Prüfbericht-Nr.: *Test report no.:*	CN21SAM6(P24-WWAN) 001	**Auftrags-Nr.:** *Order no.:*	238511397	Seite 1 von 29 *Page 1 of 29*
Kunden-Referenz-Nr.: *Client reference no.:*	N/A	**Auftragsdatum:** *Order date:*	2021-04-16	
Auftraggeber: *Client:*	Skinny Lab Inc. DBA Spin 450 Mission St. Ste. 400 San Francisco			
Prüfgegenstand: *Test item:*	E-scooter			
Bezeichnung / Typ-Nr.: *Identification / Type no.:*	S-100T			
Auftrags-Inhalt: *Order content*:	FCC Part 24 Test report			
Prüfgrundlage: *Test specification:*	FCC 47CFR Part 24 Subpart E			

Wareneingangsdatum: *Date of sample receipt:*	2021-02-23
Prüfmuster-Nr.: *Test sample no:*	A003005263-014
Prüfzeitraum: *Testing period:*	2021-04-19 - 2021-04-27
Ort der Prüfung: *Place of testing:*	EMC/RF Taipei Testing Site
Prüflaboratorium: *Testing laboratory:*	Taipei Testing Laboratories
Prüfergebnis*: *Test result*:*	Pass

überprüft von: *reviewed by:*	David Huang	**genehmigt von:** authorized by:	Ryan Chen
Datum: *Date:* 2021-05-07		**Ausstellungsdatum:** *Issue date:* 2021-05-07	
Stellung / *Position:*	Project Manager	**Stellung** / *Position:*	Senior Project Manager

Sonstiges / *Other:*

Zustand des Prüfgegenstandes bei Anlieferung: Prüfmuster vollständig und unbeschädigt
Condition of the test item at delivery: *Test item complete and undamaged*

* Legende:	1 = sehr gut	2 = gut	3 = befriedigend	4 = ausreichend	5 = mangelhaft
	P(ass) = entspricht o.g. Prüfgrundlage(n)		F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	N/A = nicht anwendbar	N/T = nicht getestet
** Legend:*	*1 = very good*	*2 = good*	*3 = satisfactory*	*4 = sufficient*	*5 = poor*
	P(ass) = passed a.m. test specification(s)		*F(ail) = failed a.m. test specification(s)*	*N/A = not applicable*	*N/T = not tested*

TEST SUMMARY

Report Section	FCC Clause	Test Item	Result
5.1.1	2.1046 24.232(c)	Conducted Output Power and Effective Isotropically Radiated Power	Pass
5.1.2	2.1055 24.235	Frequency Stability	Pass
5.1.3	24.232(d)	Peak to Average Ratio	Pass
5.1.4	2.1049	Occupied Bandwidth and 26 dB Bandwidth	Pass
5.1.5	2.1051 24.238(a)	Conducted Band Edge	Pass
5.1.6	2.1051 24.238(a)	Conducted Spurious Emissions	Pass
5.1.7	2.1053 24.238(a)	Radiated Spurious Emissions	Pass

Note: Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

Contents

HISTORY OF THIS TEST REPORT

Report No.	Description	Date Issued
CN21SAM6(P24-WWAN) 001	Original Release	2021-04-14

1. General Remarks

1.1 Complementary Materials

All attachments are integral parts of this test report. This applies especially to the following appendix:
Appendix A - Test Result of Conducted
Appendix B - Test Result of Radiated Spurious Emissions
Appendix SP - Photographs Test Setup
Appendix EP - Photographs of EUT

Applied Standard and Test Levels

Radio
FCC 47CFR Part 2
FCC 47CFR Part 24 Subpart E
KDB 971168 D01 Power Meas License Digital Systems v03r01
ANSI/TIA/EIA-603-E 2016
ANSI C63.26-2015

1.2 Decision Rule of Conformity

The decision rule of conformity of this test report is following the requirements of the requested standard in the quotation, and agreed among testing laboratory and manufacturer (applicant) to exclude the consideration of Measurement Uncertainty, unless it is required by the specific standard.

2. Test Sites

2.1 Test Laboratory

Taipei Testing Laboratories

11F. No.758, Sec. 4, Bade Rd., Songshan Dist.
Taipei City 105
Taiwan (R.O.C.)

2.2 Test Facility

Taipei Testing Laboratories

No.458-18, Sec. 2, Fenliao Rd., Linkou Dist.,
New Taipei City 244
Taiwan (R.O.C.)
FCC Registration No.: 226631
ISED Registration No.: 25563

2.3 Traceability

All measurement equipment calibrations are traceable to NML(Taiwan)/NIST(USA) or where calibration is performed outside Taiwan, to equivalent nationally recognized standards organizations.

2.4 Calibration

Equipment requiring calibration is calibrated periodically in a suitably accredited Calibration Lab. Additionally all equipment is verified for proper performance on a regular basics using in house standards or comparisons.

2.5 Measurement Uncertainty

All measurement uncertainty values are shown with a coverage factor of k=2 to indicate a 95% level of confidence.

Emission Measurement Uncertainty

Parameter	Uncertainty
Radiated Emission (9 kHz ~ 30 MHz)	± 1.15 dB
Radiated Emission (30 MHz ~ 200 MHz)	± 1.32 dB
Radiated Emission (200 MHz ~ 1 GHz)	± 1.31 dB
Radiated Emission (1 GHz ~ 18 GHz)	± 1.53 dB
Radiated Emission (18 GHz ~ 40 GHz)	± 2.50 dB

3. General Product Information

3.1 Product Function and Intended Use

The EUT is an E-scooter. It contains a WWAN compatible module enabling the user to communicate data through a wireless interface.
For details refer to the User Guide, Data Sheet and Circuit Diagram.

3.2 System Details and Ratings

Basic Information of EUT

Item	EUT information
Kind of Equipment/Test Item	E-scooter
Type Identification	S-100T
FCC ID	2AMWASPINS150-001

Technical Specification of EUT

Item	EUT information	
Operating Frequency	LTE-M1 Band 2 (1.4 MHz)	1850.7 ~ 1909.3 MHz
	LTE-M1 Band 2 (3 MHz)	1851.5 ~ 1908.5 MHz
	LTE-M1 Band 2 (5 MHz)	1852.5 ~ 1907.5 MHz
	LTE-M1 Band 2 (10 MHz)	1855.0 ~ 1905.0 MHz
	LTE-M1 Band 2 (15 MHz)	1857.5 ~ 1902.5 MHz
	LTE-M1 Band 2 (20 MHz)	1860.0 ~ 1900.0 MHz
Modulation	LTE-M1	QPSK, 16QAM
Operation Voltage	110-240Vac from Charger, 48.1Vdc from Battery	
Antenna Information	Metal PIFA with 3.3 dBi gain	
Accessory Device	Refer to 4.3	

Maximum EIRP and Emission Designator

Item	Band	Value
Maximum EIRP (mW)	LTE-M1 Band 2	139
Emission Designator	LTE-M1 Band 2 (1.4 MHz)	1M10D7W
	LTE-M1 Band 2 (3 MHz)	1M10G7D
	LTE-M1 Band 2 (5 MHz)	1M10G7D
	LTE-M1 Band 2 (10 MHz)	1M12D7W
	LTE-M1 Band 2 (15 MHz)	1M11D7W
	LTE-M1 Band 2 (20 MHz)	1M12D7W

3.3 Noise Generating and Noise Suppressing Parts

Refer to the Circuit Diagram.

3.4 Submitted Documents

- Circuit Diagram
- Instruction Manual
- Rating Label
- Technical Description

4. Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

The equipment under test (EUT) was configured to measure its maximum power level. The test modes were adapted accordingly in reference to the instructions for use.

4.2 Test Operation and Test Software

Setup for testing: Test samples make a communication with MT8821C when the power is on.

Test Software	None.

The samples were used as follows:
A003005263-014 for conducted and radiated tests
Full test was applied on all test modes, but only worst case was shown.

Effective Isotropically Radiated Power (EIRP)

☒ Pre-Scan full test was applied on all test modes, but only worst case was shown.
☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Band	Channel Bandwidth	Available Channel	Tested Channel	Modulation	Mode	Postion
-	LTE-M1 Band 2	20 MHz	18700 to 19100	18700, 18900, 19100	QPSK, 16QAM	1 RB	Z-plane

Frequency Stability

☒ Pre-Scan full test was applied on all test modes, but only worst case was shown.
☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Band	Channel Bandwidth	Available Channel	Tested Channel	Modulation	Mode
-	LTE-M1 Band 2	1.4 MHz	18607 to 19193	18607, 19193	QPSK	1 RB
		3 MHz	18615 to 19185	18615, 19185	QPSK	1 RB
		5 MHz	18625 to 19175	18625, 19175	QPSK	1 RB
		10 MHz	18650 to 19150	18650, 19150	QPSK	1 RB
		15 MHz	18675 to 19125	18675, 19125	QPSK	1 RB
		20 MHz	18700 to 19100	18700, 19100	QPSK	1 RB

Peak to Average Ratio

☒ Pre-Scan full test was applied on all test modes, but only worst case was shown.
☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Band	Channel Bandwidth	Available Channel	Tested Channel	Modulation	Mode
-	LTE-M1 Band 2	1.4 MHz	18607 to 19193	18607, 18900, 19193	QPSK, 16QAM	1 RB
		3 MHz	18615 to 19185	18615, 18900, 19185	QPSK, 16QAM	1 RB
		5 MHz	18625 to 19175	18625, 18900, 19175	QPSK, 16QAM	1 RB
		10 MHz	18650 to 19150	18650, 18900, 19150	QPSK, 16QAM	1 RB
		15 MHz	18675 to 19125	18675, 18900, 19125	QPSK, 16QAM	1 RB
		20 MHz	18700 to 19100	18700, 18900, 19100	QPSK, 16QAM	1 RB

Occupied Bandwidth and 26 dB Bandwidth

☒ Pre-Scan full test was applied on all test modes, but only worst case was shown.
☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Band	Channel Bandwidth	Available Channel	Tested Channel	Modulation	Mode
-	LTE-M1 Band 2	1.4 MHz	18607 to 19193	18607, 18900, 19193	QPSK, 16QAM	Full RB
		3 MHz	18615 to 19185	18615, 18900, 19185	QPSK, 16QAM	Full RB
		5 MHz	18625 to 19175	18625, 18900, 19175	QPSK, 16QAM	Full RB
		10 MHz	18650 to 19150	18650, 18900, 19150	QPSK, 16QAM	Full RB
		15 MHz	18675 to 19125	18675, 18900, 19125	QPSK, 16QAM	Full RB
		20 MHz	18700 to 19100	18700, 18900, 19100	QPSK, 16QAM	Full RB

Band Edge

☒ Pre-Scan full test was applied on all test modes, but only worst case was shown.
☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Band	Channel Bandwidth	Available Channel	Tested Channel	Modulation	Mode
-	LTE-M1 Band 2	1.4 MHz	18607 to 19193	18607, 19193	QPSK, 16QAM	1 RB / Full RB
		3 MHz	18615 to 19185	18615, 19185	QPSK, 16QAM	1 RB / Full RB
		5 MHz	18625 to 19175	18625, 19175	QPSK, 16QAM	1 RB / Full RB
		10 MHz	18650 to 19150	18650, 19150	QPSK, 16QAM	1 RB / Full RB
		15 MHz	18675 to 19125	18675, 19125	QPSK, 16QAM	1 RB / Full RB
		20 MHz	18700 to 19100	18700, 19100	QPSK, 16QAM	1 RB / Full RB

Conducted Spurious Emissions

☒ Pre-Scan full test was applied on all test modes, but only worst case was shown.
☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Band	Channel Bandwidth	Available Channel	Tested Channel	Modulation	Mode
-	LTE-M1 Band 2	1.4 MHz	18607 to 19193	18607, 18900, 19193	QPSK, 16QAM	1 RB
		3 MHz	18615 to 19185	18615, 18900, 19185	QPSK, 16QAM	1 RB
		5 MHz	18625 to 19175	18625, 18900, 19175	QPSK, 16QAM	1 RB
		10 MHz	18650 to 19150	18650, 18900, 19150	QPSK, 16QAM	1 RB
		15 MHz	18675 to 19125	18675, 18900, 19125	QPSK, 16QAM	1 RB
		20 MHz	18700 to 19100	18700, 18900, 19100	QPSK, 16QAM	1 RB

Radiated Spurious Emissions

☒ Pre-Scan full test was applied on all test modes, but only worst case was shown.

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Band	Channel Bandwidth	Available Channel	Tested Channel	Modulation	Mode	Postion
-	LTE-M1 Band 2	20 MHz	18700 to 19100	18700, 18900, 19100	QPSK	1 RB	H-plane

Test Condition

Test Item	Ambient Temperature	Relative Humidity	Tested by
ERP / EIRP	20.1-24.1 °C	60-65 %	Eagle Tsai
Frequency Stability	20.9-25.8 °C	55.6-65.5 %	Chun-Yi Wu
Peak to Average Ratio	20.9-25.8 °C	55.6-65.5 %	Chun-Yi Wu
Occupied Bandwidth and 26 dB Bandwidth	20.9-25.8 °C	55.6-65.5 %	Chun-Yi Wu
Band Edge	20.9-25.8 °C	55.6-65.5 %	Chun-Yi Wu
Conducted Spurious Emissions	20.1-24.1 °C	60-65 %	Eagle Tsai
Radiated Spurious Emissions	20.1-24.1 °C	60-65 %	Eagle Tsai

4.3 Special Accessories and Auxiliary Equipment

The product has been tested together with the following additional accessories:

Accessory of EUT

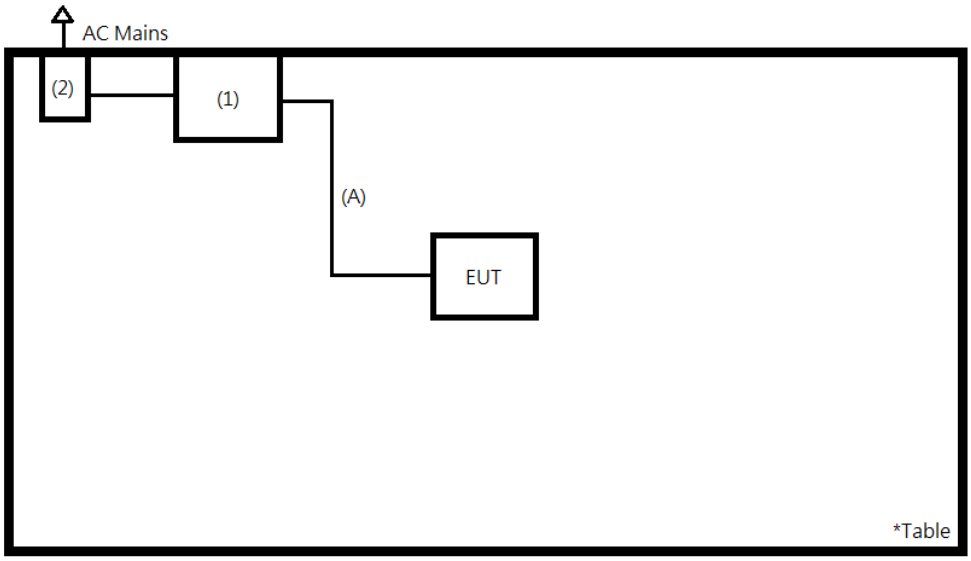
No.	Product	Brand	Model	Description
A	AC Adapter	MDA	SPBC4802A	I/P: 100-240 Vac, O/P: 54.6 Vdc, 180 cm shielded cable with core
				Radiated, Mains Conducted and E.I.R.P Tests
B	LI-ION BATTERY PACK	SPIN	B1	48.1Vdc, 11100 mAh
				Radiated and E.I.R.P. Tests

Support Unit

No.	Description	Brand	Model	S/N	Remark
Conducted Test					
-	Notebook	HP	TPN-C139	CND93662WT	-

4.4 Test Setup Diagram

<E.I.R.P. and Radiated Emission>



5. Test Results

5.1 Transmitter Requirement & Test Suites

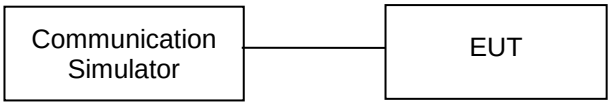
5.1.1 Conducted Output Power and EIRP

Limit 2 watt (EIRP)

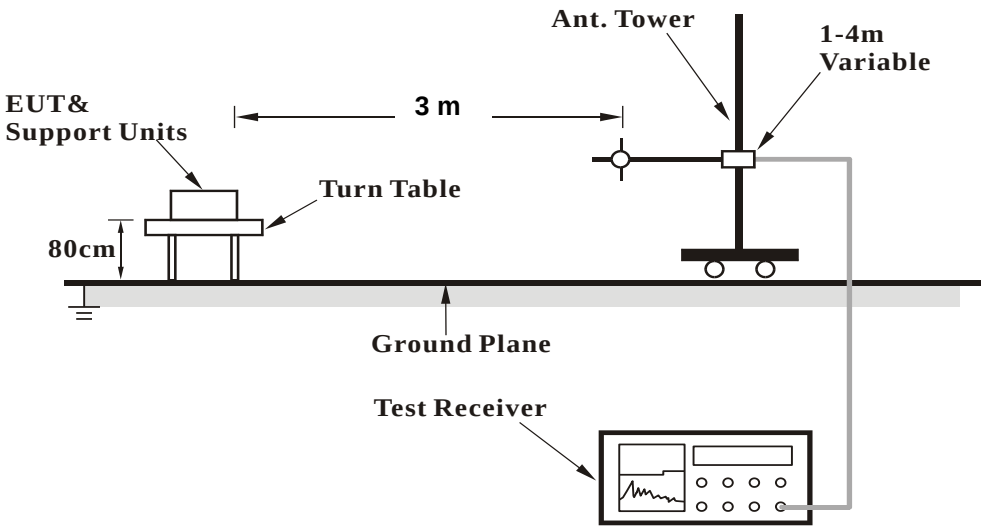
Kind of Test Site Shielded room

Test Setup

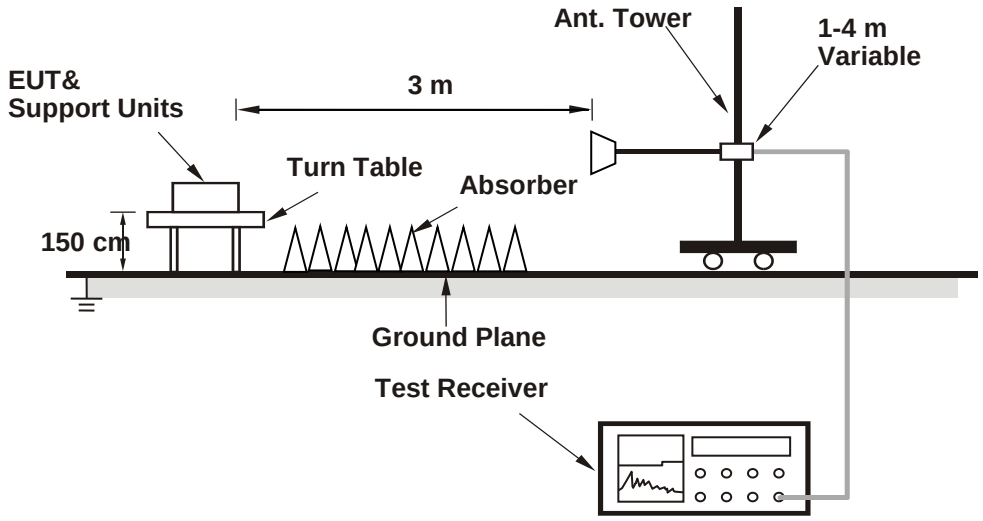
<Conducted Output Power>



<Radiated Emission below or equal to 1 GHz>



<Radiated Emission above 1 GHz>



Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date
Signal Analyzer	R&S	FSV40	101508	2021/3/16	2022/3/15
Receiver	R&S	ESR7	102109	2021/3/16	2022/3/15
Bilog Antenna	SCHWARZBECK	VULB-9168	00951	2021/2/18	2022/2/17
Horn Antenna	ETS-Lindgren	3117	00218930	2020/12/1	2021/11/30
LF-AMP	Agilent	8447D	2944A10772	2021/2/18	2022/2/17
HF-AMP + AC source	EMCI	EMC051845SE	980633	2021/2/9	2022/2/8
HF-AMP + AC source	EMCI	EMC184045SE	980657	2021/2/1	2022/1/31
Horn Antenna	SCHWARZBECK	BBHA 9170	00887	2021/4/8	2022/4/7
Microwave Cable	HUBER+SUHNER	SUCOFLEX 104EA	800056/4EA	2021/3/17	2022/3/16
Microwave Cable	HUBER+SUHNER	SUCOFLEX 104	804680/4	2021/3/17	2022/3/16
Microwave Cable	HUBER+SUHNER	SUCOFLEX 104	MY37202/4	2021/3/17	2022/3/16
Microwave Cable	HUBER+SUHNER	SUCOFLEX 102EA	800898/2EA	2021/4/16	2022/4/15
Microwave Cable	HUBER+SUHNER	SUCOFLEX 102EA	800898/2EA	2020/4/17	2021/4/16
Microwave Cable	HUBER+SUHNER	SUCOFLEX 102EA	800901/2EA	2021/4/16	2022/4/15
Microwave Cable	HUBER+SUHNER	SUCOFLEX 102EA	800901/2EA	2020/4/17	2021/4/16
Microwave Cable	HUBER+SUHNER	SUCOFLEX 102EA	801027/2EA	2021/4/16	2022/4/15
Microwave Cable	HUBER+SUHNER	SUCOFLEX 102EA	801027/2EA	2020/4/17	2021/4/16
Loop Antenna	Chance Most	EMCILPA600 +calibration	287	2020/6/17	2021/6/16

Test Procedures

Conducted Power Measurement:
The EUT was set up for the maximum power with WWAN link data modulation and link up with simulator. Set the EUT to transmit under low, middle and high channel and record the power level shown on simulator.

EIRP / ERP Measurement:

a. All measurements were done at low, middle and high operational frequency range. RBW and VBW is 1 MHz for GSM, GPRS & EDGE, and 5 MHz for WCDMA and CDMA, and 10 MHz for LTE mode.
b. Substitution method is used for E.I.R.P measurement. In the semi-anechoic chamber, EUT placed on the 0.8 m (below or equal 1 GHz) and/or 1.5 m (above 1 GHz) 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 1 m to 4 m to find the maximum polar radiated power. The “Read Value” is the spectrum reading the maximum power value.
c. 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 b. Record the power level of S.G.
d. EIRP = Output power level of S.G – TX cable loss + Antenna gain of substitution horn. 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.R.P power - 2.15 dB.
e. The ERP / EIRP testing was performed in the X(E1), Y(H) and Z(E2) axis orientation. The worst-case Axis orientation is recorded in this test report.

Test Result

<Conducted Output Power>

LTE-M1 Band 2												
Bandwidth	1.4 MHz						3 MHz					
Modulation	RB Size	RB Offset	NB Index	Channel / Frequency (MHz)			RB Size	RB Offset	NB Index	Channel / Frequency (MHz)		
				18607/ 1850.7	18900/ 1880	19193/ 1909.3				18615/ 1851.5	18900/ 1880	19185/ 1908.5
QPSK	1	0	0	20.93	20.96	20.97	1	0	0	20.91	21.00	21.01
	1	5	0	20.70	20.73	20.82	1	5	1	20.69	20.87	20.93
	3	0	0	19.78	19.83	19.99	3	0	0	19.76	19.79	19.89
	3	3	0	19.65	19.65	19.81	3	3	1	19.61	19.62	19.72
	6	0	0	18.91	18.96	19.20	6	0	0	18.83	18.86	19.08
	-	-	-	-	-	-	6	0	1	18.86	18.90	19.07
16QAM	1	0	0	20.15	19.93	19.98	1	0	0	19.47	19.57	19.80
	1	4	0	19.92	19.77	19.81	1	4	1	19.40	19.47	19.61
	3	0	0	18.65	18.71	18.72	3	0	0	18.58	18.65	18.75
	3	2	0	18.51	18.66	18.80	3	2	1	18.56	18.59	18.85
	5	0	0	18.81	18.84	19.05	5	0	0	18.82	18.90	19.07
	-	-	-	-	-	-	5	0	1	18.79	18.82	18.96
Bandwidth	5 MHz							10 MHz				
Modulation	RB Size	RB Offset	NB Index	Channel / Frequency (MHz)			RB Size	RB Offset	NB Index	Channel / Frequency (MHz)		
				18625/ 1852.5	18900/ 1880	19175/ 1907.5				18650/ 1855	18900/ 1880	19150/ 1905
QPSK	1	0	0	20.74	20.82	21.04	1	0	0	20.82	20.88	21.11
	1	0	3	20.82	20.87	21.06	1	0	3	20.80	20.89	21.14
	1	5	0	20.59	20.66	20.88	1	5	4	20.59	20.66	20.89
	1	5	3	20.57	20.70	20.91	1	5	7	20.72	20.75	20.88
	3	0	0	20.77	20.84	20.99	3	0	0	20.80	20.82	20.94
	3	3	3	20.62	20.65	20.88	3	3	7	20.75	20.79	20.91
	6	0	0	19.77	19.82	19.99	6	0	0	19.69	19.81	19.93
	6	0	3	19.78	19.87	19.92	6	0	7	19.82	19.72	19.95
16QAM	1	0	0	20.59	20.68	20.87	1	0	0	20.68	20.71	20.88
	1	0	3	20.58	20.86	20.81	1	0	3	20.66	20.67	20.83
	1	4	0	20.44	20.53	20.64	1	4	4	20.49	20.57	20.73
	1	4	3	20.43	20.62	20.66	1	4	7	20.55	20.54	20.76
	3	0	0	20.48	20.62	20.79	3	0	0	20.52	20.68	20.75
	3	2	3	20.44	20.55	20.69	3	2	7	20.48	20.65	20.76
	5	0	0	19.76	19.74	19.96	5	0	0	20.74	20.83	21.01
	5	0	3	19.76	19.71	19.90	5	0	7	20.84	20.85	21.10

LTE-M1 Band 2												
Bandwidth	15 MHz						20 MHz					
Modulation	RB Size	RB Offset	NB Index	Channel / Frequency (MHz)			RB Size	RB Offset	NB Index	Channel / Frequency (MHz)		
				18625/ 1852.5	18900/ 1880	19175/ 1907.5				18650/ 1855	18900/ 1880	19150/ 1905
QPSK	1	0	0	20.71	20.84	20.98	1	0	0	20.76	20.86	21.15
	1	0	3	20.82	20.93	21.10	1	0	3	20.81	20.90	21.05
	1	5	8	20.66	20.82	20.86	1	5	12	20.70	20.79	20.93
	1	5	11	20.73	20.76	20.96	1	5	15	20.67	20.83	20.93
	3	0	0	20.78	20.82	20.93	3	0	0	20.79	20.82	20.94
	3	3	11	20.71	20.83	20.99	3	3	15	20.69	20.77	20.97
	6	0	0	20.84	20.79	21.02	6	0	0	20.80	20.80	21.02
	6	0	11	20.86	20.95	21.06	6	0	15	20.81	20.92	21.13
16QAM	1	0	0	20.56	20.60	20.82	1	0	0	20.60	20.63	20.81
	1	0	3	20.59	20.62	20.87	1	0	3	20.56	20.69	20.83
	1	4	8	20.52	20.51	20.63	1	4	12	20.54	20.64	20.77
	1	4	11	20.54	20.62	20.77	1	4	15	20.51	20.60	20.79
	3	0	0	20.48	20.53	20.71	3	0	0	20.49	20.57	20.72
	3	2	11	20.52	20.61	20.77	3	2	15	20.49	20.60	20.70
	5	0	0	20.52	20.60	20.93	5	0	0	20.76	20.79	20.90
	5	0	11	20.47	20.62	20.99	5	0	15	20.76	20.88	21.03

<EIRP>

LTE-M1 Band 2_Channel Bandwidth_20M							
QPSK							
Plane	Channel	Frequency (MHz)	Reading (dBm)	Correction Factor (dB)	EIRP (dBm)	EIRP (mW)	Polarization (H/V)
Z	18700	1860.0	-25.22	46.26	21.04	127.06	H
	18900	1880.0	-25.21	46.57	21.36	136.77	
	19100	1900.0	-24.84	46.81	21.97	157.40	
	18700	1860.0	-28.24	47.39	19.15	82.22	V
	18900	1880.0	-27.35	47.64	20.29	106.91	
	19100	1900.0	-28.38	47.77	19.39	86.90	
16QAM							
Plane	Channel	Frequency (MHz)	Reading (dBm)	Correction Factor (dB)	EIRP (dBm)	EIRP (mW)	Polarization (H/V)
Z	18700	1860.0	-26.13	46.26	20.13	103.04	H
	18900	1880.0	-26.32	46.57	20.25	105.93	
	19100	1900.0	-25.36	46.81	21.45	139.64	
	18700	1860.0	-29.54	47.39	17.85	60.95	V
	18900	1880.0	-28.46	47.64	19.18	82.79	
	19100	1900.0	-29.67	47.77	18.10	64.57	

Note: EIRP (dBm) = Reading (dBm) + Correction Factor (dB)

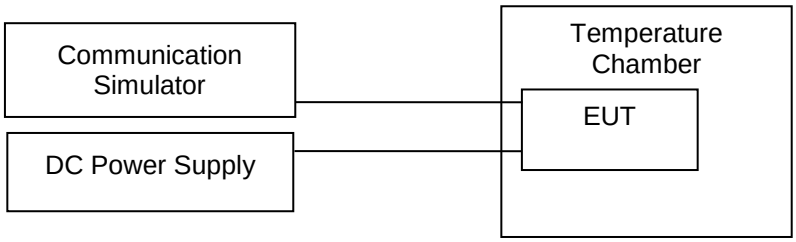
5.1.2 Frequency Stability

Limit

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

Kind of Test Site Shielded room

Test Setup



Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Radio Communition Analyzer	Anritsu	MT8821C	6262044753	2021/1/29	2022/1/28	2021/4/19	2021/4/19
Thermal Chamber	Giant Force	GHT-150-40-CP-SD	MAA1902-010	2021/3/4	2022/3/3	2021/4/19	2021/4/19

Test Procedure

a. Device is placed at the temperature chamber. The temperature chamber could control the temperatures and humidity. Power warm up is at least 15 min and power applied should perform before recording frequency error.
b. 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.
c. The temperature range step is 10 degrees in this test items. All temperature levels shall be hold the ±0.5 ℃ 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.

Test Results

LTE-M1 Band 2_1.4 MHz				
Frequency Error versus Voltage				
Power Supply (Vdc)	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
4.37	1850.700000	0.014580	1909.300000	-0.006579
3.8	1850.700000	0.005944	1909.300000	0.008380
3.23	1850.700000	-0.002346	1909.300000	0.014831
Frequency Error versus Temperature				
Temperature (°C)	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
50	1850.700000	-0.001225	1909.300000	-0.010789
40	1850.700000	0.008984	1909.300000	-0.013883
30	1850.700000	-0.005780	1909.300000	-0.004190
20	1850.700000	0.005944	1909.300000	0.008380
10	1850.700000	-0.000196	1909.300000	-0.004610
0	1850.700000	-0.013147	1909.300000	0.010260
-10	1850.700000	0.008132	1909.300000	-0.010971

LTE-M1 Band 2_3 MHz				
Frequency Error versus Voltage				
Power Supply (Vdc)	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
4.37	1851.500000	0.010079	1908.500000	-0.000425
3.8	1851.500000	0.007021	1908.500000	0.010479
3.23	1851.500000	-0.003484	1908.500000	-0.002977
Frequency Error versus Temperature				
Temperature (°C)	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
50	1851.500000	0.010895	1908.500000	0.004603
40	1851.500000	-0.010426	1908.500000	-0.004560
30	1851.500000	0.013045	1908.500000	0.010373
20	1851.500000	0.007021	1908.500000	0.010479
10	1851.500000	0.012305	1908.500000	-0.013089
0	1851.500000	0.014785	1908.500000	-0.004842
-10	1851.500000	0.001299	1908.500000	-0.009843

LTE-M1 Band 2_5 MHz				
Frequency Error versus Voltage				
Power Supply (Vdc)	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
4.37	1852.500000	0.005597	1907.500000	0.013718
3.8	1852.500000	0.006478	1907.500000	-0.005767
3.23	1852.500000	0.000645	1907.500000	-0.004656
Frequency Error versus Temperature				
Temperature (°C)	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
50	1852.500000	0.004960	1907.500000	0.002282
40	1852.500000	-0.011835	1907.500000	-0.009172
30	1852.500000	-0.013643	1907.500000	-0.013059
20	1852.500000	0.006478	1907.500000	-0.005767
10	1852.500000	0.001571	1907.500000	0.003321
0	1852.500000	-0.006226	1907.500000	0.014228
-10	1852.500000	-0.013230	1907.500000	0.005026

LTE-M1 Band 2_10 MHz				
Frequency Error versus Voltage				
Power Supply (Vdc)	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
4.37	1855.000000	0.000915	1905.000000	0.011110
3.8	1855.000000	-0.009717	1905.000000	-0.006291
3.23	1855.000000	-0.003983	1905.000000	-0.011639
Frequency Error versus Temperature				
Temperature (°C)	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
50	1855.000000	0.011094	1905.000000	0.000071
40	1855.000000	0.000593	1905.000000	-0.003932
30	1855.000000	-0.003596	1905.000000	-0.001441
20	1855.000000	-0.009717	1905.000000	-0.006291
10	1855.000000	-0.010556	1905.000000	0.014190
0	1855.000000	-0.002062	1905.000000	0.004691
-10	1855.000000	0.000463	1905.000000	-0.009209

LTE-M1 Band 2_15 MHz				
Frequency Error versus Voltage				
Power Supply (Vdc)	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
4.37	1857.500000	0.014863	1902.500000	0.008383
3.8	1857.500000	-0.007557	1902.500000	-0.009436
3.23	1857.500000	-0.001289	1902.500000	0.006979
Frequency Error versus Temperature				
Temperature (°C)	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
50	1857.500000	-0.000888	1902.500000	0.011020
40	1857.500000	0.009987	1902.500000	0.012835
30	1857.500000	-0.011847	1902.500000	0.013889
20	1857.500000	-0.007557	1902.500000	-0.009436
10	1857.500000	0.001742	1902.500000	0.009037
0	1857.500000	-0.008861	1902.500000	-0.009983
-10	1857.500000	0.003874	1902.500000	-0.012351

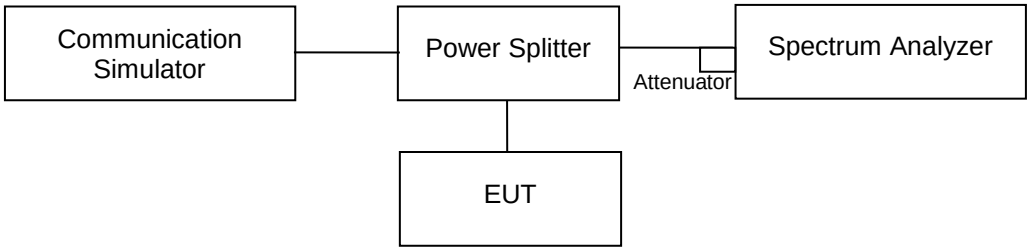
LTE-M1 Band 2_20 MHz				
Frequency Error versus Voltage				
Power Supply (Vdc)	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
4.37	1860.000000	0.004457	1900.000000	0.013028
3.8	1850.000000	-0.005398	1889.000000	-0.005767
3.23	1860.000000	-0.012840	1900.000000	-0.009691
Frequency Error versus Temperature				
Temperature (°C)	Low Channel		High Channel	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
50	1870.000000	0.005398	1900.000000	0.011009
40	1870.000000	0.005398	1900.000000	0.009436
30	1866.000000	0.003239	1900.000000	0.008388
20	1850.000000	-0.005398	1889.000000	-0.005767
10	1867.000000	0.003779	1900.000000	0.003670
0	1847.000000	-0.007018	1900.000000	0.005767
-10	1870.000000	0.005398	1900.000000	0.012058

5.1.3 Peak to Average Ratio

Limit 13 dB

Kind of Test Site Shielded room

Test Setup



Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Spectrum Analyzer	R&S	FSV40	101512	2021/1/28	2022/1/27	2021/4/22	2021/4/22
Radio Communition Analyzer	Anritsu	MT8821C	6262044753	2021/1/29	2022/1/28	2021/4/22	2021/4/22

Test Procedure

1. Set resolution/measurement bandwidth ≥ 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 %.

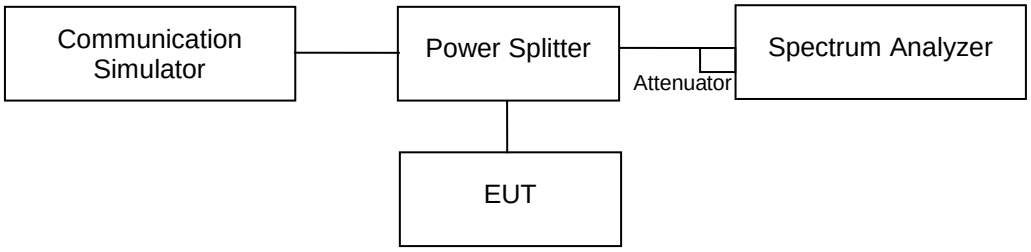
Test Results

Please refer to Appendix A.

5.1.4 Occupied Bandwidth and 26 dB Bandwidth Measurement

Kind of Test Site Shielded room

Test Setup



Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Spectrum Analyzer	R&S	FSV40	101512	2021/1/28	2022/1/27	2021/4/20	2021/4/27
Radio Communition Analyzer	Anritsu	MT8821C	6262044753	2021/1/29	2022/1/28	2021/4/20	2021/4/27

Test Procedure

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.
- Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

Test Results

Please refer to Appendix A.

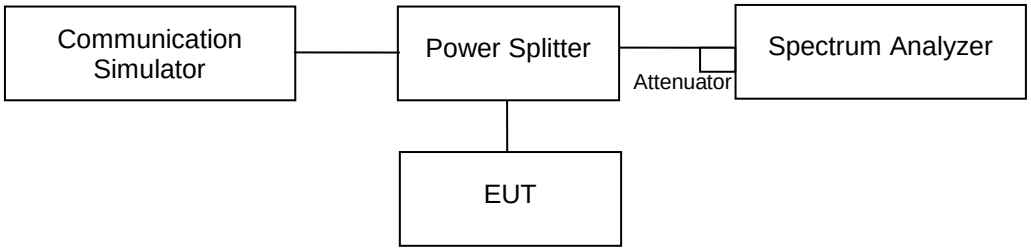
5.1.5 Conducted Band Edge

Limit

In the 1 MHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 1% of the emission bandwidth of the fundamental emission of the transmitter limit at least 43 + 10 log(P) dB.

Kind of Test Site Shielded room

Test Setup



Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Spectrum Analyzer	R&S	FSV40	101512	2021/1/28	2022/1/27	2021/4/20	2021/4/27
Radio Communition Analyzer	Anritsu	MT8821C	6262044753	2021/1/29	2022/1/28	2021/4/20	2021/4/27

Test Procedure

a. All measurements were done at low and high operational frequency range.
b. The center frequency of spectrum is the band edge frequency.
c. Record the maximum trace plot into the test report.

Test Results

Please refer to Appendix A.

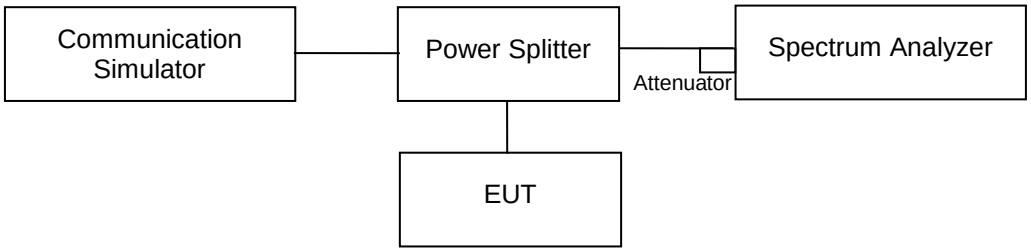
5.1.6 Conducted Spurious Emissions

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.

Kind of Test Site Shielded room

Test Setup



Test Instruments

Kind of Equipment	Manufacturer	Type	S/N	Calibration Date	Calibration Due Date	Test Date	
						From	Until
Spectrum Analyzer	R&S	FSV40	101512	2020/2/24	2021/2/23	2021/4/21	2021/4/21
Spectrum Analyzer	R&S	FSV40	101512	2021/1/28	2022/1/27		
Wireless Communication Tester	R&S	CMW500	166923	2020/2/11	2021/2/10	2021/4/21	2021/4/21
Radio Communition Analyzer	Anritsu	MT8821C	6262044753	2021/1/29	2022/1/28		

Test Procedure

a. The EUT makes a phone call to the communication simulator. All measurements were done at low, middle and high operational frequency range.
b. Measuring frequency range is from 9 KHz to the 10^{th} harmonic of fundamental frequency. 10 dB attenuation pad is connected with spectrum.

Test Results

Please refer to Appendix A.

5.1.7 Radiated Spurious Emissions

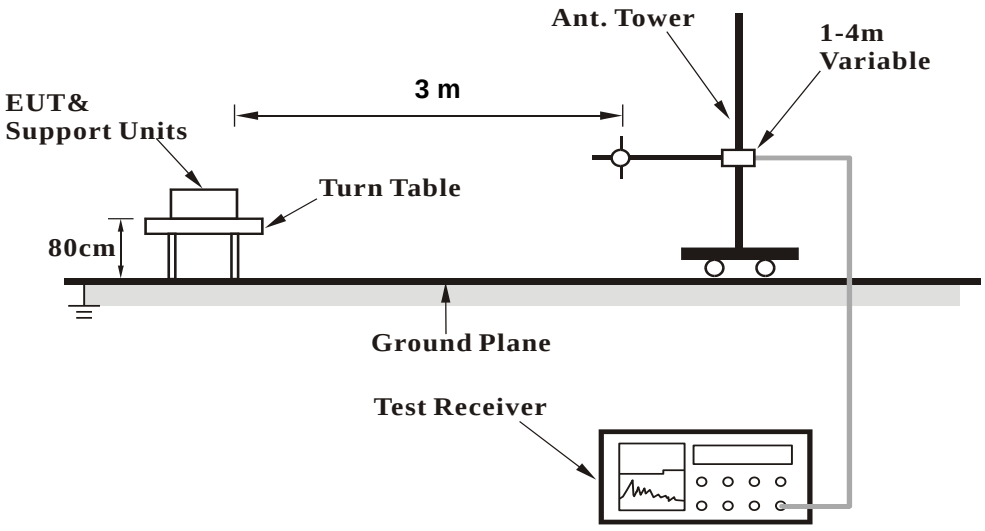
Limit

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.

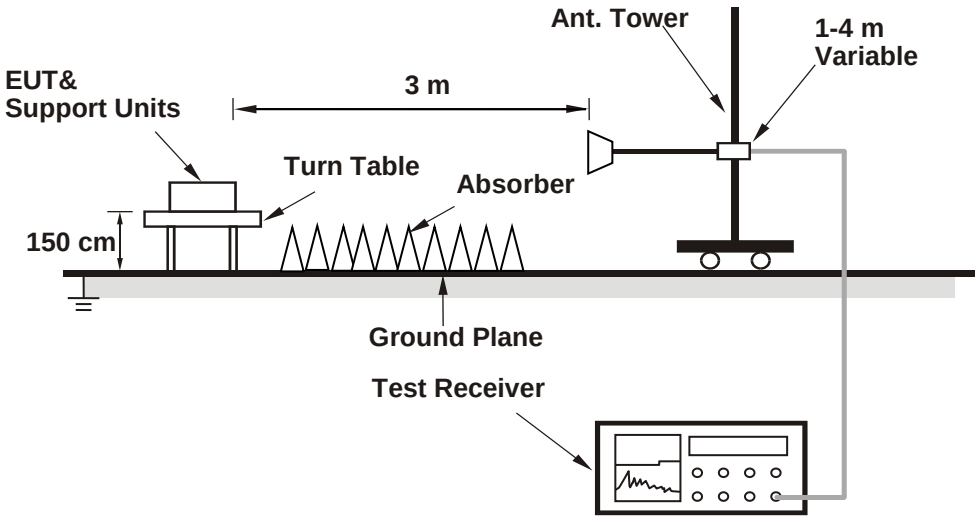
Kind of Test Site 3m Semi-Anechoic Chamber

Test Setup

<Radiated Emissions below or equal to 1 GHz>



<Radiated Emissions above 1 GHz>



For the actual test configuration, please refer to the attached file (Test Setup Photo).

Test Instruments

Refer to 5.1.1 Test Instruments

Test Procedures

a. Substitution mothod is used for E.I.R.P. measurement. In the semi-anechoic chamber, EUT placed on the 0.8m (below or equal to 1 GHz) and/or 1.5m (above 1 GHz) height of turn table, rotated the table around 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.
b. 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.
c. E.I.R.P. = Output power level of S.G – TX cable loss + Antenna gain of substitution horn.
d. E.R.P. can be calculated from E.I.R.P. by subtracting the gain of dipole, E.R.P. = E.I.R.P – 2.15 dB.

Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1MHz/3MHz.
2. Testing was carried out within frequency range 30 MHz to the tenth harmonic.
3. All modes of operation were investigated and the worst-case emissions are reported.
4. The Radiated Emissions testing was performed in X(E1), Y(H) and Z(E2) axis orientation. The worst-case Axis orientation is recorded in this test report.

Test Results

Please refer to Appendix B.

Appendix A: Test Results of Conducted Test

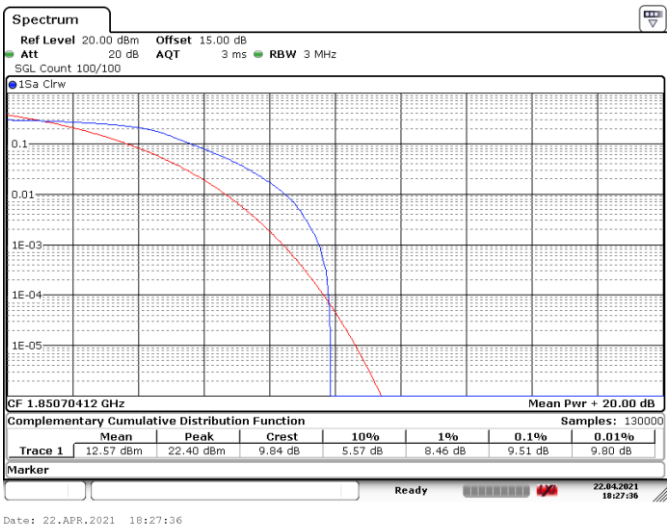
Peak to Average Ratio

LTE Band 2 _ Channel Bandwidth: 1.4 MHz

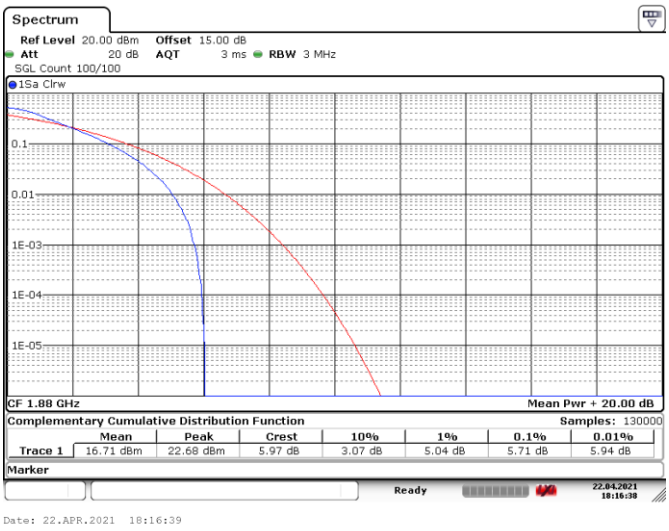
Channel	Frequency (MHz)	Peak to Average Ratio (dB)	
		QPSK	16QAM
18607	1850.7	9.51	8.99
18900	1880.0	5.71	7.80
19193	1909.3	9.57	10.26

QPSK

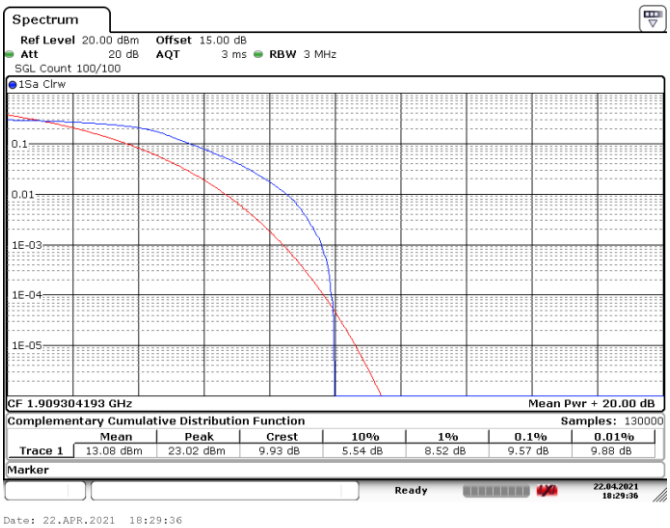
Channel_18607



Channel_18900

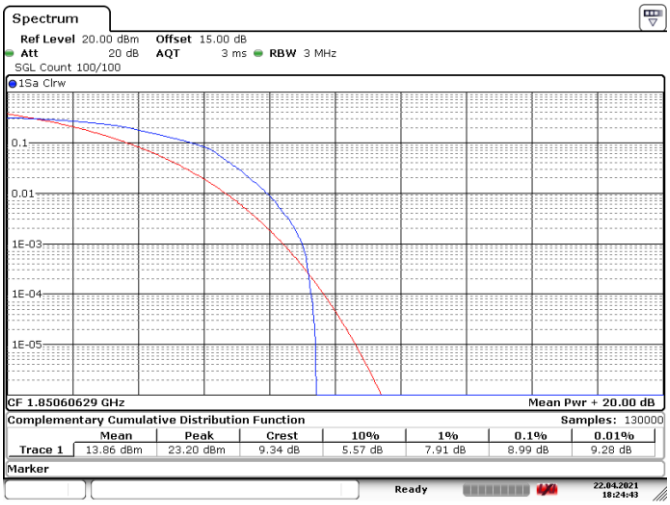


Channel_19193



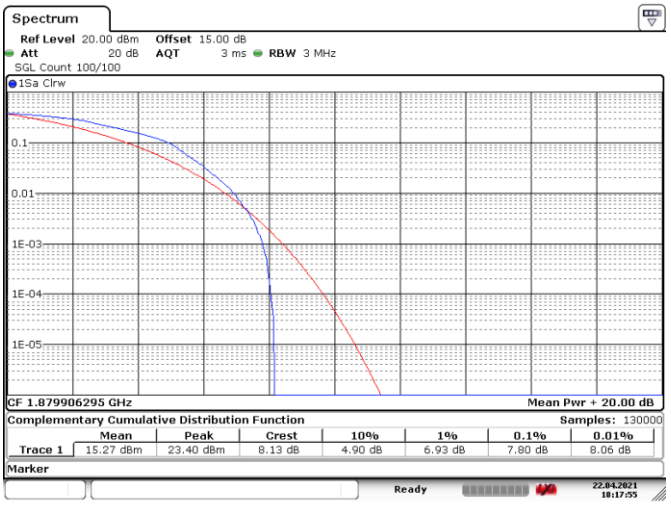
16QAM

Channel_18607



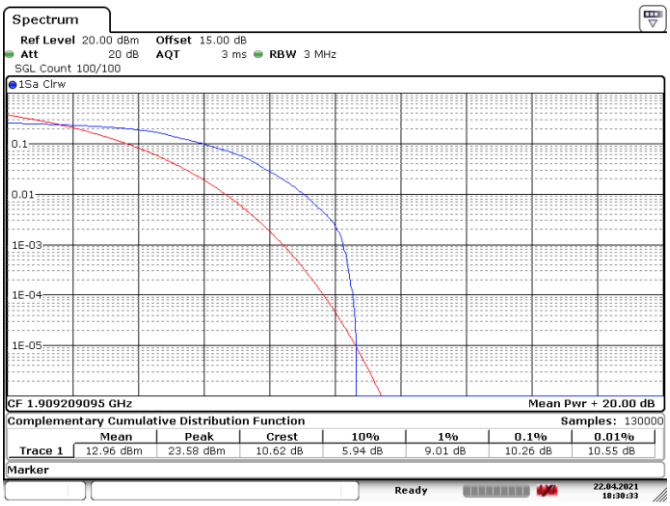
Date: 22.APR.2021 18:24:43

Channel_18900



Date: 22.APR.2021 18:17:55

Channel_19193



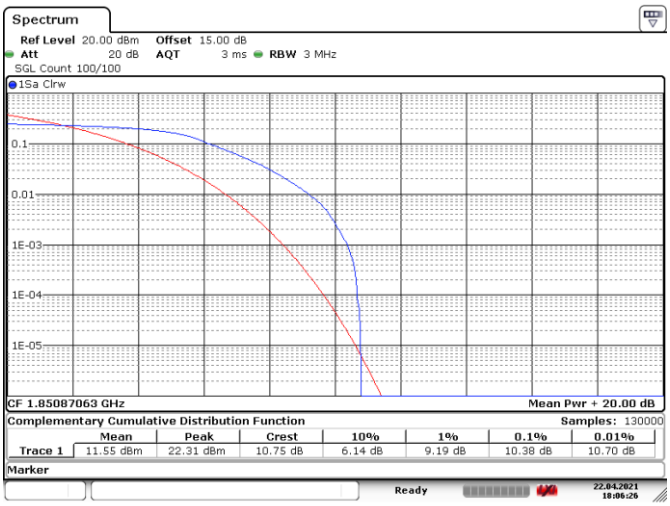
Date: 22.APR.2021 18:30:33

LTE Band 2 _ Channel Bandwidth: 3 MHz

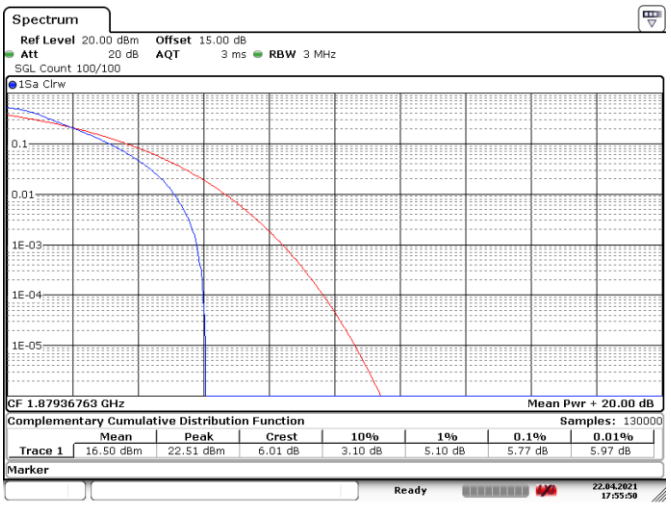
Channel	Frequency (MHz)	Peak to Average Ratio (dB)	
		QPSK	16QAM
18615	1851.5	10.38	8.06
18900	1880.0	5.77	8.06
19185	1908.5	5.28	9.04

QPSK

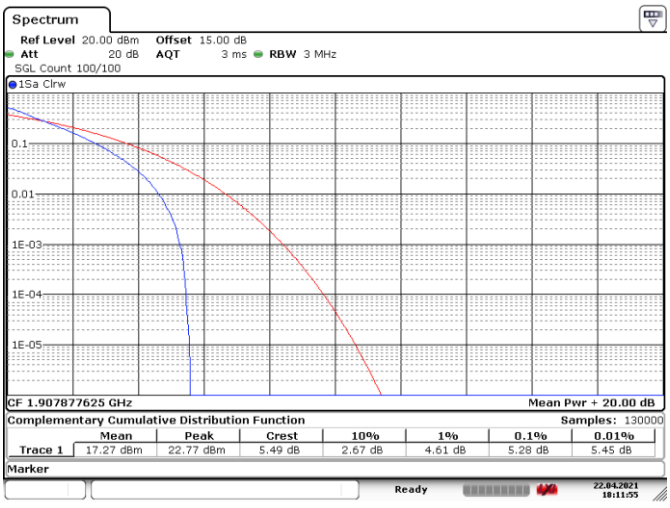
Channel_18615



Channel_18900

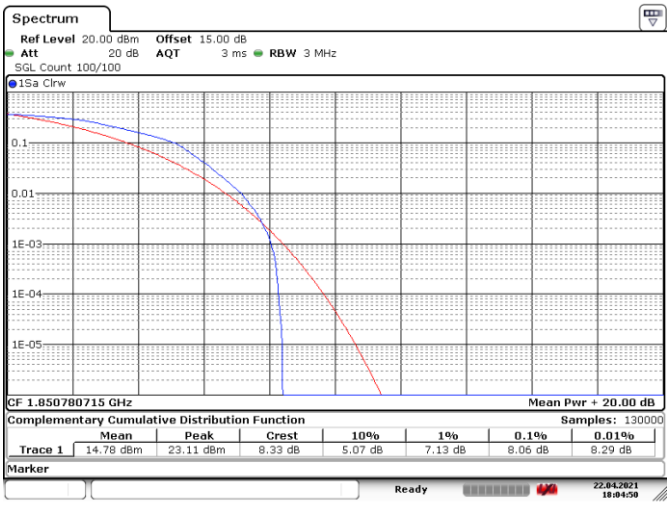


Channel_19185

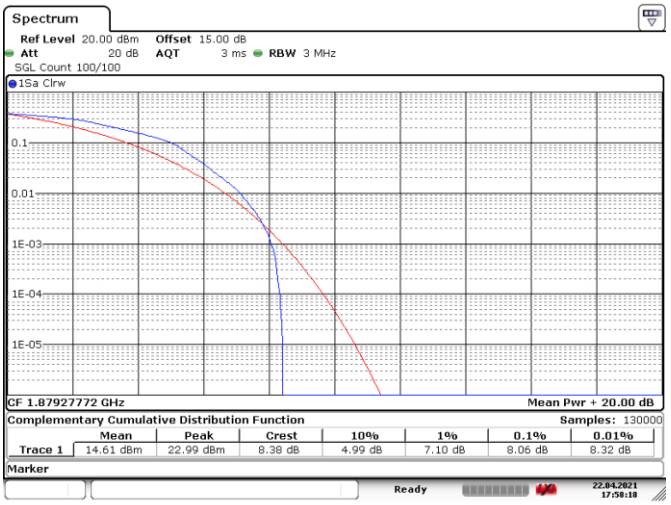


16QAM

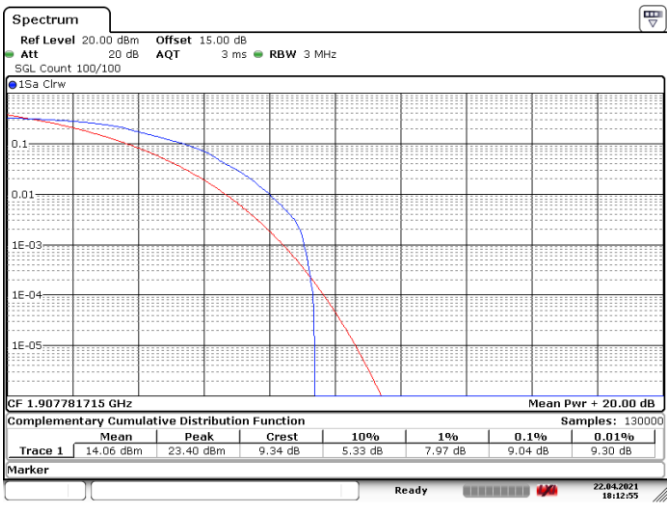
Channel_18615



Channel_18900



Channel_19185

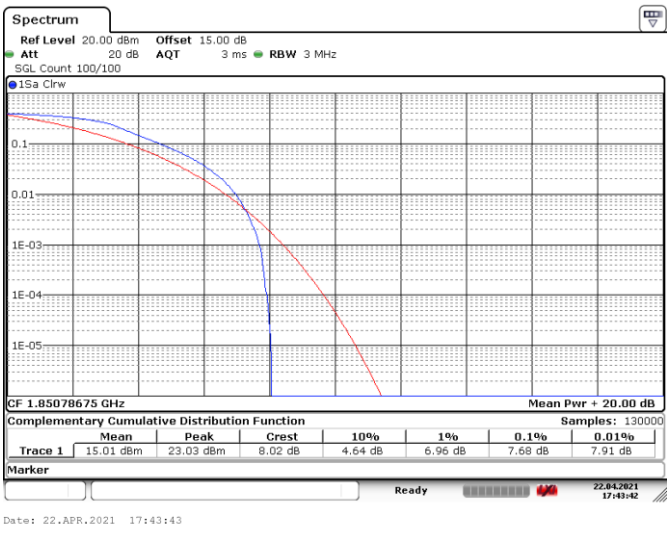


LTE Band 2 _ Channel Bandwidth: 5 MHz

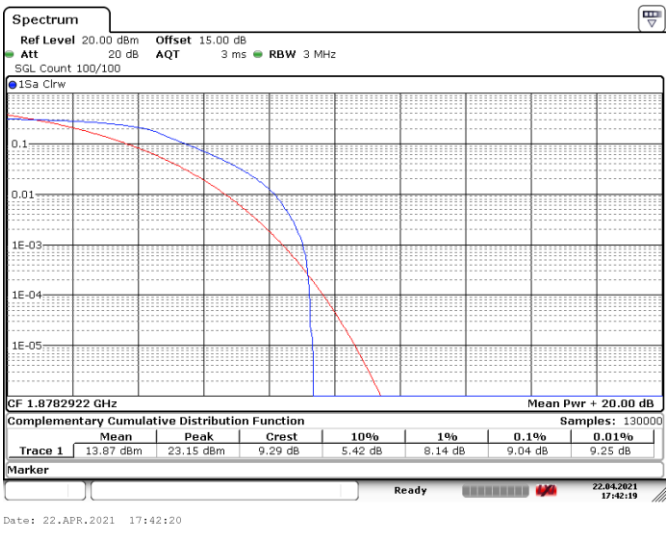
Channel	Frequency (MHz)	Peak to Average Ratio (dB)	
		QPSK	16QAM
18625	1852.5	7.68	7.74
18900	1880.0	9.04	8.84
19175	1907.5	10.93	10.93

QPSK

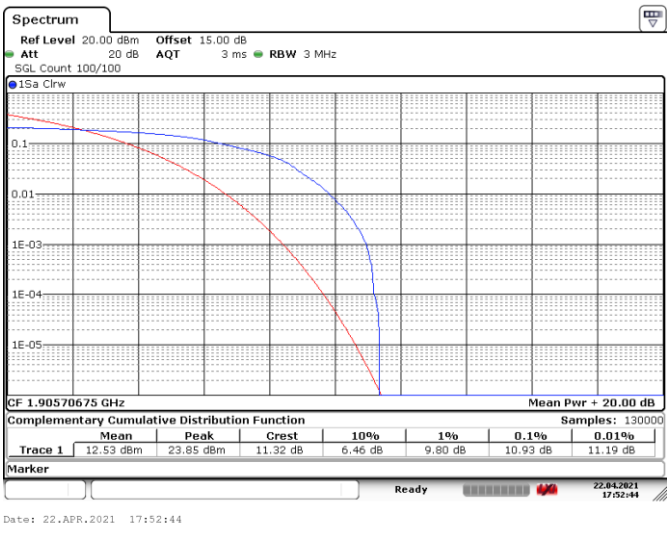
Channel_18625



Channel_18900

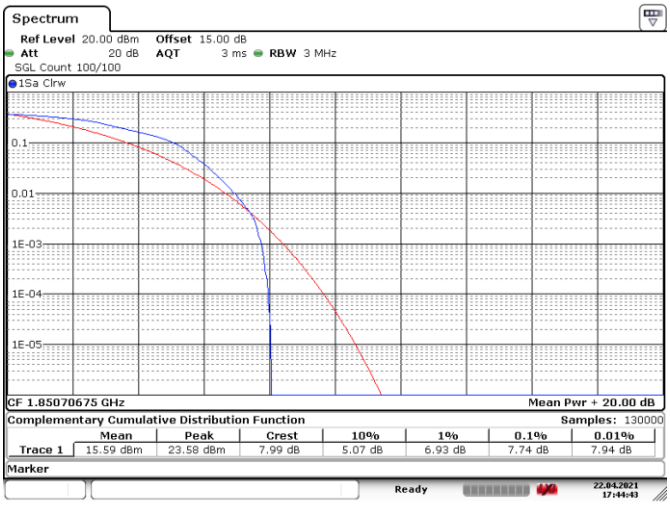


Channel_19175



16QAM

Channel_18625



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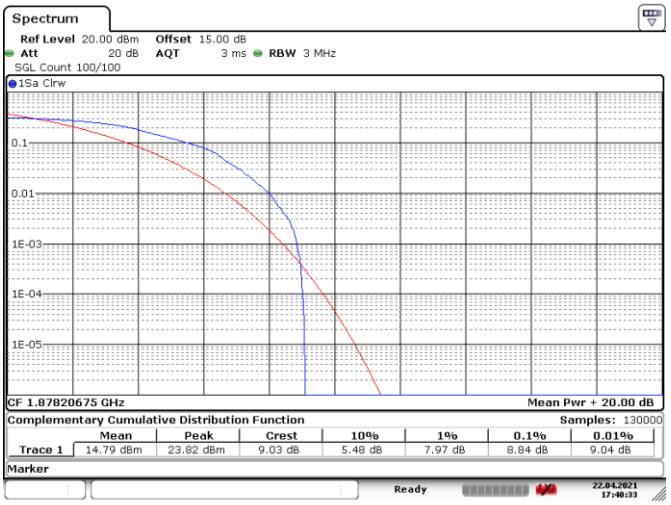

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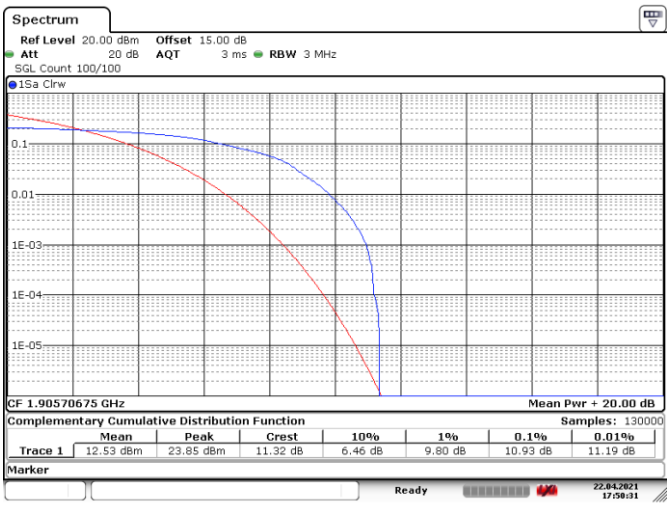

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