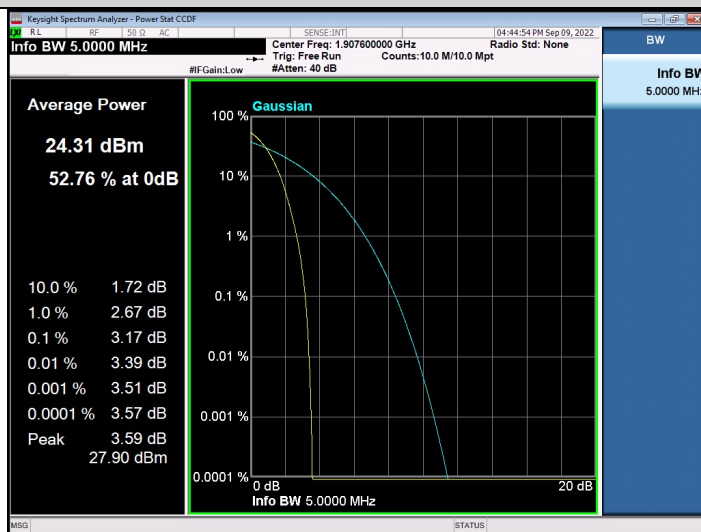
WCDMA BAND2-Channel 9262



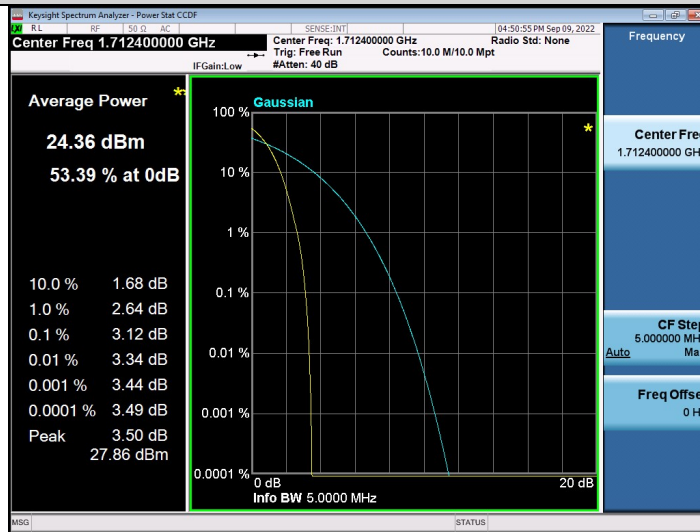
WCDMA BAND2-Channel 9400



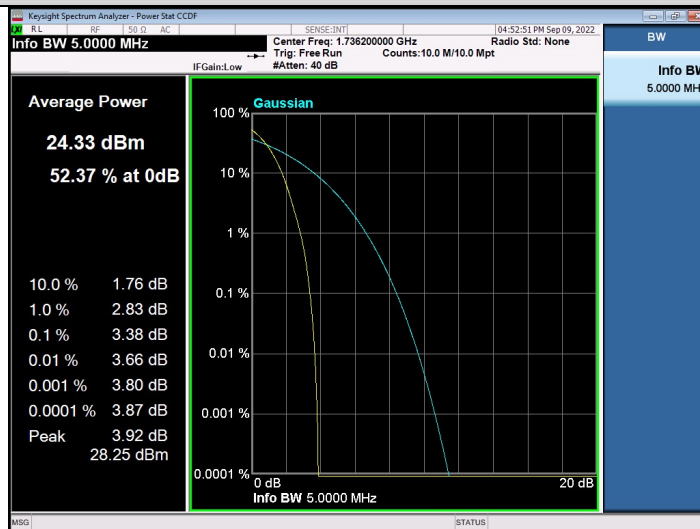
WCDMA BAND2-Channel 9538



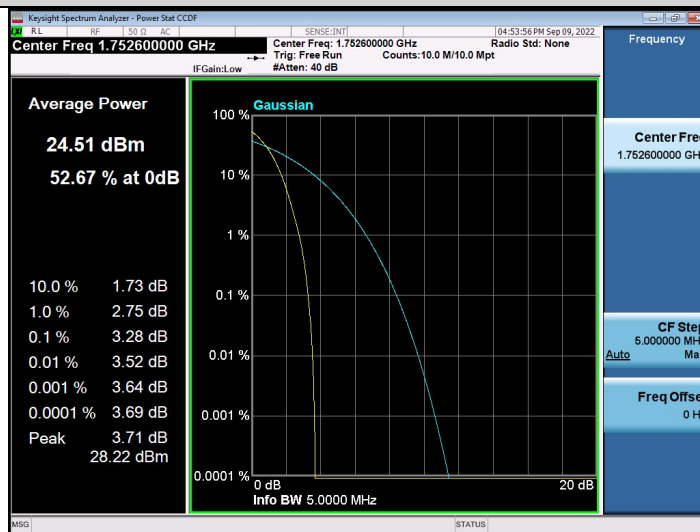
WCDMA BAND4-Channel 1312



WCDMA BAND4-Channel 1413



WCDMA BAND4-Channel 1513



APPENDIX I - FREQUENCY STABILITY

WCDMA BAND2				
Channel:	9400	Frequency:	1880MHz	
Temperature vs. Frequency Stability				
Temperature(°C)	Frequency Error (Hz)	Frequency Error (ppm)	Limit(ppm)	
-35	4.32	0.002297872	±2.5	
-30	5.22	0.002776596		
-20	-7.55	0.004015957		
-10	3.89	0.002069149		
0	-4.67	0.002484043		
10	5.42	0.002882979		
20	-2.96	0.001574468		
30	-4.32	0.002297872		
40	-5.22	0.002776596		
50	-5.10	0.002712766		
60	-3.25	0.001728723		
70	-5.69	0.003026596		
75	-3.76	0.002		
Max. Deviation (ppm)	5.42	0.004015957		

Voltage vs. Frequency Stability			
Voltage(Volts)	Frequency Error (Hz)	Frequency Error (ppm)	Limit(ppm)
4.5	-5.20	0.002765957	±2.5
3.8	-6.22	0.003308511	
3.4	2.85	0.001515957	
Max. Deviation (ppm)	6.22	0.003308511	

WCDMA BAND4			
Channel:	1413	Frequency:	1732.6MHz
Temperature vs. Frequency Stability			
Temperature(°C)	Frequency Error (Hz)	Frequency Error (ppm)	Limit(ppm)
-35	-4.27	0.002464504	±2.5
-30	-5.22	0.003012813	
-20	-7.35	0.004242179	
-10	-5.34	0.003082073	
0	-4.49	0.002591481	
10	5.67	0.003272538	
20	7.85	0.004530763	
30	2.24	0.001292855	
40	-3.65	0.002106661	
50	5.19	0.002995498	
60	-6.22	0.00358998	
70	6.84	0.003947824	
75	-4.18	0.002412559	
Max. Deviation (ppm)	7.85	0.004530763	

Voltage vs. Frequency Stability			
Voltage(Volts)	Frequency Error (Hz)	Frequency Error (ppm)	Limit(ppm)
4.5	-5.29	0.003053215	±2.5
3.8	-6.39	0.003688099	
3.4	-6.52	0.003763131	
Max. Deviation (ppm)	6.52	0.003763131	

End of Test Report