FCC Radio Test Report

FCC ID: ZMOSC138NA

This report concerns: Original Grant

Project No.	:	2111C042
Equipment	:	LTE Module
Brand Name	:	Fibocom
Test Model	:	SC138-NA
Series Model	:	N/A
Applicant	:	Fibocom Wireless Inc.
Address	:	1101,Tower A, Building 6, Shenzhen International Innovation Valley, Dashi 1st Rd, Nanshan,Shenzhen,China
Manufacturer	:	Fibocom Wireless Inc.
Address	:	1101,Tower A, Building 6, Shenzhen International Innovation Valley, Dashi 1st Rd, Nanshan,Shenzhen,China
Factory	:	Huizhou HYE Technology Co., Ltd.
Address	:	No. 237, Sanhe group, Sanhe village, Tonghu Town, Zhongkai hi tech Zone, Huizhou
Date of Receipt	:	Nov. 03, 2021
Date of Test	:	Nov. 15, 2021 ~ Dec. 06, 2021
Issued Date	:	Dec. 23, 2021
Report Version	:	R01
Test Sample	:	Engineering Sample No.: DG20211115162
Standard(s)	:	42 CFR Part 2 96 ANSI/TIA-603-E ANSI C63.26-2015 FCC KDB 971168 D01 Power Meas License Digital Systems v03r01 FCC KDB 940660 D01 Part 96 CBRS Eqpt v03

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

Edward Li

Prepared by : Edward Li

Steven Lu

Approved by : Steven Lu

TESTING CERT #5123.02

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Declaration

BTL represents to the client that testing is done in accordance with standard procedures as applicable and that test instruments used has been calibrated with standards traceable to international standard(s) and/or national standard(s).

BTL's reports apply only to the specific samples tested under conditions. It is manufacture's responsibility to ensure that additional production units of this model are manufactured with the identical electrical and mechanical components. **BTL** shall have no liability for any declarations, inferences or generalizations drawn by the client or others from **BTL** issued reports.

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BTL's laboratory quality assurance procedures are in compliance with the **ISO/IEC 17025** requirements, and accredited by the conformity assessment authorities listed in this test report.

BTL is not responsible for the sampling stage, so the results only apply to the sample as received.

The information, data and test plan are provided by manufacturer which may affect the validity of results, so it is manufacturer's responsibility to ensure that the apparatus meets the essential requirements of applied standards and in all the possible configurations as representative of its intended use.

Limitation

For the use of the authority's logo is limited unless the Test Standard(s)/Scope(s)/Item(s) mentioned in this test report is (are) included in the conformity assessment authorities acceptance respective.
Please note that the measurement Uncertainty are provided for informational purpose only and are not use in determining the Pass/Fail results.

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REPORT ISSUED HISTORY

Report Version	Description	Issued Date
R00	Original Issue.	Dec. 15, 2021
R01	Modified the comments of TCB.	Dec. 23, 2021

1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standard(s):

FCC Part 96 & Part 2			
Standard(s) Section	Test Item	Judgment	Remark
96.41(b)	Equivalent Isotropic Radiated	PASS	------
2.1046	Conducted Output Power	PASS	------
2.1049	Occupied Bandwidth	PASS	------
2.1051& 96.41(e)	Conducted Spurious Emissions	PASS	------
2.1053 & 96.41(e)	Radiated Spurious Emissions	PASS	------
2.1051 & 96.41(e)	Band Edge Measurements&ACLR	PASS	------
2.1055	Frequency Stability for Temperature & Voltage	PASS	------
96.41(g)	Peak To Average Ratio	PASS	------

Note:

(1)" N/A" denotes test is not applicable to this device.

1.1 TEST FACILITY

The test facilities used to collect the test data of radiated in this report is at the location of No. 3 Jinshagang 1st Rd. Shixia, Dalang Town, Dongguan City, Guangdong, People's Republic of China.

The test facilities used to collect the test data of conduted in this report is at the location of Room 108, Building 2, No.1, Yile Road, Songshan Lake Zone, Dongguan City, Guangdong, People's Republic of China.
BTL's Test Firm Registration Number for FCC: 357015
BTL's Designation Number for FCC: CN1240

1.2 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 BTL measurement uncertainty as below table:

A. Radiated Measurement:

Test Site	Method	Measurement Frequency Range	U,(dB)
DG-CB01	CISPR	9kHz ~ 30MHz	2.36

Test Site	Method	Measurement Frequency Range	Ant. H / V	U,(dB)
DG-CB03	CISPR	30MHz ~ 200MHz	V	4.36
		30MHz ~ 200MHz	H	3.32
		200MHz ~ 1,000MHz	V	4.08
		200MHz ~ 1,000MHz	H	3.96
		1GHz ~ 6GHz	-	3.80
		6GHz ~ 18GHz	-	4.82
		18 GHz ~ 26.5 GHz	-	3.62
		26.5 GHz ~ 40 GHz	-	4.00

B. Other Measurement:

Parameter	Uncertainty
Spectrum Bandwidth	±3.8 %
Maximum Output Power	±0.95 dB
Power Spectral Density	±0.86 dB
Frequency Stability	±0.16 dB
Temperature	±0.08 °C
Time	±0.58 %
Supply voltages	±0.3 %

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

1.3TEST ENVIRONMENT CONDITIONS

Test Item	Temperature	Humidity	Test Voltage	Tested By
Output Power & EIRP	24°C	57%	DC 3.8V	Rick Liao
Occupied Bandwidth	24°C	57%	DC 3.8V	Rick Liao
Conducted Spurious Emissions	24°C	57%	DC 3.8V	Rick Liao
Radiated Spurious Emissions	22°C	55%	DC 3.8V	Kwok Guo
Band Edge	24°C	57%	DC 3.8V	Rick Liao
Peak to Average Ratio	24°C	57%	DC 3.8V	Rick Liao
Frequency Stability	Normal and Extreme			Rick Liao

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

Equipment	LTE Module				
Brand Name	Fibocom				
Test Model	SC138-NA				
Series Model	N/A				
Model Difference(s)	N/A				
Hardware Version	SC138-NA				
Software Version	SC138-NA-Q62.00.104				
Power Source	DC Voltage supplied from external power supply.				
Power Rating	DC 3.5V ~ 4.2V				
IEMI No.	866280050002329				
Modulation Type	LTE		UL: QPSK,16QAM,64QAM DL: QPSK,16QAM,64QAM		
Max. EIRP	LTE	Channel Bandwidth (MHz)	QPSK (dBm)	16QAM (dBm)	64QAM (dBm)
	Band 48	5	23.77	23.05	21.87
		10	23.66	23.06	21.85
		15	23.76	23.07	21.86
		20	23.82	23.13	21.94

Note:

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

2. The Channel List:

LTE Band 48			
Test Frequency ID	Bandwidth (MHz)	EARFCN	Frequency (UL and DL) (MHz)
Low Range	5	55265	3552.5
	10	55290	3555.0
	15	55315	3557.5
	20	55340	3560.0
Mid Range	5/10/15/20	55990	3625.0
High Range	5	56715	3697.5
	10	56690	3695.0
	15	56665	3692.5
	20	56640	3690.0

3. Table for Filed Antenna:

Brand	Model Name	Antenna Type	Connector	Gain (dBi)	Note
N/A	N/A	Dipole	SMA	-0.13	LTE Band 48

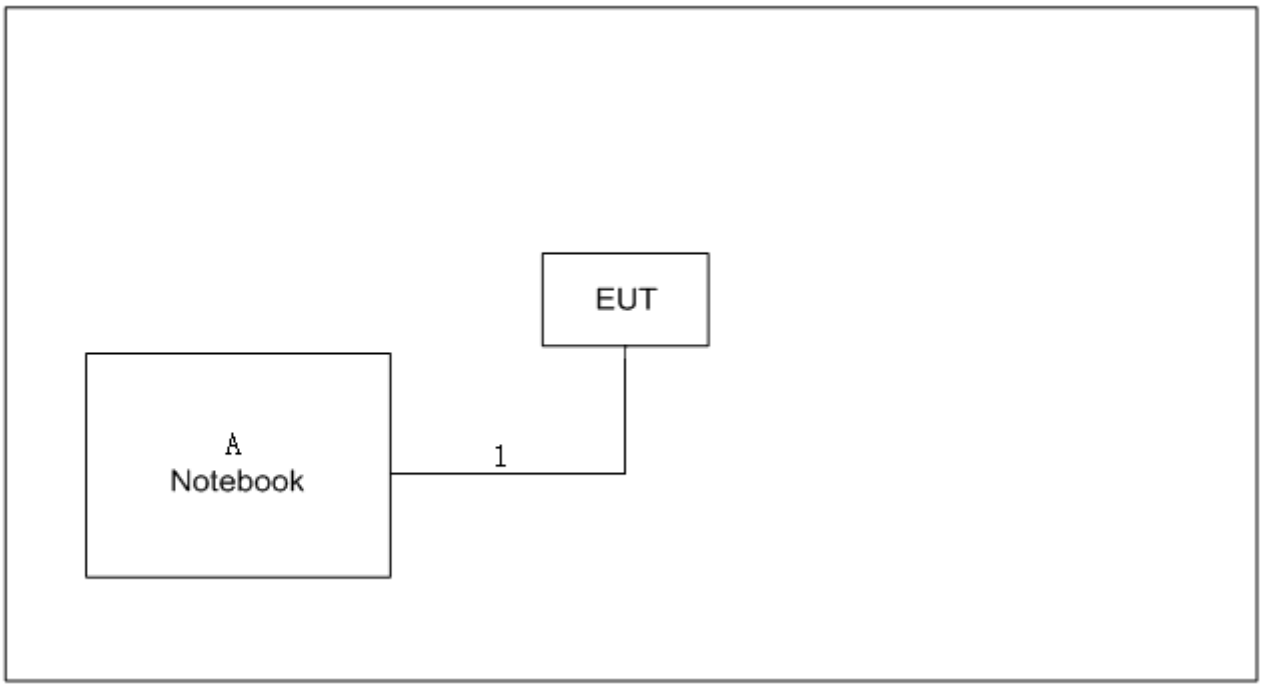
Note: The antenna gain is provided by the manufacturer.

2.2 DESCRIPTION OF TEST MODES AND TEST CONDITION

Following mode(s) was (were) found to be the worst case(s) and selected for the final test:

LTE BAND 48 MODE					
Test Item	Available Channel	Tested Channel	Channel Bandwidth	Modulation	Mode
Output Power & EIRP	55265 to 56715	55265, 55990, 56715	5MHz	QPSK, 16QAM, 64QAM	1RB/12RB/25RB
	55290 to 56690	55290, 55990, 56690	10MHz	QPSK, 16QAM, 64QAM	1RB/25RB/50RB
	55315 to 56665	55315, 55990, 56665	15MHz	QPSK, 16QAM, 64QAM	1RB/36RB/75RB
	55340 to 56640	55340, 55990, 56640	20MHz	QPSK, 16QAM, 64QAM	1RB/50RB/100RB
Occupied Bandwidth	55265 to 56715	55265, 55990, 56715	5MHz	QPSK, 16QAM, 64QAM	25RB
	55290 to 56690	55290, 55990, 56690	10MHz	QPSK, 16QAM, 64QAM	50RB
	55315 to 56665	55315, 55990, 56665	15MHz	QPSK, 16QAM, 64QAM	75RB
	55340 to 56640	55340, 55990, 56640	20MHz	QPSK, 16QAM, 64QAM	100RB
Conducted Spurious Emissions	55265 to 56715	55990	5MHz	QPSK	1RB
	55290 to 56690	55990	20MHz	QPSK	1RB
Radiated Spurious Emissions	55315 to 56665	55990	5MHz	QPSK	1RB
	55340 to 56640	55990	20MHz	QPSK	1RB
Band Edge& ACLR	55265 to 56715	55265, 55990, 56715	5MHz	QPSK	1RB/24RB/25RB
	55290 to 56690	55290, 55990, 56690	10MHz	QPSK	1RB/49RB/50RB
	55315 to 56665	55315, 55990, 56665	15MHz	QPSK	1RB/74RB/75RB
	55340 to 56640	55340, 55990, 56640	20MHz	QPSK	1RB/99RB/100RB
Peak To Average Ratio	55265 to 56715	55265, 55990, 56715	5MHz	QPSK, 16QAM, 64QAM	1RB
	55290 to 56690	55290, 55990, 56690	10MHz	QPSK, 16QAM, 64QAM	1RB
	55315 to 56665	55315, 55990, 56665	15MHz	QPSK, 16QAM, 64QAM	1RB
	55340 to 56640	55340, 55990, 56640	20MHz	QPSK, 16QAM, 64QAM	1RB
Frequency Stability for Temperature & Voltage	55340 to 56640	55340, 56640	20MHz	QPSK	1RB

2.3 BLOCK DIGRAM SHOWING THECONFIGURATION OF SYSTEM TESTED



2.4 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.
A	Notebook	Lenovo	V310-14ISK	LR07GZNB

Item	Cable Type	Shielded Type	Ferrite Core	Length
1	USB Cable	NO	NO	0.8m

3. TEST RESULT

3.1 OUTPUT POWER & EIRP MEASUREMENT

3.1.1 LIMIT

EIRP for CBRS equipment as below table:

Device	Maximum EIRP (dBm/10 MHz)
End User Device	23
Category A CBSD	30
Category B CBSD	47

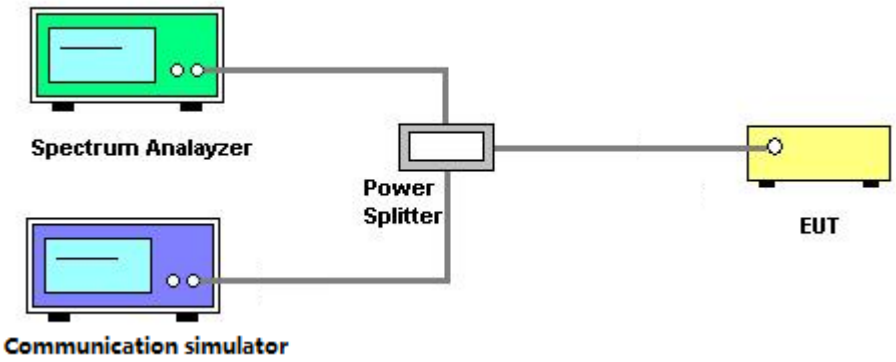
3.1.2 TEST PROCEDURE

The testing follows ANSI C63.26-2015 Section 5.2.4.4.2
Conducted Output Power:
The EUT can operate with a constant duty cycle.
a) Set span to 2 × to 3 × the OBW.
b) Set RBW = 1% to 5% of the OBW.
c) Set VBW ⩾ 3 × RBW.
d) Set number of measurement points in sweep ⩾ 2 × span / RBW.
e) Sweep time:
1) Set = auto-couple, or
2) Set ⩾ [10 × (number of points in sweep) × (transmission symbol period)] for single sweep (automation-compatible) measurement.
f) Detector = power averaging (rms).
g) Set sweep trigger to “free run.”
h) Trace average at least 100 traces in power averaging (rms) mode if sweep is set to auto-couple. To accurately determine the average power over the on and off time of the transmitter, it can be necessary to increase the number of traces to be averaged above 100, or if using a manually configured sweep time, increase the sweep time.
i) Compute power by integrating the spectrum across the OBW of the signal using the instrument’s band or channel power measurement function with band/channel limits set equal to the OBW band edges. If the instrument does not have a band or channel power function, sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.
j) Add 10 log (1/duty cycle) to the measured power level to compute the average power during continuous transmission. For example, add [10 log (1/0.25)] = 6 dB if the duty cycle is a constant 25%.

EIRP Power:
The testing follows ANSI C63.26-2015 Section 5.2.5.5
According to KDB 412172 D01 Power Approach,
EIRP = PT + GT – LC, where
PT = transmitter output power in dBm
GT = gain of the transmitting antenna in dBi
LC = signal attenuation in the connecting cable between the transmitter and antenna in dB

3.1.3 TESTSETUP LAYOUT

Conducted Power Measurement



3.1.4 TEST DEVIATION

No deviation

3.1.5 TEST RESULTS

Please refer to the APPENDIX A.

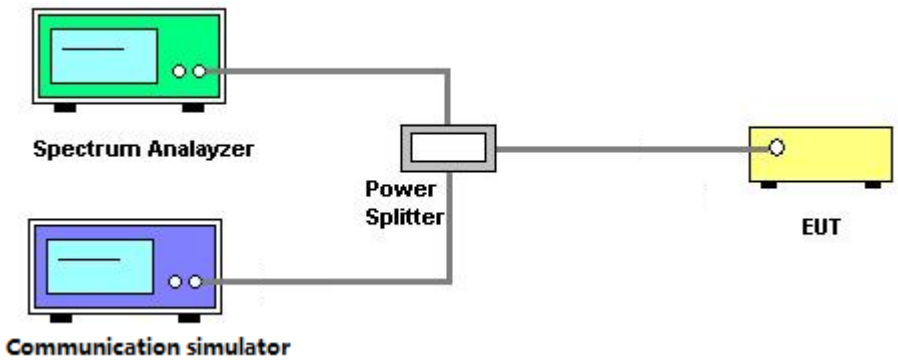
3.2 OCCUPIED BANDWIDTH MEASUREMENT

3.2.1 TEST PROCEDURE

The testing follows ANSI C63.26-2015 Section 5.4.3 (26dB) and Section 5.4.4 (99OB)

1. The EUT was connected to spectrum analyzer and system simulator via a power divider.
2. The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the spectrum analyzer shall be between two and five times the anticipated OBW.
3. The nominal resolution bandwidth (RBW) shall be in the range of 1 to 5 % of the anticipated OBW, and the VBW shall be at least 3 times the RBW.
4. Set the detection mode to peak, and the trace mode to max hold.
5. Determine the reference value: Set the EUT to transmit a modulated signal. Allow the trace to stabilize. Set the spectrum analyzer marker to the highest level of the displayed trace. (this is the reference value)
6. Determine the “-26 dB down amplitude” as equal to (Reference Value – X).
7. Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display such that each marker is at or slightly below the “–X dB down amplitude” determined in step 6. If a marker is below this “-X dB down amplitude” value it shall be placed as close as possible to this value. The OBW is the positive frequency difference between the two markers.
8. Use the 99 % power bandwidth function of the spectrum analyzer and report the measured bandwidth.

3.2.2 TEST SETUP LAYOUT



3.2.3 TEST DEVIATION

No deviation

3.2.4 TEST RESULTS

Please refer to the APPENDIX B.

3.3 CONDUCTED EMISSIONS MEASUREMENT

3.3.1 LIMIT

The conducted power of emissions below 3530 MHz or above 3720 MHz shall not exceed -40dBm/MHz.

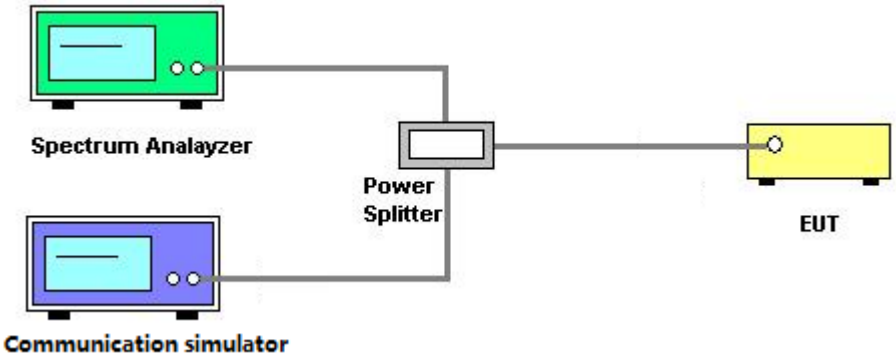
Between 3530 MHz and 3720 MHz is the band edge range.

3.3.2 TEST PROCEDURE

The testing follows ANSI C63.26-2015 Section 5.7

1. The EUT was connected to spectrum analyzer and system simulator via a power divider.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.
   The path loss was compensated to the results for each measurement.
3. The middle channel for the highest RF power within the transmitting frequency was measured.
4. The conducted spurious emission for the whole frequency range was taken.
5. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz.
6. Set spectrum analyzer with RMS detector.
7. Taking the record of maximum spurious emission.
8. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
9. The limit line is −40dBm/MHz.

3.3.3 TESTSETUP LAYOUT



3.3.4 TESTDEVIATION

No deviation

3.3.5 TEST RESULTS

Please refer to the APPENDIX C.

3.4 RADIATED EMISSIONS MEASUREMENT

3.4.1 LIMIT

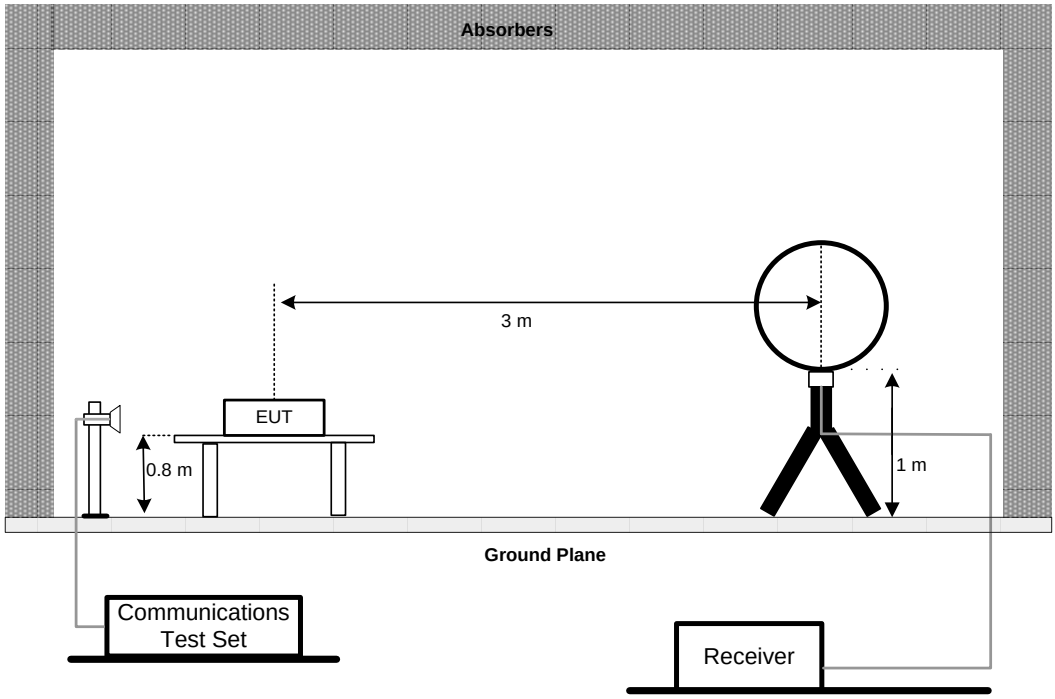
The power of any emission outside of the authorized operating frequency ranges shall not exceed -40dBm/MHz.

3.4.2 TEST PROCEDURES

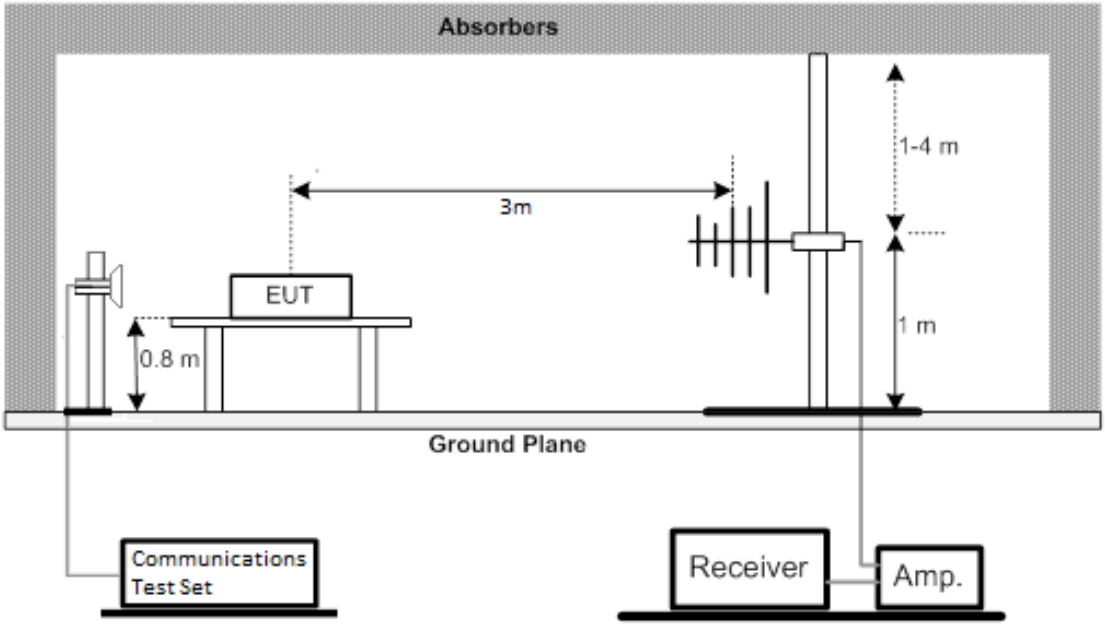
1. Substitution method is used for E.I.R.P measurement. In the semi-anechoic chamber, EUT placed on the 0.8m height of Turn Table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 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. EIRP = Output power level of S.G – TX cable loss + Antenna gain of substitution horn.
4. E.R.P power can be calculated form E.I.R.P power by subtracting the gain of dipole, E.R.P power = E.I.P.R power - 2.15dBi.
5. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1MHz/3MHz.

3.4.3TEST SETUP LAYOUT

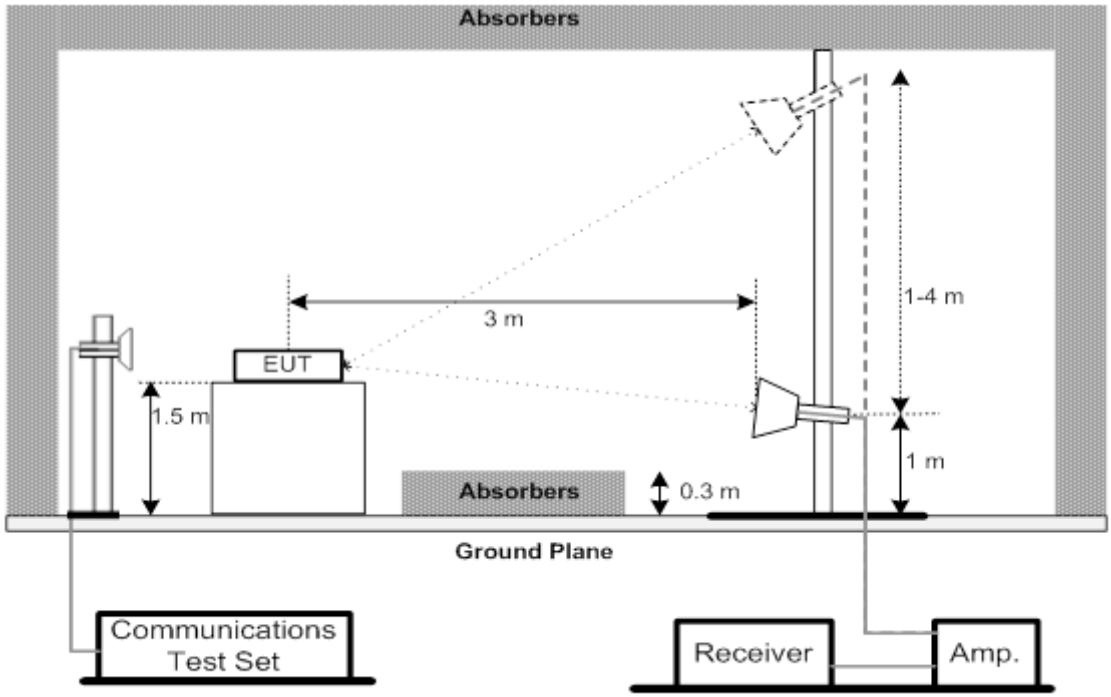
Below 30MHz



30MHz to 1000MHz



Above 1GHz



3.4.4 TESTDEVIATION

No deviation

3.4.5 TEST RESULTS (9KHZ TO 30MHZ)

Please refer to the APPENDIX D.

3.4.6 TEST RESULTS (30MHZ TO 1000MHZ)

Please refer to the APPENDIX E.

3.4.7 TEST RESULTS (ABOVE 1000MHZ)

Please refer to the APPENDIX F.

3.5 BAND EDGE MEASUREMENT

3.5.1 LIMIT

For channel and frequency assignments made by a CBSD to End User Devices,the conducted power of any End User Device emission outside the fundamental emission (whether in or outside of the authorized band) shall not exceed -13dBm/MHz within 0 to B megahertz (where B is the bandwidth in the assigned channel or multiple contiguous channels of the End User Device) above the upper CBSD-assigned channel edge and within 0 to B megahertz below the lower CBSD-assigned channel edge. At all frequencies greater than B megahertz above the upper CBSD assigned channel edge and less than B megahertz below the lower CBSD-assigned channel edge, the conducted power of any End User Device emission shall not exceed 25 dBm/Mhz.

Additional protection levels. Notwithstanding paragraph (e)(1) of this section, for CBSDs and End User Devices, the conducted power of emissions below 3540 MHz or above 3710 MHz shall not exceed -25 dBm/MHz, and the conducted power of emissions below 3530 MHz or above 3720 MHz shall not exceed -40dBm/MHz.

Notwithstanding the emission limits in this paragraph, the Adjacent Channel Leakage Ratio for End User Devices shall be at least 30 dB.

3.5.2 TEST PROCEDURES

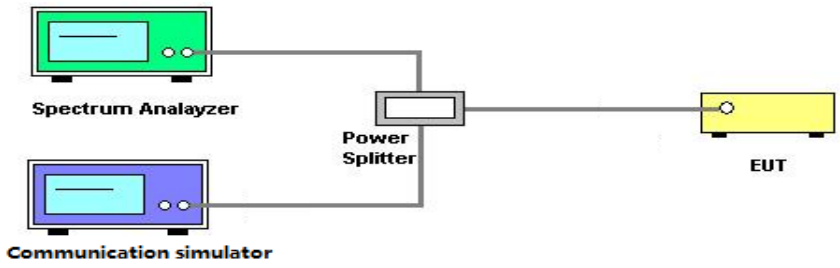
The testing follows FCC KDB 971168 D01 v03r01 Section 6.1.

1. The EUT was connected to spectrum analyzer and system simulator via a power divider.
2. The band edges of low and high channels for the highest RF powers were measured.
3. Set RBW >= 1% EBW in the 1MHz band immediately outside and adjacent to the band edge.
4. Beyond the 1 MHz band from the band edge, RBW=1MHz was used
5. Set spectrum analyzer with RMS detector.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

For Adjacent Channel Leakage Ratio (ACLR) measurement,

7. The Adjacent Channel Leakage Ratio (ACLR) is the ratio of the average power in the assigned aggregated channel bandwidth to the average power over the equivalent adjacent channel bandwidth.
8. The option ACLR of spectrum analyzer is used and measures the ACLR ratio by setting equivalent channel bandwidth.
9. The measured ACLR ratio shall be at least 30 dB.

3.5.3 TESTSETUP LAYOUT



3.5.4 TESTDEVIATION

No deviation

3.5.5 TEST RESULTS

Please refer to the APPENDIX G.

3.6 FREQUENCY STABILITY MEASUREMENT

3.6.1 LIMIT

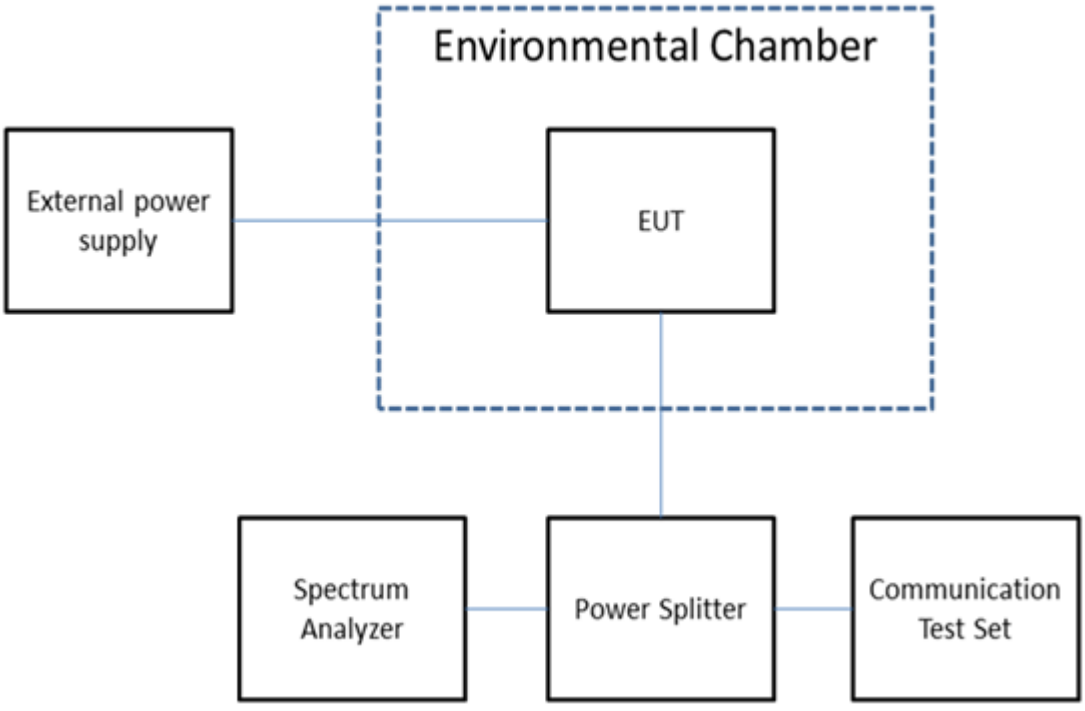
Limit is not defined in part 96 standard. BTL uses the following restrictions:The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

3.6.2 TEST PROCEDURES

The testing follows ANSI C63.26-2015 Section 5.6.

1. A reference point shall be established at the applicable unwanted emissions limit using a RBW equal to the RBW required by the unwantedemissions specification of the applicable regulatory standard. These reference points measuredusing the lowest and highest channel of operation shall be identified as f L and f H respectively. The worst-case frequency offset determined in the above methods shall be added or subtracted from the values of f L and f H and the resulting frequencies must remain within the band.
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 step 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.

3.6.3 TESTSETUP LAYOUT



3.6.4 TESTDEVIATION

No deviation

3.6.5 TEST RESULTS

Please refer to the APPENDIX H.

3.7 PEAK TO AVERAGE RATIO MEASUREMENT

3.7.1 LIMIT

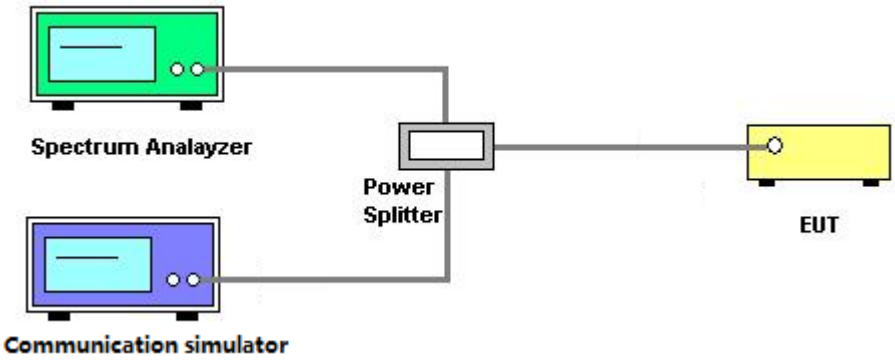
In measuring transmissions in this band using an average power technique, the peak to-average ratio (PAR) of the transmission may not exceed 13 dB.

3.7.2 TEST PROCEDURES

The testing follows ANSI C63.26-2015 Section 5.2.6.

1. The EUT was connected to spectrum and system simulator via a power divider.
2. Set the CCDF (Complementary Cumulative Distribution Function) option in spectrum analyzer.
3. The highest RF powers were measured and recorded the maximum PAPR level associated with a probability of 0.1 %.
4. Record the deviation as Peak to Average Ratio

3.7.3 TEST SETUP LAYOUT



3.7.4 TEST DEVIATION

No deviation

3.7.5 TEST RESULTS

Please refer to the APPENDIX I.

4. LIST OF MEASUREMENT EQUIPMENTS

Radiated Emissions - 9 kHz to 30 MHz					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	MXE EMI Receiver	Keysight	N9038A	MY56400091	Feb. 27, 2022
2*	Active Loop Antenna	R&S	HFH2-Z2	830749/020	Aug. 23, 2024
3	Cable	N/A	RG 213/U (9kHz~1GHz)	N/A	May 27, 2022
4	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A
5	wideband radio communication tester	R&S	CMW500	152372	Feb. 27, 2022
6	Wireless Communication Test SET	Agilent	E5515C	MY48364183	Feb. 28, 2022
7	966 Chamber Room	ETS	9*6*6	N/A	Jul. 17, 2022

Radiated Emissions - 30 MHz to 1 GHz					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Antenna	Schwarzbeck	VULB9160	9160-3232	Mar. 15, 2022
2	Amplifier	HP	8447D	2944A08742	Feb. 28, 2022
3	Cable	emci	LMR-400	N/A	May 20, 2022
4	Controller	CT	SC100	N/A	N/A
5	Controller	MF	MF-7802	MF780208416	N/A
6	Receiver	Agilent	N9038A	MY52130039	Mar. 19, 2022
7	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A
8	wideband radio communication tester	R&S	CMW500	152372	Feb. 27, 2022
9	Wireless Communication Test SET	Agilent	E5515C	MY48364183	Feb. 28, 2022
10	966 Chamber Room	RM	9*6*6	N/A	Jul. 24, 2022

Radiated Emissions - Above 1 GHz					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Double Ridged Horn Antenna	ARA	DRG-118A	16554	Apr. 21, 2022
2	Broad-Band Horn Antenna	Schwarzbeck	BBHA 9170	9170319	Jun. 30, 2022
3	Amplifier	Agilent	8449B	3008A02584	Jul. 10, 2022
4	Controller	CT	SC100	N/A	N/A
5	Controller	MF	MF-7802	MF780208416	N/A
6	Receiver	Agilent	N9038A	MY52130039	Mar. 19, 2022
7	EXA Spectrum Analyzer	Keysight	N9010A	MY56480488	Feb. 28, 2022
8	Low Noise Amplifier	CONNPHY	CLN-18G40G -4330-K	619413	Jul. 16, 2022
9	Cable	N/A	A81-SMAMSMAM -12.5M	N/A	Oct. 15, 2022
10	Cable	Talent microwave	A40-2.92M2.92M -2.5M	N/A	Nov. 29, 2021 Nov. 30, 2022
11	Filter	STI	STI15-9912	N/A	Jul. 10, 2022
12	Measurement Software	Farad	EZ-EMC Ver.NB -03A1-01	N/A	N/A
13	wideband radio communication tester	R&S	CMW500	152372	Feb. 27, 2022
14	Wireless Communication Test SET	Agilent	E5515C	MY48364183	Feb. 28, 2022
15	966 Chamber Room	RM	9*6*6	N/A	Jul. 24, 2022

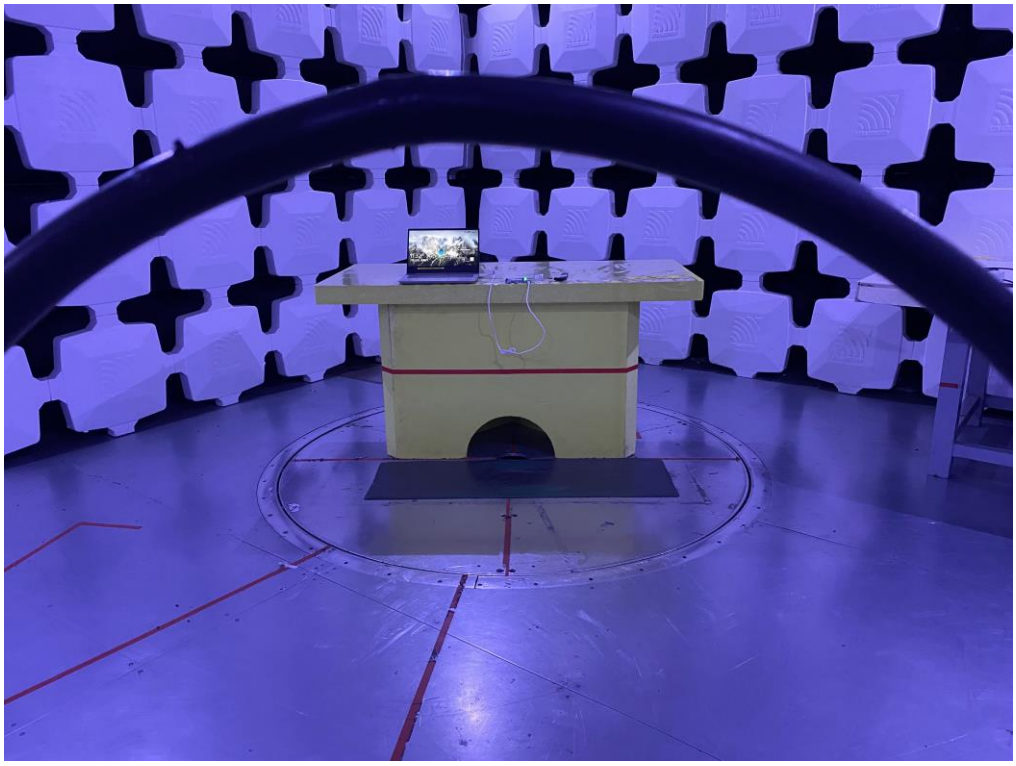
Conducted Measurement					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	8960 Series 10 Wireless Com Test set	Agilent	E5515E	MY52112163	Jul. 24, 2022
2	MXA Signal Analyzer	Keysight	N9020A	MY49100060	Jul. 24, 2022
3	Power Splitter	Mini-Circuits	ZFRSC-183-S+	SF103501511S	Jul. 24, 2022
4	wideband radio communication tester	R&S	CMW500	104462	Jul. 24, 2022
5	Const Temp. & Humidity Chamber	Bell	BTH-50C	20170306001	Feb. 27, 2022
6*	Multi-output DC Power Supply	GW Instek	GPC-3030DN	EK880675	Jul. 25, 2023

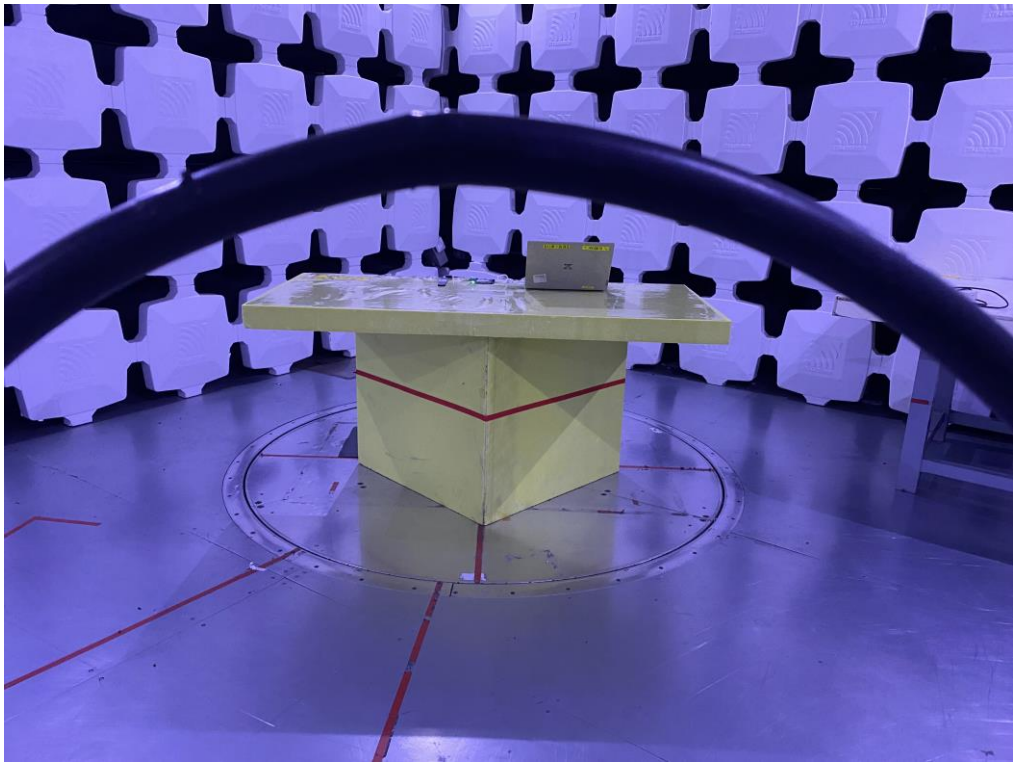
Remark: ”N/A” denotes no model name, serial no. or calibration specified.
Except * item, all calibration period of equipment list is one year.
“*” calibration period of equipment list is three year.

5. EUT TEST PHOTO

Radiated Emissions Test Photos

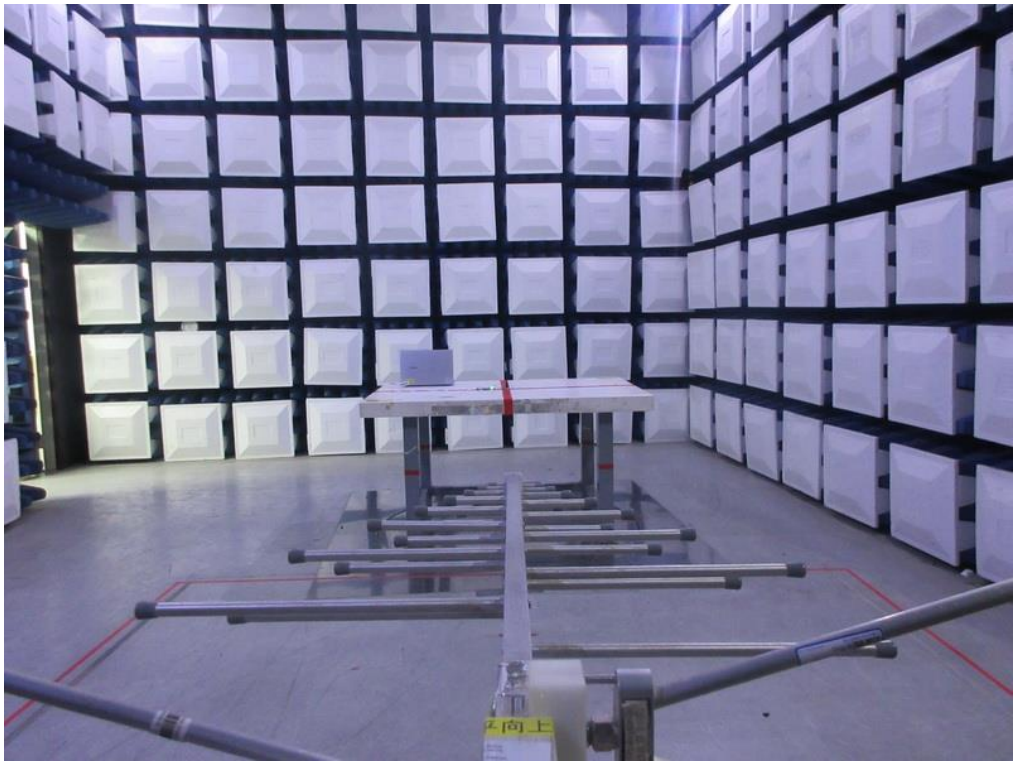
9 kHz to 30 MHz

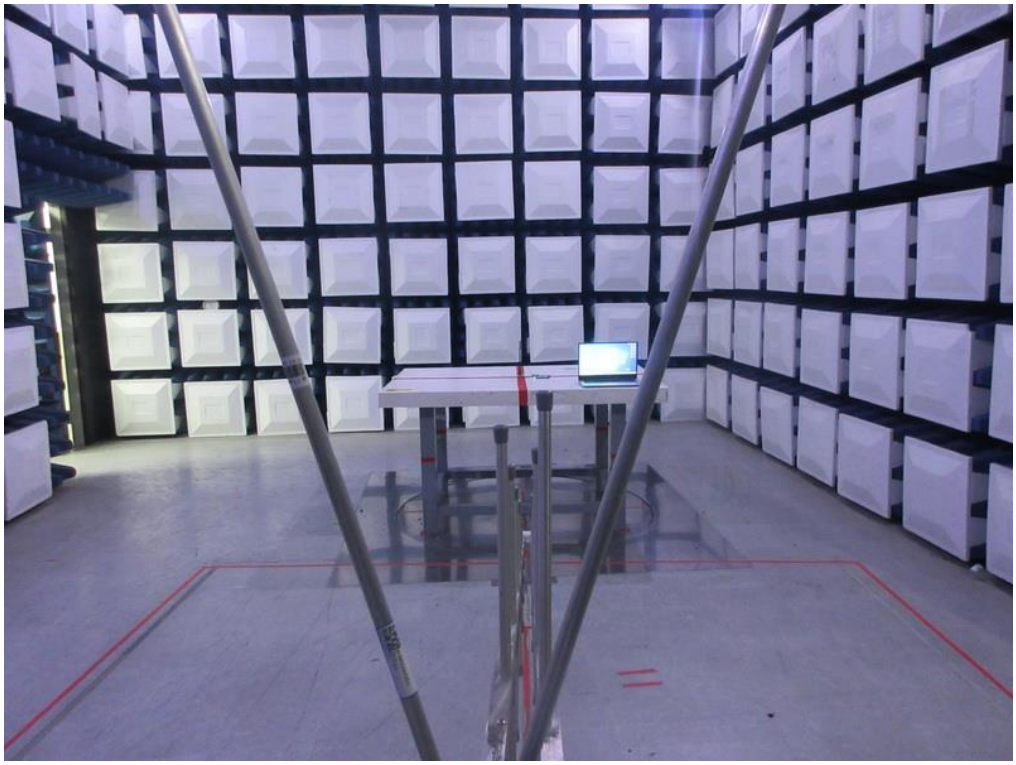




Radiated Emissions Test Photos

30 MHz to 1 GHz

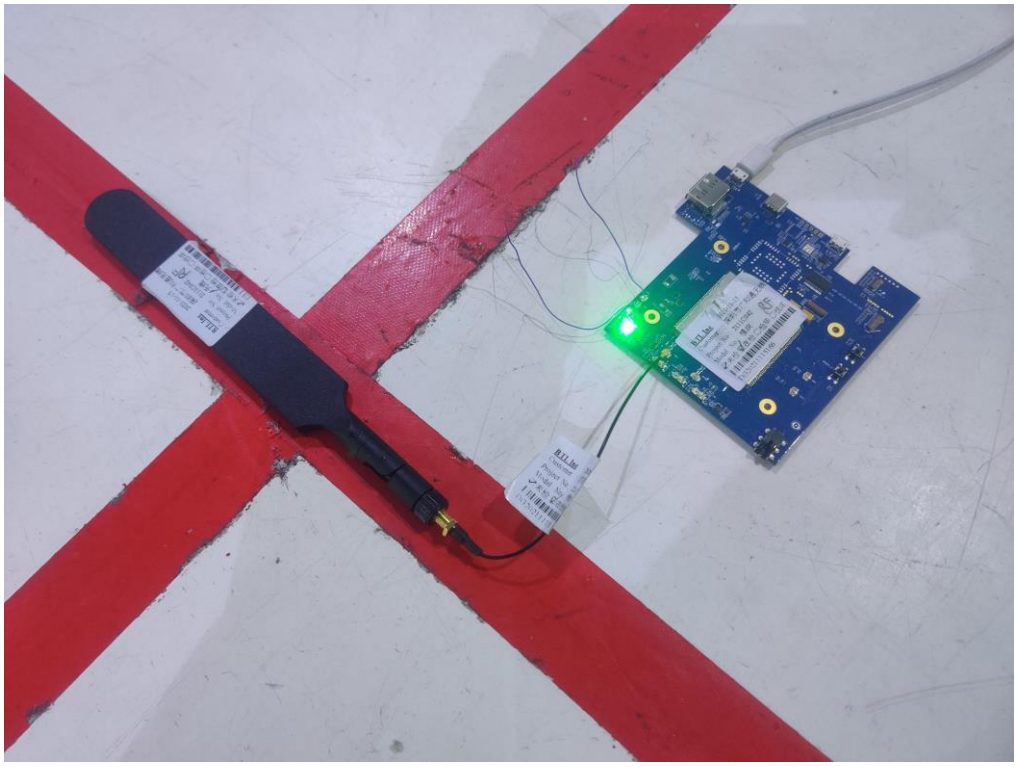




Radiated Emissions Test Photos

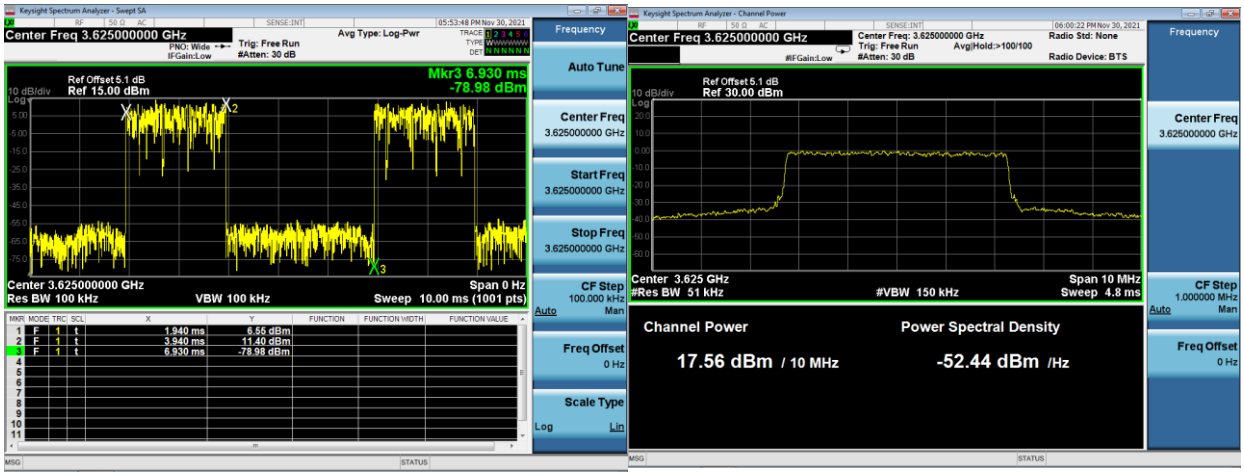
Above 1 GHz

Radiated Emissions Test Photos



APPENDIX A - OUTPUT POWER & EIRP

Duty Cycle **Sample Measuremet Screen**



Duty cycle=On time/Total time

=(3.940-1.940)/(6.930-1.940)

Duty factor=10 log (1/duty cycle)=3.97

Conducted Power (Average power) (dBm/10MHz):

Average Power=Read Power+ Duty factor

LTE Band / BW	Modulation	RB Size	RB Offset	Low CH	Mid CH	High CH
				55265CH	55990CH	56715CH
				3552.5MHz	3625.0MHz	3697.5MHz
48 / 5M	QPSK	1	0	23.58	23.88	23.32
		1	13	23.65	23.90	23.37
		1	24	23.63	23.76	23.30
		12	0	22.66	22.91	22.31
		12	6	22.68	22.90	23.39
		12	11	22.65	22.81	22.36
		25	0	22.69	22.86	22.34
	16QAM	1	0	22.96	23.16	22.65
		1	13	22.98	23.18	22.75
		1	24	22.98	23.10	22.70
		12	0	21.86	22.06	21.51
		12	6	21.85	22.06	21.49
		12	11	21.82	21.95	21.50
		25	0	21.80	21.98	21.52
	64QAM	1	0	21.81	22.00	21.50
		1	13	21.85	21.98	21.56
		1	24	21.79	21.93	21.50
		12	0	20.89	21.12	20.53
		12	6	20.91	21.05	20.62
		12	11	20.83	21.08	20.56
		25	0	20.89	21.07	20.61

LTE Band / BW	Modulation	RB Size	RB Offset	Low CH	Mid CH	High CH
				55290CH	55990CH	56690CH
				3555.0MHz	3625.0MHz	3695.0MHz
48 / 10M	QPSK	1	0	23.62	23.79	23.32
		1	25	23.65	23.75	23.35
		1	49	23.66	23.75	23.34
		25	0	22.73	22.88	22.37
		25	13	22.69	22.90	22.42
		25	25	22.65	22.85	22.38
		50	0	22.70	22.87	22.38
	16QAM	1	0	22.96	23.19	22.66
		1	25	22.96	23.13	22.70
		1	49	22.95	23.05	22.70
		25	0	21.84	22.03	21.45
		25	13	21.83	22.06	21.56
		25	25	21.84	21.99	21.56
		50	0	21.85	22.05	21.54
	64QAM	1	0	21.76	21.98	21.46
		1	25	21.75	21.92	21.49
		1	49	21.78	21.92	21.53
		25	0	20.90	21.09	20.61
		25	13	20.93	21.15	20.62
		25	25	21.91	21.11	20.61
		50	0	20.83	21.06	20.54

LTE Band / BW	Modulation	RB Size	RB Offset	Low CH	Mid CH	High CH
				55315CH	55990CH	56665CH
				3557.5MHz	3625.0MHz	3692.5MHz
48 / 15M	QPSK	1	0	23.66	23.89	23.23
		1	38	23.66	21.83	21.31
		1	74	23.84	23.71	23.45
		36	0	22.72	22.90	22.39
		36	18	22.84	22.93	22.47
		36	39	22.82	22.86	22.44
		75	0	22.83	22.87	22.35
	16QAM	1	0	22.93	23.20	22.59
		1	38	22.96	23.16	22.63
		1	74	23.10	23.17	22.74
		36	0	21.80	22.01	21.44
		36	18	21.93	22.04	21.56
		36	39	21.91	21.99	21.52
		75	0	21.94	21.99	21.58
	64QAM	1	0	21.78	21.97	21.40
		1	38	21.78	21.98	21.46
		1	74	21.99	21.92	21.56
		36	0	20.86	21.06	20.51
		36	18	21.02	21.09	20.60
		36	39	20.95	21.02	20.60
		75	0	20.98	21.02	20.54

LTE Band / BW	Modulation	RB Size	RB Offset	Low CH	Mid CH	High CH
				55340CH	55990CH	56640CH
				3560.0MHz	3625.0MHz	3690.0MHz
48 / 20M	QPSK	1	0	23.69	23.95	23.37
		1	50	23.68	23.86	23.43
		1	99	23.80	23.80	23.48
		50	0	22.74	22.93	22.38
		50	25	22.81	22.89	22.44
		50	50	22.85	22.89	22.39
		100	0	22.87	22.95	22.43
	16QAM	1	0	23.00	23.26	22.63
		1	50	22.99	23.13	22.64
		1	99	23.12	23.07	22.74
		50	0	21.88	22.05	21.58
		50	25	21.98	22.06	21.57
		50	50	21.96	22.03	21.60
		100	0	21.96	22.07	21.53
	64QAM	1	0	21.80	22.07	21.46
		1	50	21.83	21.99	21.49
		1	99	21.94	21.95	21.60
		50	0	20.90	21.15	20.53
		50	25	20.99	21.10	20.59
		50	50	21.01	21.05	20.65
		100	0	20.98	21.07	20.58

EIRP (dBm/10MHz):

EIRP=Average Power+Ant. Gain

LTE Band / BW	Modulation	RB Size	RB Offset	Low CH	Mid CH	High CH
				55265CH	55990CH	56715CH
				3552.5MHz	3625.0MHz	3697.5MHz
48 / 5M	QPSK	1	0	23.45	23.75	23.19
		1	13	23.52	23.77	23.24
		1	24	23.50	23.63	23.17
		12	0	22.53	22.78	22.18
		12	6	22.55	22.77	23.26
		12	11	22.52	22.68	22.23
		25	0	22.56	22.73	22.21
	16QAM	1	0	22.83	23.03	22.52
		1	13	22.85	23.05	22.62
		1	24	22.85	22.97	22.57
		12	0	21.73	21.93	21.38
		12	6	21.72	21.93	21.36
		12	11	21.69	21.82	21.37
		25	0	21.67	21.85	21.39
	64QAM	1	0	21.68	21.87	21.37
		1	13	21.72	21.85	21.43
		1	24	21.66	21.80	21.37
		12	0	20.76	20.99	20.40
		12	6	20.78	20.92	20.49
		12	11	20.70	20.95	20.43
		25	0	20.76	20.94	20.48

LTE Band / BW	Modulation	RB Size	RB Offset	Low CH	Mid CH	High CH
				55290CH	55990CH	56690CH
				3555.0MHz	3625.0MHz	3695.0MHz
48 / 10M	QPSK	1	0	23.49	23.66	23.19
		1	25	23.52	23.62	23.22
		1	49	23.53	23.62	23.21
		25	0	22.60	22.75	22.24
		25	13	22.56	22.77	22.29
		25	25	22.52	22.72	22.25
		50	0	22.57	22.74	22.25
	16QAM	1	0	22.83	23.06	22.53
		1	25	22.83	23.00	22.57
		1	49	22.82	22.92	22.57
		25	0	21.71	21.90	21.32
		25	13	21.70	21.93	21.43
		25	25	21.71	21.86	21.43
		50	0	21.72	21.92	21.41
	64QAM	1	0	21.63	21.85	21.33
		1	25	21.62	21.79	21.36
		1	49	21.65	21.79	21.40
		25	0	20.77	20.96	20.48
		25	13	20.80	21.02	20.49
		25	25	21.78	20.98	20.48
		50	0	20.70	20.93	20.41

LTE Band / BW	Modulation	RB Size	RB Offset	Low CH	Mid CH	High CH
				55315CH	55990CH	56665CH
				3557.5MHz	3625.0MHz	3692.5MHz
48 / 15M	QPSK	1	0	23.53	23.76	23.10
		1	38	23.53	21.70	21.18
		1	74	23.71	23.58	23.32
		36	0	22.59	22.77	22.26
		36	18	22.71	22.80	22.34
		36	39	22.69	22.73	22.31
		75	0	22.70	22.74	22.22
	16QAM	1	0	22.80	23.07	22.46
		1	38	22.83	23.03	22.50
		1	74	22.97	23.04	22.61
		36	0	21.67	21.88	21.31
		36	18	21.80	21.91	21.43
		36	39	21.78	21.86	21.39
		75	0	21.81	21.86	21.45
	64QAM	1	0	21.65	21.84	21.27
		1	38	21.65	21.85	21.33
		1	74	21.86	21.79	21.43
		36	0	20.73	20.93	20.38
		36	18	20.89	20.96	20.47
		36	39	20.82	20.89	20.47
		75	0	20.85	20.89	20.41

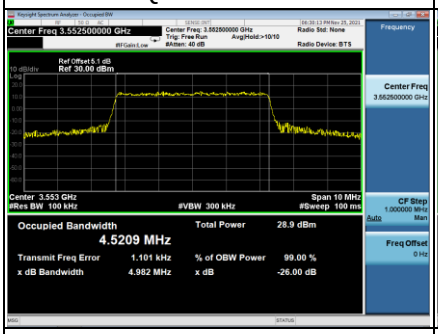
LTE Band / BW	Modulation	RB Size	RB Offset	Low CH	Mid CH	High CH
				55340CH	55990CH	56640CH
				3560.0MHz	3625.0MHz	3690.0MHz
48 / 20M	QPSK	1	0	23.56	23.82	23.24
		1	50	23.55	23.73	23.30
		1	99	23.67	23.67	23.35
		50	0	22.61	22.80	22.25
		50	25	22.68	22.76	22.31
		50	50	22.72	22.76	22.26
		100	0	22.74	22.82	22.30
	16QAM	1	0	22.87	23.13	22.50
		1	50	22.86	23.00	22.51
		1	99	22.99	22.94	22.61
		50	0	21.75	21.92	21.45
		50	25	21.85	21.93	21.44
		50	50	21.83	21.90	21.47
		100	0	21.83	21.94	21.40
	64QAM	1	0	21.67	21.94	21.33
		1	50	21.70	21.86	21.36
		1	99	21.81	21.82	21.47
		50	0	20.77	21.02	20.40
		50	25	20.86	20.97	20.46
		50	50	20.88	20.92	20.52
		100	0	20.85	20.94	20.45

APPENDIX B - OCCUPIED BANDWIDTH

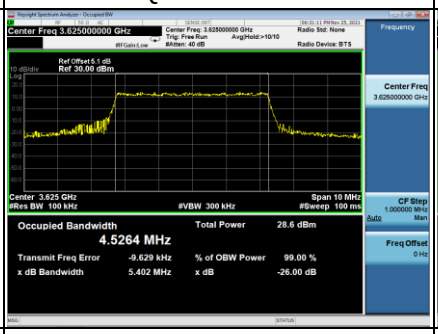
LTE Band 48_5MHz							
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)			26dB Bandwidth (MHz)		
		QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
55265	3552.5	4.5209	4.4988	4.5173	4.982	5.059	5.055
55990	3625.0	4.5264	4.4961	4.5142	5.402	4.958	5.377
56715	3697.5	4.5098	4.4993	4.5193	5.241	5.053	5.110

Spectrum Plot

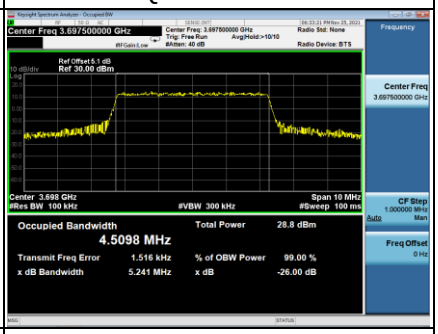
QPSK-55265



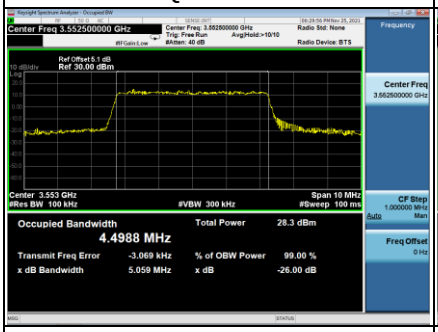
QPSK-55990



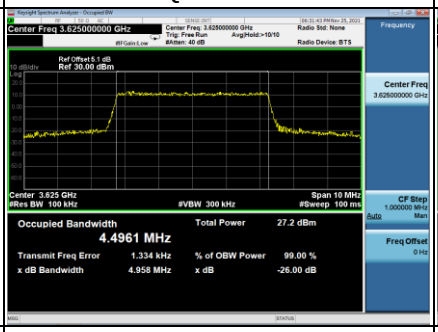
QPSK-56715



16QAM-55265



16QAM-55990



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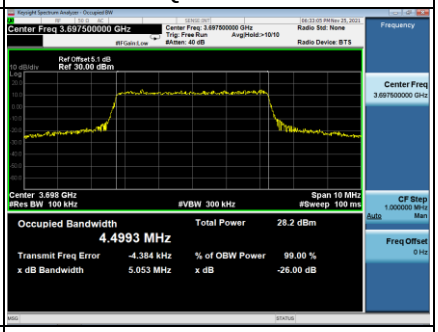

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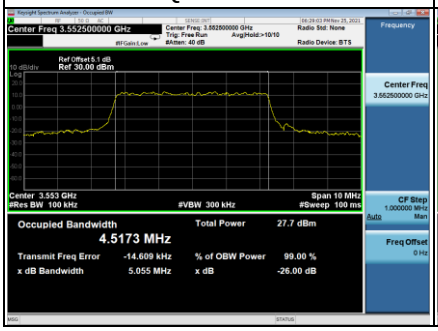

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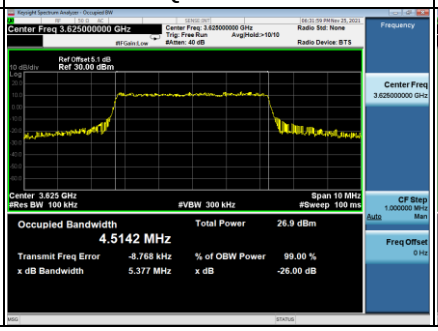

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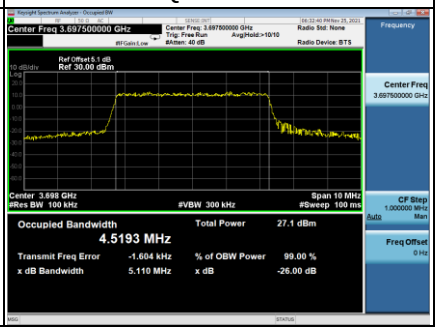
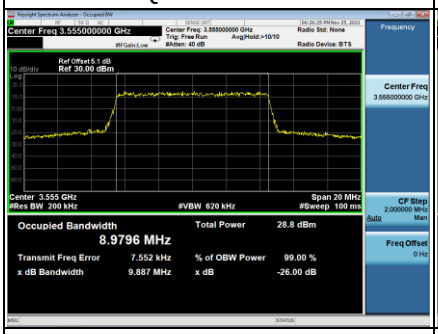


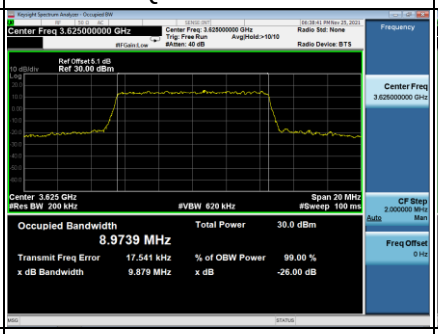
LTE Band 48_10MHz							
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)			26dB Bandwidth (MHz)		
		QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
55290	3555.0	8.9796	8.9542	8.9864	9.887	9.813	9.834
55990	3625.0	8.9739	8.9579	8.9709	9.879	9.746	9.729
56690	3695.0	9.0372	8.9725	8.9904	9.877	9.823	9.817

Spectrum Plot

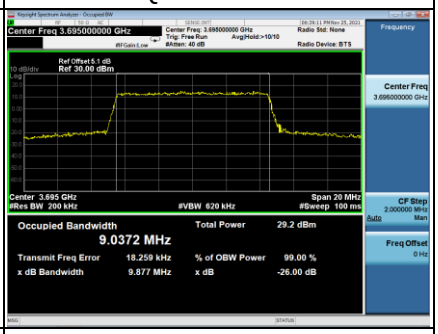
QPSK-55290



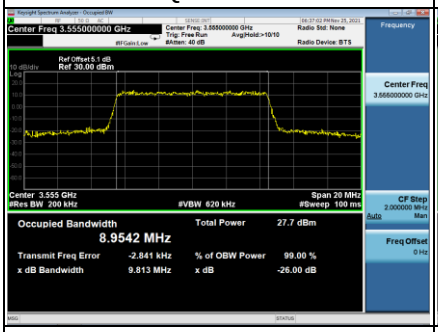
QPSK-55990



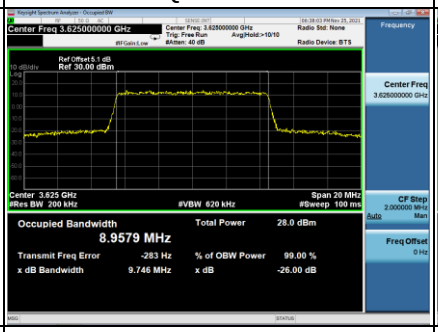
QPSK-56690



16QAM-55290



16QAM-55990



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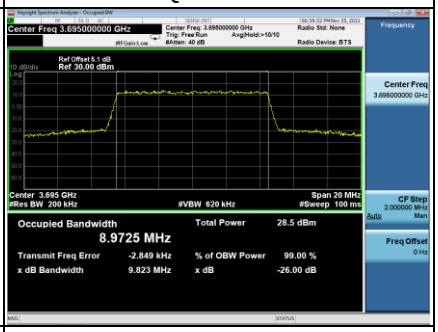
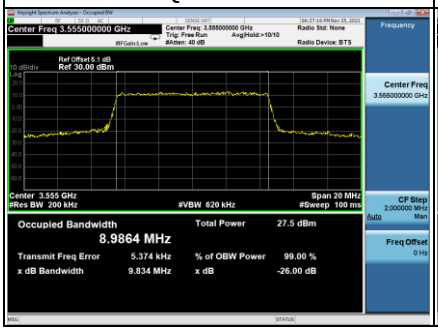
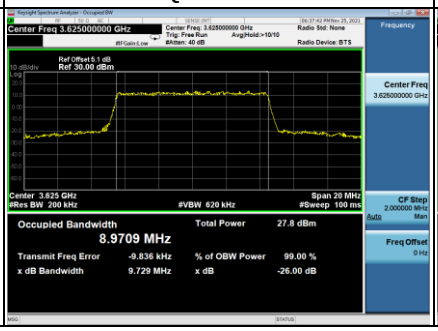


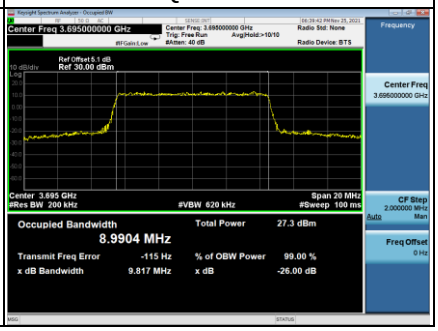
64QAM-55290



64QAM-55990



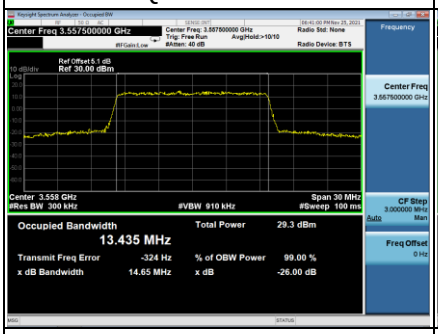
64QAM-56690



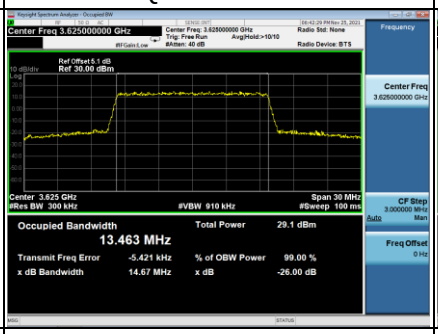
LTE Band 48_15MHz							
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)			26dB Bandwidth (MHz)		
		QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
55315	3557.5	13.435	13.445	13.472	14.65	14.65	14.76
55990	3625.0	13.463	13.469	13.467	14.67	14.62	14.69
56665	3692.5	13.457	13.478	13.478	14.67	14.72	14.63

Spectrum Plot

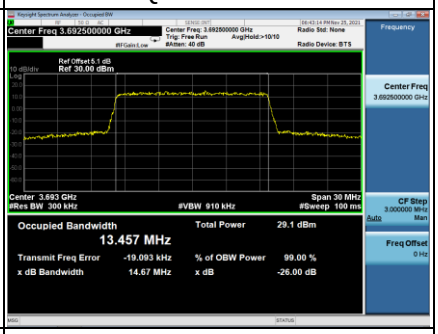
QPSK-55315



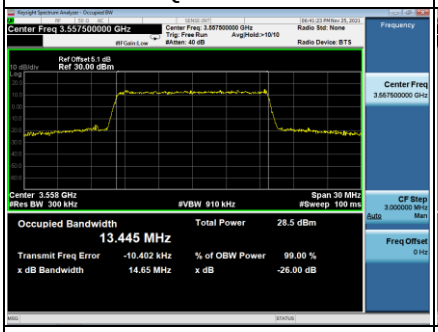
QPSK-55990



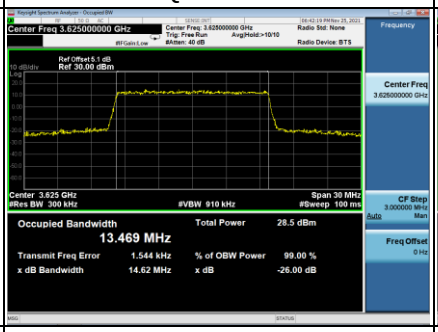
QPSK-56665



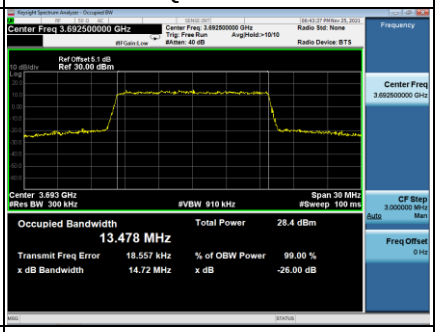
16QAM-55315



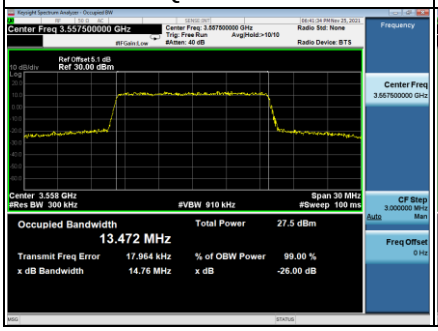
16QAM-55990



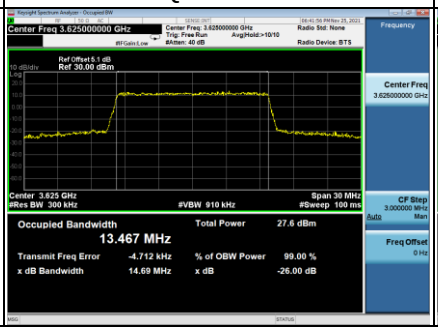
16QAM-56665



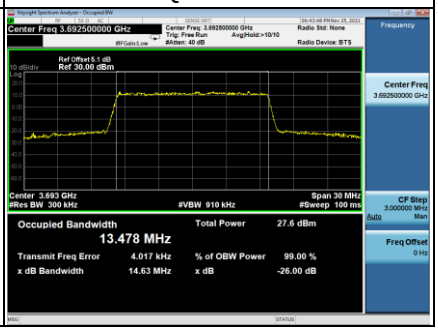
64QAM-55315



64QAM-55990



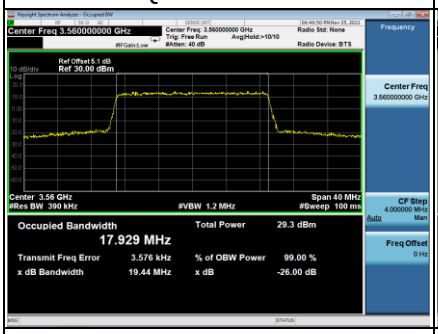
64QAM-56665



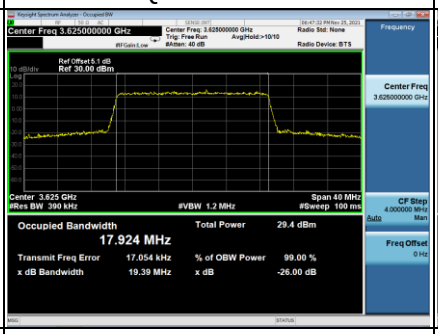
LTE Band 48_20MHz							
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)			26dB Bandwidth (MHz)		
		QPSK	16QAM	64QAM	QPSK	16QAM	64QAM
55340	3560.0	17.929	17.930	17.931	19.44	19.30	19.43
55990	3625.0	17.924	17.939	17.942	19.39	19.50	19.57
56640	3690.0	17.968	17.896	17.946	19.49	19.47	19.46

Spectrum Plot

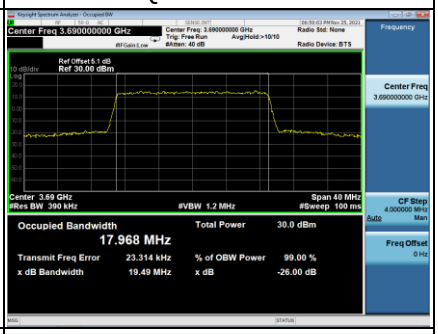
QPSK-55340



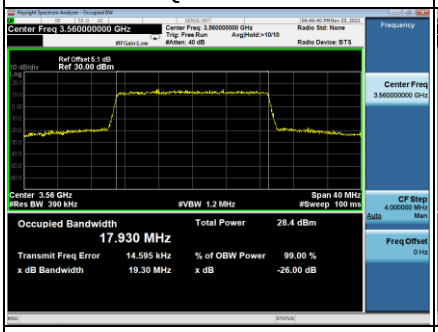
QPSK-55990



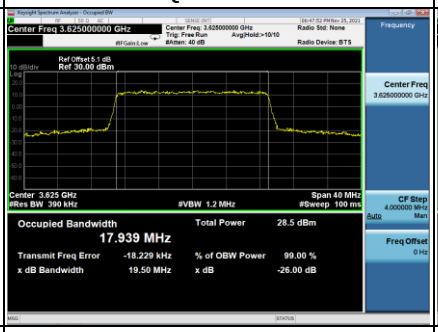
QPSK-56640



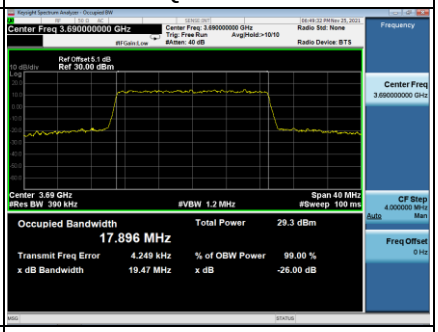
16QAM-55340



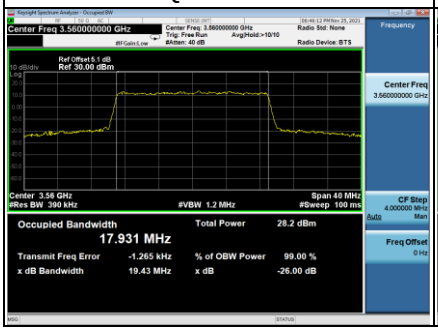
16QAM-55990



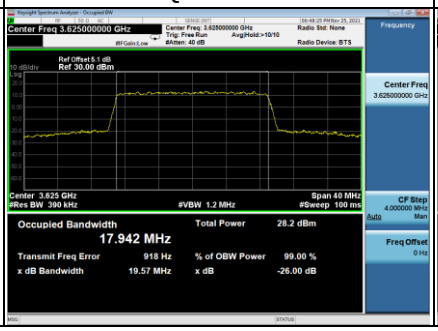
16QAM-56640



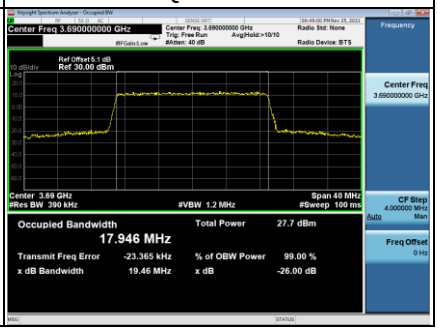
64QAM-55340



64QAM-55990

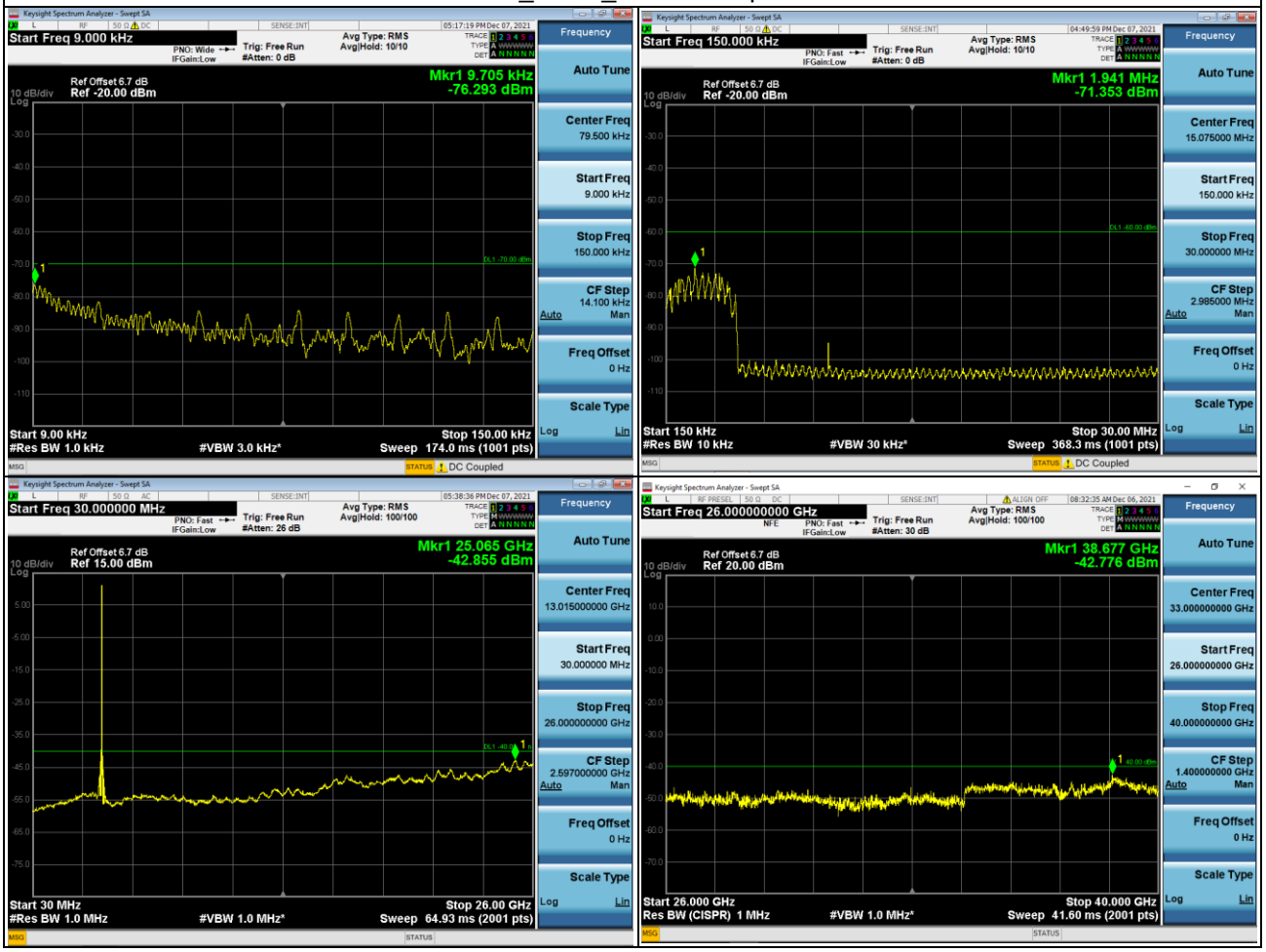


64QAM-56640

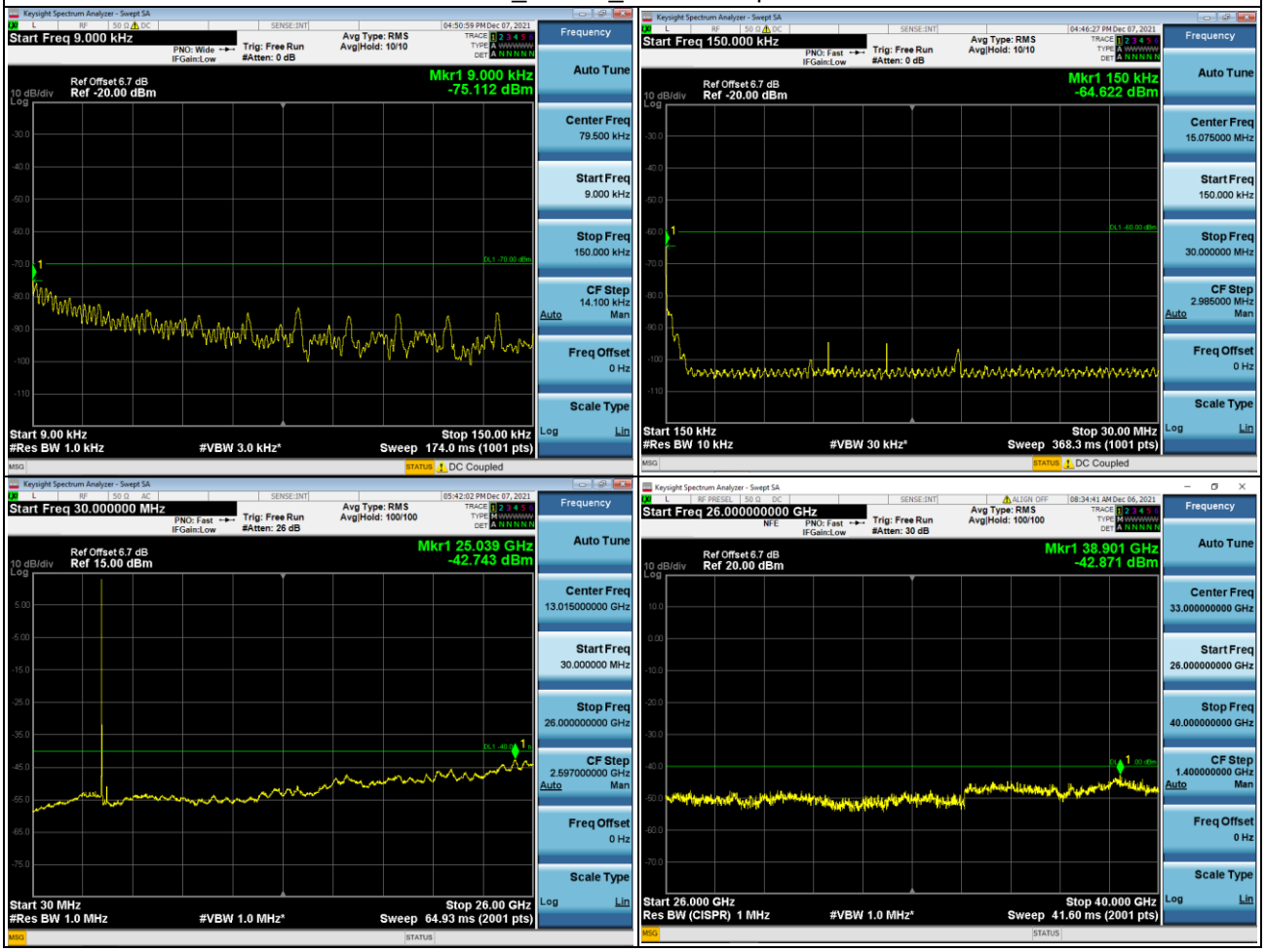


APPENDIX C - CONDUCTED EMISSIONS

LTE Band 48_5MHz_CH55990 Spectrum Plot



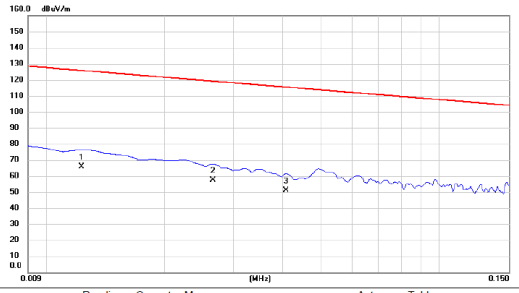
LTE Band 48_20MHz_CH55990 Spectrum Plot



APPENDIX D - RADIATED SPURIOUS EMISSIONS (9KHZ TO 30MHZ)

Test Mode :	TX Mode

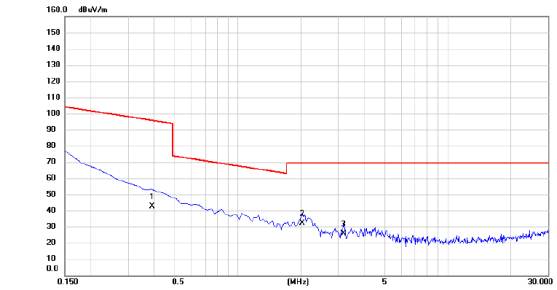
Ant 0°



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1	*	0.0123	49.23	16.71	65.94	125.81	-59.87	AVG			
2		0.0266	43.25	14.14	57.39	119.11	-61.72	AVG			
3		0.0407	37.12	13.81	50.93	115.41	-64.48	AVG			

Test Mode :	TX Mode

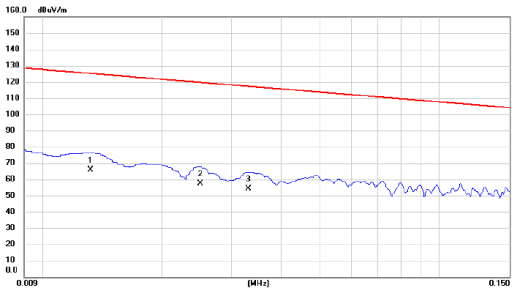
Ant 0°



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		0.3914	29.15	13.46	42.61	95.75	-53.14	AVG			
2	*	2.0305	20.16	12.08	32.24	69.54	-37.30	QP			
3		3.1947	14.26	11.72	25.98	69.54	-43.56	QP			

Test Mode :	TX Mode

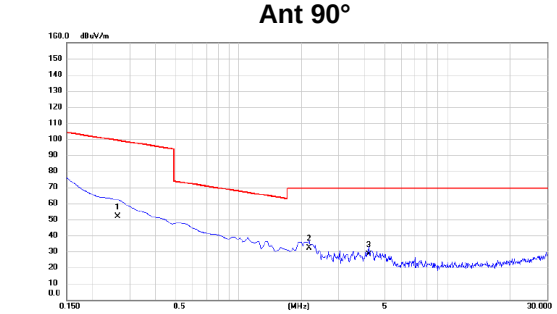
Ant 90°



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1	*	0.0132	49.26	16.43	65.69	125.19	-59.50	AVG			
2		0.0250	43.22	14.17	57.39	119.65	-62.26	AVG			
3		0.0330	40.16	13.99	54.15	117.23	-63.08	AVG			

Test Mode :	TX Mode

Ant 90°

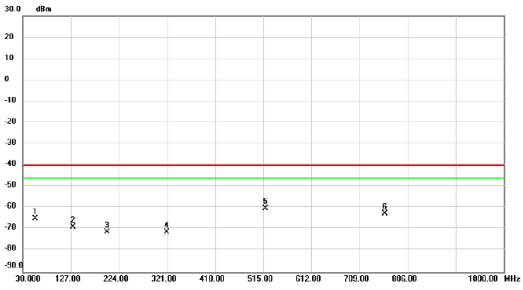


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		0.2621	38.16	13.59	51.75	99.24	-47.49	AVG			
2	*	2.1798	20.14	12.02	32.16	69.54	-37.38	QP			
3		4.1798	16.54	11.72	28.26	69.54	-41.28	QP			

APPENDIX E - RADIATED SPURIOUS EMISSIONS (30MHZ TO 1000MHZ)

Test Mode :	LTE Band 48_TX CH55990_5MHz

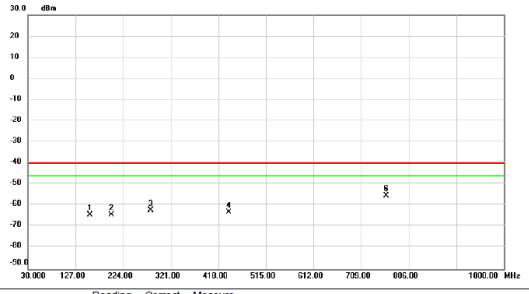
Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1		55.7050	-62.91	-2.18	-65.09	-40.00	-25.09	peak	
2		131.8500	-65.37	-3.36	-68.73	-40.00	-28.73	peak	
3		200.2350	-65.79	-5.32	-71.11	-40.00	-31.11	peak	
4		320.0300	-70.21	-1.14	-71.35	-40.00	-31.35	peak	
5	*	519.8500	-63.30	3.03	-60.27	-40.00	-20.27	peak	
6		759.9250	-70.13	7.56	-62.57	-40.00	-22.57	peak	

Test Mode :	LTE Band 48_TX CH55990_5MHz

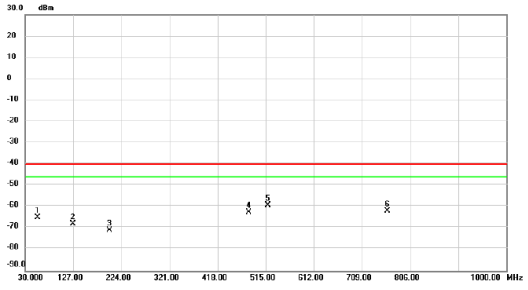
Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1		155.6150	-62.22	-2.08	-64.30	-40.00	-24.30	peak	
2		200.2350	-59.02	-5.32	-64.34	-40.00	-24.34	peak	
3		279.7750	-60.10	-2.24	-62.34	-40.00	-22.34	peak	
4		439.8250	-64.95	1.67	-63.28	-40.00	-23.28	peak	
5	*	759.9250	-63.04	7.56	-55.48	-40.00	-15.48	peak	
6	*	759.9250	-63.04	7.56	-55.48	-40.00	-15.48	peak	

Test Mode :	LTE Band 48_TX CH55990_20MHz

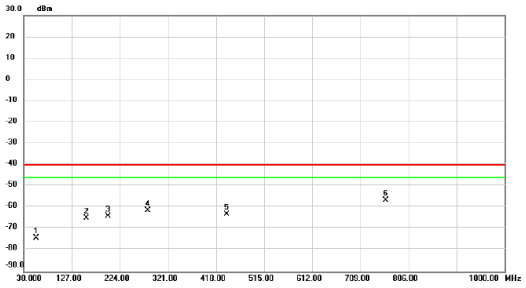
Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1		55.2200	-62.88	-2.13	-65.01	-40.00	-25.01	peak	
2		126.0300	-64.15	-3.87	-68.02	-40.00	-28.02	peak	
3		200.2350	-65.53	-5.32	-70.85	-40.00	-30.85	peak	
4		480.0800	-64.87	2.40	-62.47	-40.00	-22.47	peak	
5	*	519.8500	-62.36	3.03	-59.33	-40.00	-19.33	peak	
6		759.9250	-69.62	7.56	-62.06	-40.00	-22.06	peak	

Test Mode :	LTE Band 48_TX CH55990_20MHz

Horizontal

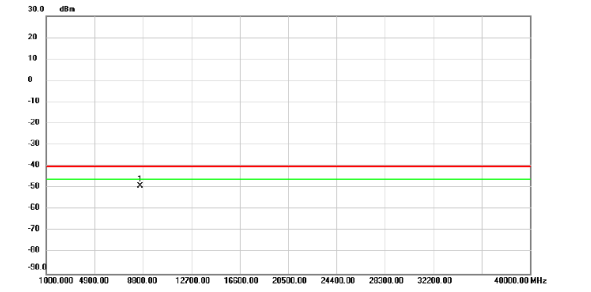


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1		55.7050	-71.99	-2.18	-74.17	-40.00	-34.17	peak	
2		155.6150	-63.00	-2.08	-65.08	-40.00	-25.08	peak	
3		200.2350	-58.64	-5.32	-63.96	-40.00	-23.96	peak	
4		279.7750	-59.10	-2.24	-61.34	-40.00	-21.34	peak	
5		439.8250	-64.91	1.67	-63.24	-40.00	-23.24	peak	
6	*	759.9250	-64.23	7.56	-56.67	-40.00	-16.67	peak	

APPENDIX F - RADIATED SPURIOUS EMISSIONS (ABOVE 1000MHZ)

Test Mode :	LTE Band 48_TX CH55990_5MHz

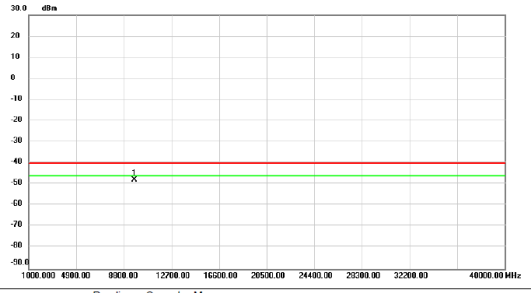
Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin	Detector	Comment
		MHz	dBm	dB	dBm	dBm	dB		
1	*	8585.500	-68.62	19.43	-49.19	-40.00	-9.19	peak	

Test Mode :	LTE Band 48_TX CH55990_5MHz

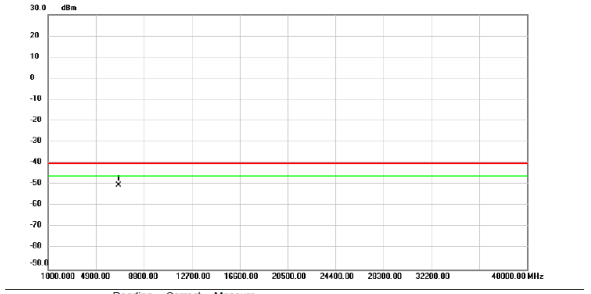
Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin	Detector	Comment
		MHz	dBm	dB	dBm	dBm	dB		
1	*	9638.500	-67.34	19.45	-47.89	-40.00	-7.89	peak	

Test Mode :	LTE Band 48_TX CH55990_20MHz

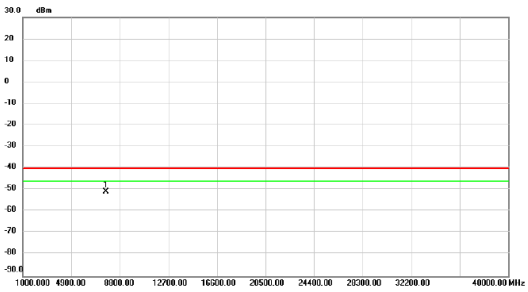
Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin	Detector	Comment
		MHz	dBm	dB	dBm	dBm	dB		
1	*	6733.000	-57.43	7.04	-50.39	-40.00	-10.39	peak	

Test Mode :	LTE Band 48_TX CH55990_20MHz

Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin	Detector	Comment
		MHz	dBm	dB	dBm	dBm	dB		
1	*	7669.000	-58.66	7.87	-50.79	-40.00	-10.79	peak	

APPENDIX G - BAND EDGE & ACLR