RF TEST REPORT

Applicant	Quectel Wireless Solutions Co., Ltd
FCC ID	XMR201808BC66
Product	NB-IoT Module
Brand	Quectel
Model	BC66
Report No.	R2105A0419-R1V4
Issue Date	August 10, 2021

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC CFR47 Part 2 (2020)/ FCC CFR 47 Part 22H (2020)**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

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Version	Revision description	Issue Date
Rev.0	Initial issue of report.	July 15, 2021
Rev.1	Update description in Page 4.	July 30, 2021
Rev.2	Update description in Page 4. Update data in Page 31.	August 5, 2021
Rev.3	Add data in Page 12~13.	August 6, 2021
Rev.4	Update description in Page 12. Add data in Page 15.	August 10, 2021
Note: This revised report (Report No. R2105A0419-R1V4) supersedes and replaces the previously issued report (Report No. R2105A0419-R1V3). Please discard or destroy the previously issued report and dispose of it accordingly.		

Summary of measurement results

No.	Test Type	Clause in FCC rules	Verdict
1	RF Power Output and Effective Radiated Power	2.1046 22.913(a)(5)	PASS
2	Occupied Bandwidth	2.1049	PASS
3	Band Edge Compliance	2.1051 / 22.917(a)	PASS
4	Peak-to-Average Power Ratio	22.913(d)/ KDB 971168 D01(5.7)	PASS
5	Frequency Stability	2.1055 / 22.355	PASS
6	Spurious Emissions at Antenna Terminals	2.1051 / 22.917(a)	PASS
7	Radiates Spurious Emission	2.1053 / 22.917 (a)	PASS
Date of Testing: (Original) October 29, 2018 ~ November 12, 2018 (Variant) May 18,2021~ June 11,2021 and August 5, 2021			
Date of Sample Received: (Variant) May 14, 2021			
Note: PASS: The EUT complies with the essential requirements in the standard. FAIL: The EUT does not comply with the essential requirements in the standard.			

BC66 (Report No.: R2105A0419-R1V4) is a variant model of BC66 (Report No.: R1809A0442-R1V3).Test values partial duplicated from Original for variant. There is only tested RF power output and Effective Radiated Power, Frequency Stability, Occupied Bandwidth, Band Edge Compliance, Receiver Spurious Emissions with worst Channel for variant in this report. The detailed product change description please refers to Statement letter.

1. Test Laboratory

1.1. Notes of the Test Report

This report shall not be reproduced in full or partial, without the written approval of **TA technology (shanghai) co., Ltd.** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein .Measurement Uncertainties were not taken into account and are published for informational purposes only. This report is written to support regulatory compliance of the applicable standards stated above.

1.2. Test facility

FCC (Designation number: CN1179, Test Firm Registration Number: 446626)

TA Technology (Shanghai) Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

A2LA (Certificate Number: 3857.01)

TA Technology (Shanghai) Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

1.3. Testing Location

Company:	TA Technology (Shanghai) Co., Ltd.
Address:	No.145, Jintang Rd, Tangzhen Industry Park, Pudong
City:	Shanghai
Post code:	201201
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2. General Description of Equipment under Test

Client Information

Applicant	Quectel Wireless Solutions Co., Ltd
Applicant address	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai 200233, China
Manufacturer	Quectel Wireless Solutions Co., Ltd
Manufacturer address	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai 200233, China

General Information

EUT Description			
Model	BC66		
IMEI	Original: 867997030054273 Variant: 867997030002819		
Hardware Version	R2.5		
Software Version	BC66NBR01A11		
Power Supply	External Power Supply		
Antenna Type	External Antenna		
Antenna Gain	Band	Frequency (MHz)	Gain (dBi)
	NB-IoT Band 5	820	2.53
		830	2.13
		840	1.89
		850	2.29
Test Mode(s)	NB-IoT Band 5;		
Test Modulation	BPSK, QPSK		
Category	NB1		
Deployment	stand-alone		
Sub-carrier spacing	3.75KHz, 15KHz		
Ntones	Single tone, multi-tone		
Maximum E.R.P.	NB-IoT Band 5:	24.51dBm	
Rated Power Supply Voltage	3.3V		
Extreme Voltage	Minimum: 2.1V Maximum: 3.63V		
Extreme Temperature	Lowest:-40°C Highest: +85°C		
Operating Frequency Range(s)	Band	Tx (MHz)	Rx (MHz)
	NB-IoT Band 5	824 ~ 849	869 ~ 894
Note: The information of the EUT is declared by the manufacturer.			

Accessory equipment	
Evaluation Board	RF Cable
RS232-to-USB Cable	Antenna: Dipole Antenna
DC 5V Adaptor	/

3. Applied Standards

According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

Test standards:

FCC CFR47 Part 27C (2020)

ANSI C63.26 (2015)

Reference standard:

FCC CFR47 Part 2 (2020)

KDB 971168 D01 Power Meas License Digital Systems v03r01

4. Test Configuration

Radiated measurements are performed by rotating the EUT in three different orthogonal test planes. EUT stand-up position (Z axis), lie-down position (X, Y axis). Receiver antenna polarization (horizontal and vertical), the worst emission was found in position (Z axis, horizontal polarization) and the worst case was recorded.

All modes as Subcarrier Spacing, modulations, Channel were investigated.
Subsequently, only the worst case emissions are reported.
The following testing in NB-IoT is set based on the maximum RF Output Power.
Test modes are chosen as the worst case configuration below for NB-IoT Band 5.

Test items	Deployment mode	Subcarrier Spacing (kHz)		Modulation		Test Channel		
	Stand-alone	3.75	15	BPSK	QPSK	L	M	H
RF power output and Effective Radiated power	O	O	O	O	O	O	O	O
Occupied Bandwidth	O	O	O	O	O	O	O	O
Band Edge Compliance	O	O	O	O	O	O	-	O
Peak-to-Average Power Ratio	O	O	O	O	O	-	O	-
Frequency Stability	O	O	O	O	O	-	O	-
Spurious Emissions at Antenna Terminals	O	-	O	-	O	O	O	O
Radiates Spurious Emission	O	-	O	-	O	O	O	O
Note1. The mark “O” means that this configuration is chosen for testing. 2. The mark “-” means that this configuration is not testing.								

5. Test Case Results

5.1. RF Power Output and Effective Isotropic Radiated Power

Ambient condition

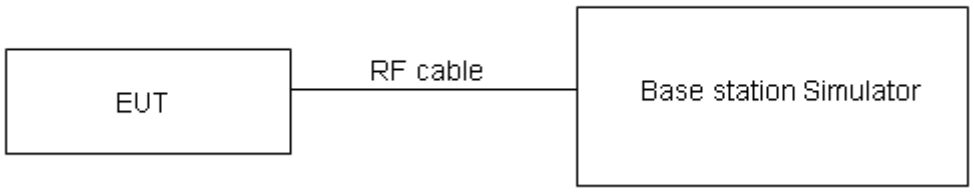
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Methods of Measurement

During the process of the testing, The EUT was connected to the Base Station Simulator with a known loss. The EUT is controlled by the Base Station Simulator test set to ensure max power transmission with proper modulation.

ERP can then be calculated as follows:
EIRP (dBm) = Output Power (dBm) - Losses (dB) + Antenna Gain (dBi)
where:dBd refers to gain relative to an ideal dipole.
EIRP (dBm) = ERP (dBm) + 2.15 (dB).

Test Setup



The loss between RF output port of the EUT and the input port of the tester has been taken into consideration.

Limits

No specific RF power output requirements in part 2.1046.

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor *k* = 2, *U*=0.4 dB for RF power output, *k* = 2, *U*= 1.19 dB for ERP/EIRP.

Test Results

Power of new variant are varied due to measurement uncertainty, and sample tolerance of the acceptance range.

Variant

Mode	Modulation	Sub-carrier spacing (KHz)	Ntones	Conducted Power (dBm) for low/mid/high channel			ERP (dBm)		
				20402 /824.2	20525 /836.5	20648 /848.8	20402 /824.2	20525 /836.5	20648 /848.8
NB-IoT Band 5 Standalone	BPSK	3.75	1@0	24.13	24.07	24.14	24.51	23.81	24.28
			1@47	24.03	24.05	24.11	24.41	23.79	24.25
		15	1@0	23.88	23.95	23.93	24.26	23.69	24.07
			1@11	23.90	23.92	24.07	24.28	23.66	24.21
	QPSK	3.75	1@0	24.11	24.08	24.15	24.49	23.82	24.29
			1@47	24.08	24.11	24.07	24.46	23.85	24.21
		15	1@0	23.86	23.96	23.95	24.24	23.70	24.09
			1@11	23.86	24.08	24.07	24.24	23.82	24.21
		15	12@0	21.87	21.68	21.89	22.25	21.42	22.03

Original

Mode	Modulation	Sub-carrier spacing (KHz)	Ntones	Output Power (dBm) for low/mid/high channel		
				20402/824.2	20525/836.5	20648/848.8
Band 5 Standalone	BPSK	3.75	1@0	24.13	24.07	24.14
			1@47	24.03	24.05	24.11
		15	1@0	23.88	23.95	23.93
			1@11	23.90	23.92	24.07
	QPSK	3.75	1@0	24.11	24.08	24.15
			1@47	24.08	24.11	24.07
		15	1@0	23.86	23.96	23.95
			1@11	23.86	24.08	24.07
		15	12@0	21.87	21.68	21.89

Mode	Channel	Frequency (MHz)	Modulation	Polarization	Sub-carrier spacing (KHz)	Ntones	ERP (dBm)	Limit (dBm)	Conclusion
Band5 Standalone	20401	824.1	BPSK	H	3.75	1@0	24.06	38.45	Pass
			QPSK	H	3.75	1@0	24.13	38.45	Pass
			BPSK	H	15	1@0	24.21	38.45	Pass
			QPSK	H	15	1@0	24.08	38.45	Pass
	20525	836.5	BPSK	H	3.75	1@0	24.11	38.45	Pass
			QPSK	H	3.75	1@0	24.38	38.45	Pass
			BPSK	H	15	1@0	24.27	38.45	Pass
			QPSK	H	15	1@0	24.16	38.45	Pass
	20649	848.9	BPSK	H	3.75	1@0	24.23	38.45	Pass
			QPSK	H	3.75	1@0	24.11	38.45	Pass
			BPSK	H	15	1@0	24.34	38.45	Pass
			QPSK	H	15	1@0	24.08	38.45	Pass

5.2. Occupied Bandwidth

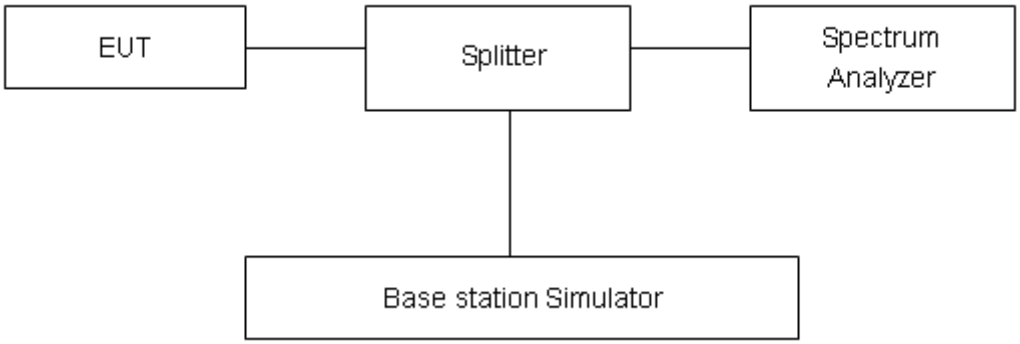
Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

The EUT was connected to Spectrum Analyzer and Base Station Simulator via power Splitter. The occupied bandwidth is measured using spectrum analyzer.
RBW is set to 2kHz, VBW is set to 6.2kHz for NB-IoT Band 5
99% power and -26dBc occupied bandwidths are recorded. Spectrum analyzer plots are included on the following pages.

Test Setup



Limits

No specific occupied bandwidth requirements in part 2.1049.

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 2, U= 624Hz.

Test Result

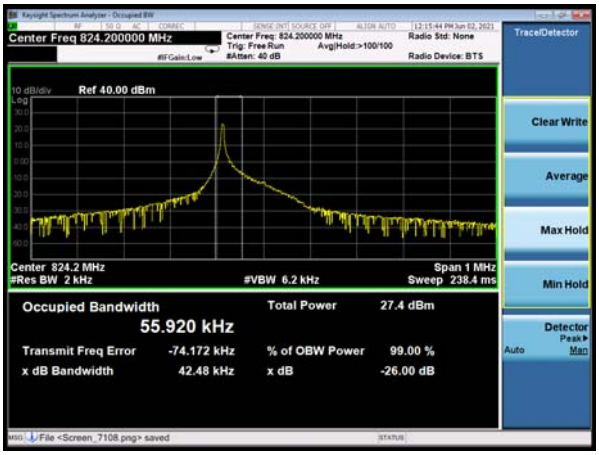
Variant

Mode	Modulation	Sub-carrier spacing (KHz)	Ntones	Bandwidth(KHz) for low/mid/high channel					
				20402/824.2		20525/836.5		20648/848.8	
				99% Power	-26dBc	99% Power	-26dBc	99% Power	-26dBc
NB-IoT Band 5 Standalone	BPSK	3.75	1@0	55.92	42.48	55.94	41.18	55.98	42.88
	QPSK	3.75	1@0	61.80	45.35	62.82	42.61	61.26	44.49
	BPSK	15	1@0	103.45	114.50	105.11	119.50	105.26	115.90
	QPSK	15	1@0	106.76	131.70	112.43	143.70	108.95	130.50
	QPSK	15	12@0	180.14	235.30	180.07	231.50	180.54	226.80

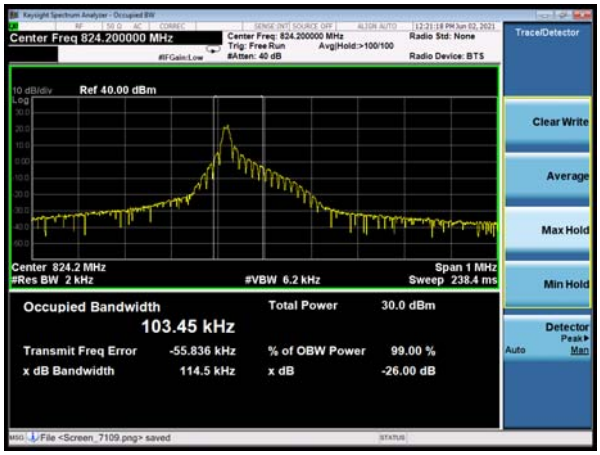
Original

Mode	Modulation	Sub-carrier spacing (KHz)	Ntones	Bandwidth(KHz) for low/mid/high channel					
				20402/824.2		20525/836.5		20648/848.8	
				99% Power	-26dBc	99% Power	-26dBc	99% Power	-26dBc
Band 5 Standalone	BPSK	3.75	1@0	58.46	42.29	57.24	43.03	56.35	40.34
	QPSK	3.75	1@0	62.97	45.14	62.28	44.72	63.75	44.85
	BPSK	15	1@0	104.49	114.30	106.07	114.90	105.01	113.50
	QPSK	15	1@0	103.23	130.10	104.14	142.00	104.05	117.20
	QPSK	15	12@0	180.23	235.90	179.40	237.70	179.65	237.80

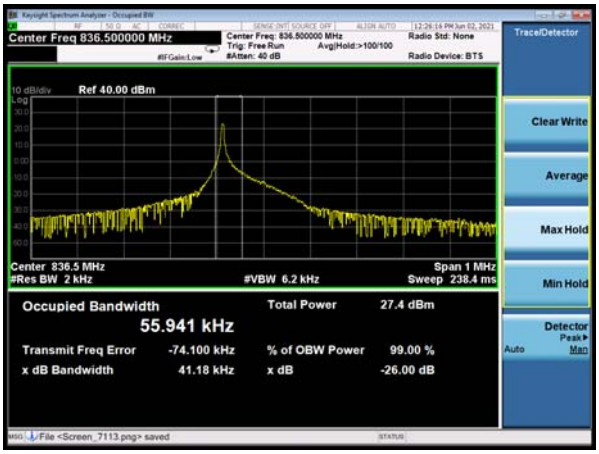
NB-IoT Band 5 BPSK 3.75kHz 1@0 CH-Low



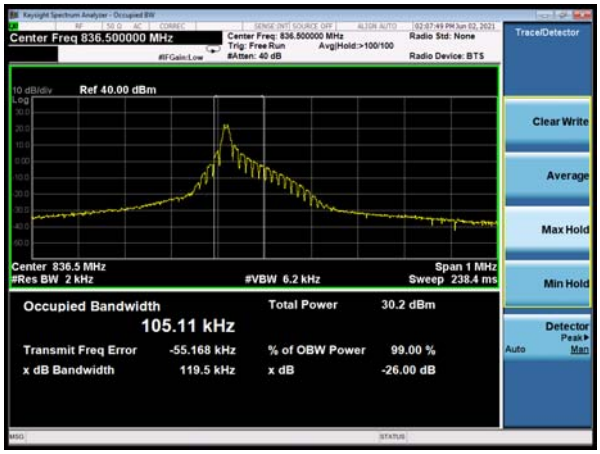
NB-IoT Band 5 BPSK 15kHz 1@0 CH-Low



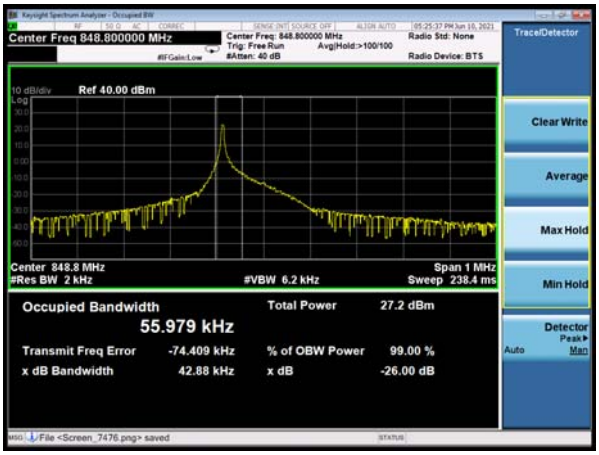
NB-IoT Band 5 BPSK 3.75kHz 1@0 CH-Middle



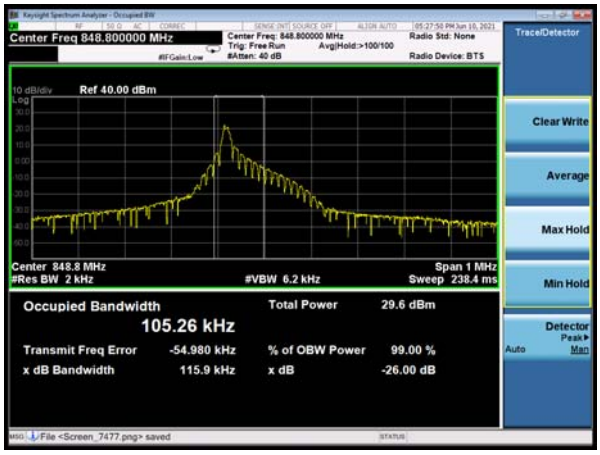
NB-IoT Band 5 BPSK 15kHz 1@0 CH-Middle



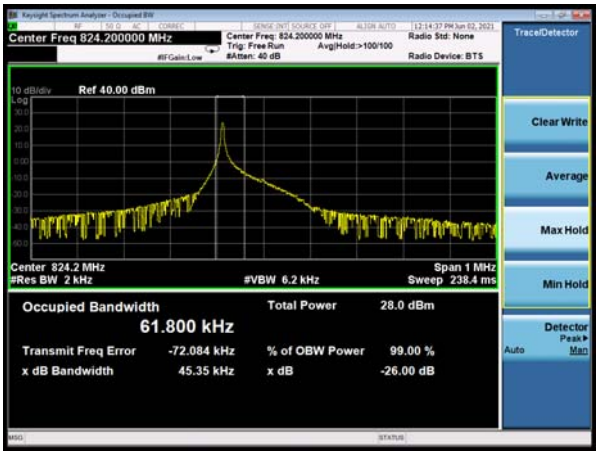
NB-IoT NB-IoT Band 5 BPSK 3.75kHz 1@0 CH-High



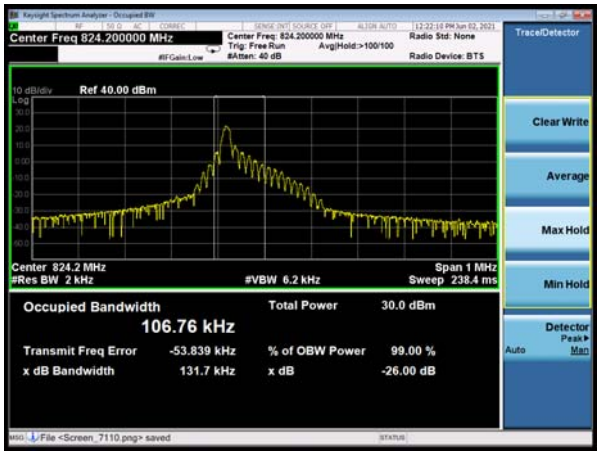
NB-IoT Band 5 BPSK 15kHz 1@0 CH-High



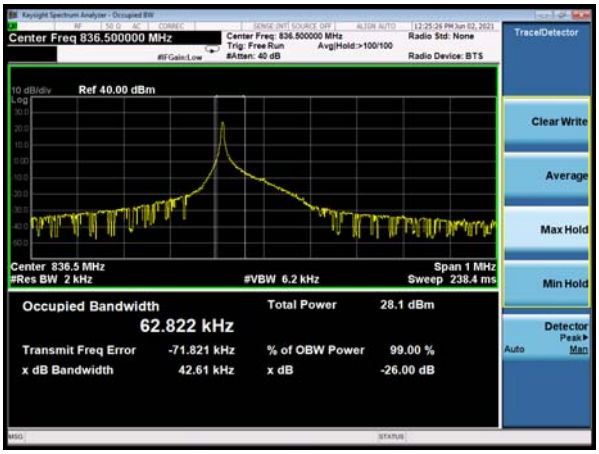
NB-IoT Band 5 QPSK 3.75kHz 1@0 CH-Low



NB-IoT Band 5 QPSK 15kHz 1@0 CH-Low

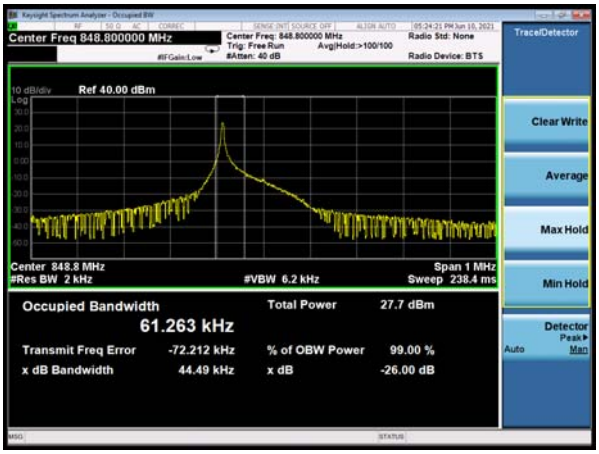


NB-IoT Band 5 QPSK 3.75kHz 1@0 CH-Middle



NB-IoT Band 5 QPSK 15kHz 1@0 CH-Middle

NB-IoT Band 5 QPSK 3.75kHz 1@0 CH-High



NB-IoT Band 5 QPSK 15kHz 1@0 CH-High

NB-IoT Band 5 QPSK 15kHz 12@0 CH-Low

NB-IoT Band 5 QPSK 15kHz 12@0 CH-Middle

NB-IoT Band 5 QPSK 15kHz 12@0 CH-High

5.3. Band Edge Compliance

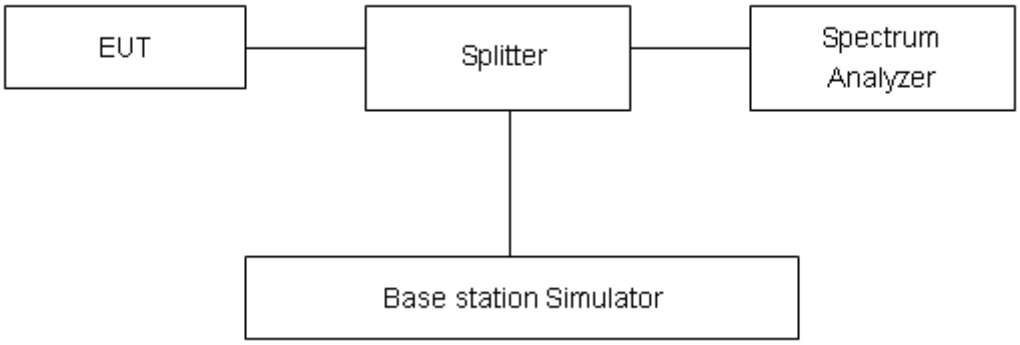
Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

The EUT was connected to Spectrum Analyzer and Base Station Simulator via power Splitter. The band edge of the lowest and highest channels were measured. The average detector is used.
RBW is set to≥1%EBW, VBW is set to 3x RBW.
Spectrum analyzer plots are included on the following pages.

Test Setup



Limits

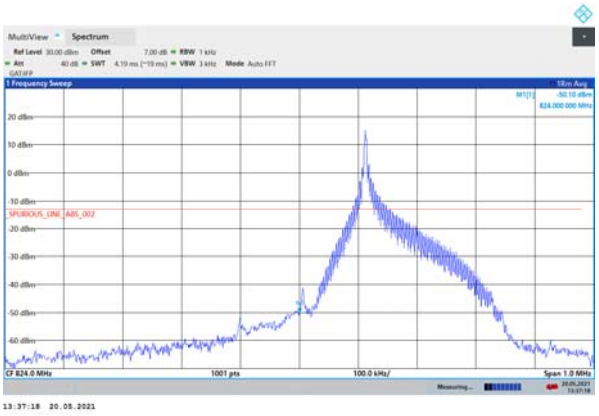
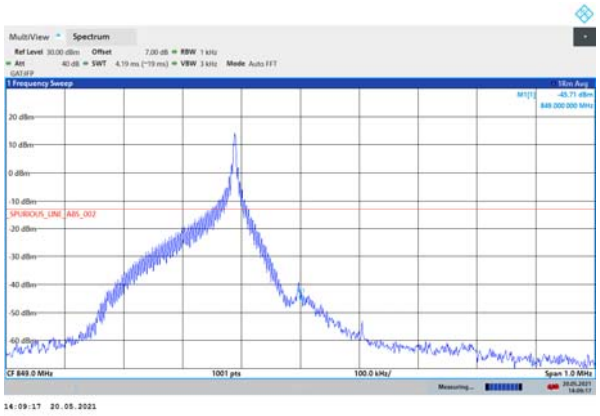
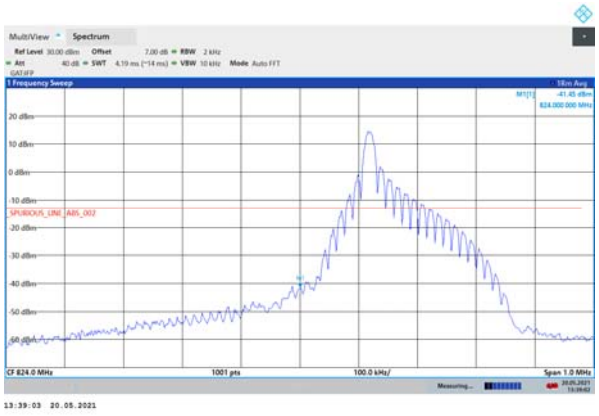
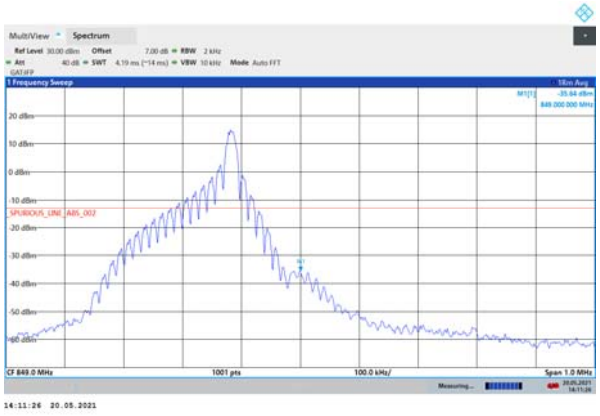
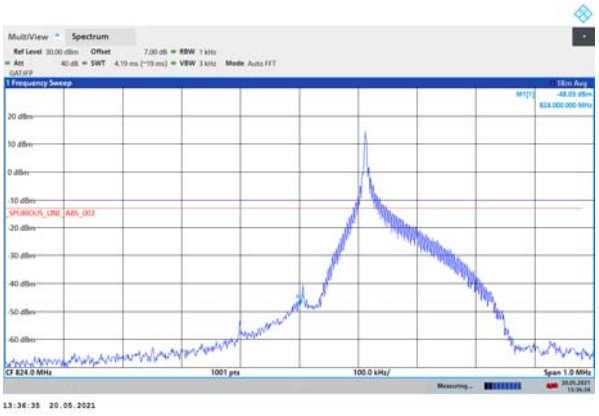
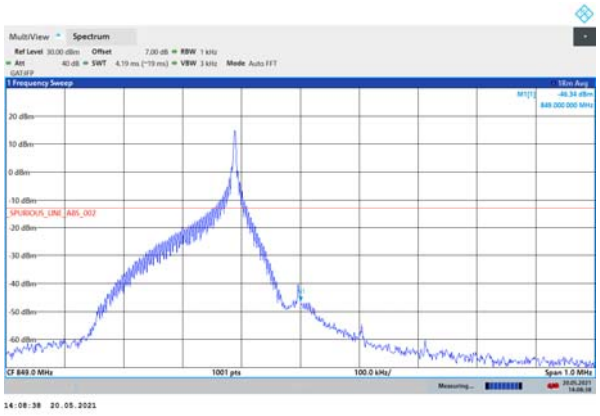
Rule Part 22.917(a) specifies that “The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.”

Limit	-13 dBm

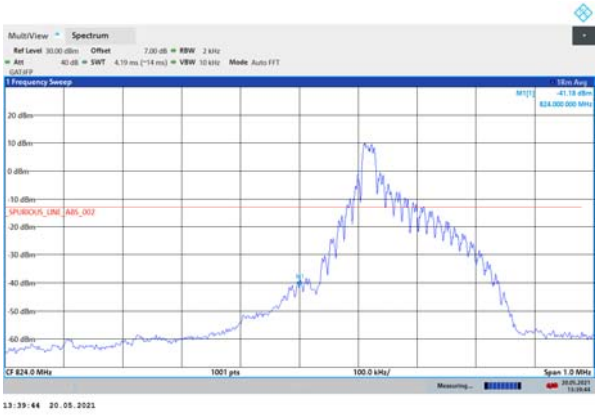
Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 1.96, U=0.684dB.

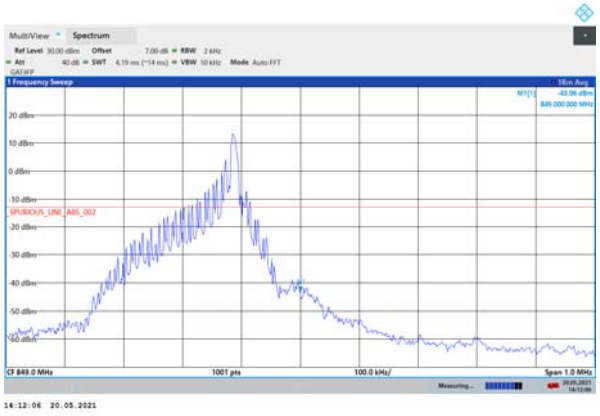
Test Result:

NB-IoT Band 5 BPSK 3.75kHz 1@0 CH-Low	NB-IoT Band 5 BPSK 3.75kHz 1@47 CH-High
	
NB-IoT Band 5 BPSK 15kHz 1@0 CH-Low	NB-IoT Band 5 BPSK 15kHz 1@11 CH-High
	
NB-IoT Band 5 QPSK 3.75kHz 1@0 CH-Low	NB-IoT Band 5 QPSK 3.75kHz 1@47 CH-High
	

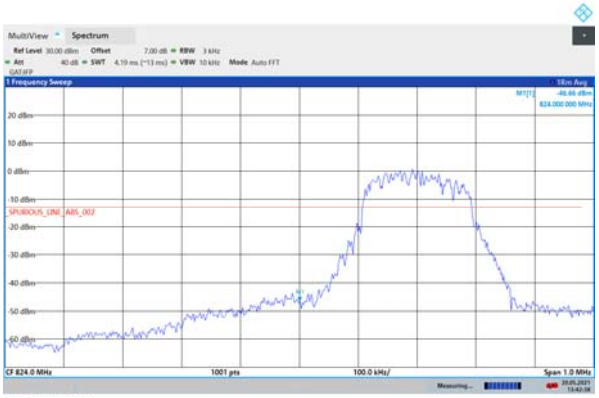
NB-IOT Band 5 QPSK 15kHz 1@0 CH-Low



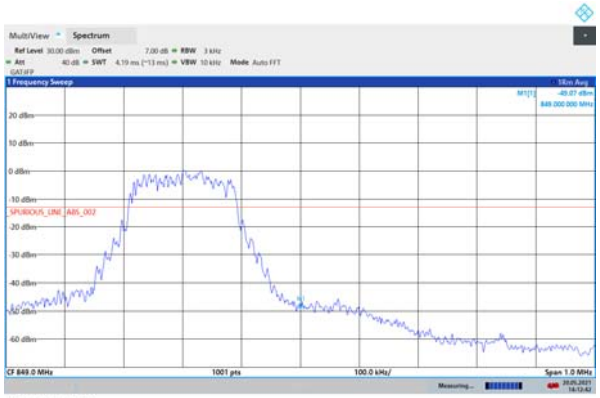
NB-IoT Band 5 QPSK 15kHz 1@11 CH-High



NB-IoT Band 5 QPSK 15kHz 12@0 CH-Low



NB-IoT Band 5 QPSK 15kHz 12@0 CH-High



5.4. Peak-to-Average Power Ratio (PAPR)

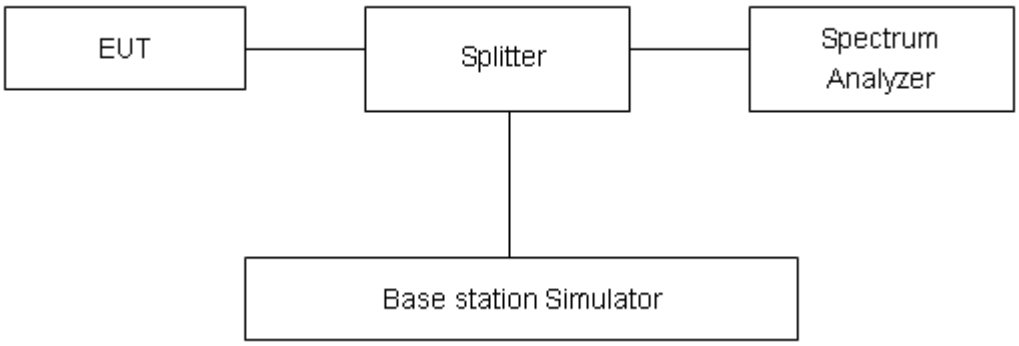
Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Methods of Measurement

Measure the total peak power and record as P_{Pk}. And measure the total average power and record as P_{Avg}. Both the peak and average power levels must be expressed in the same logarithmic units (*e.g.*, dBm). Determine the PAPR from:
PAPR (dB) = P_{Pk} (dBm) - P_{Avg} (dBm).

Test Setup



Limits

According to the Sec. 22.913(d), The peak-to-average ratio (PAR) of the transmission must not exceed 13 dB.

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 2, U= 0.4 dB.

Test Results

Mode	Modulation	Sub-carrier spacing (KHz)	Channel/ Frequency(MHz)	Peak-to-Average Power Ratio (PAPR)		
				Peak(dBm)	Avg(dBm)	PAPR(dB)
Band 5 Standalone	BPSK	3.75	20525/836.5	26.24	22.05	4.19
	QPSK	3.75	20525/836.5	25.69	22.02	3.67
	BPSK	15	20525/836.5	25.91	18.95	6.96
	QPSK	15	20525/836.5	25.67	18.97	6.70

5.5. Frequency Stability

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

Frequency Stability (Temperature Variation)

The temperature inside the climate chamber is varied from -40°C to +85°C in 10°C step size,

(1) With all power removed, the temperature was decreased to 0°C and permitted to stabilize for three hours.

(2) Measure the carrier frequency with the test equipment in a “call mode”. These measurements should be made within 1 minute of powering up the mobile station, to prevent significant self warming.

(3) Repeat the above measurements at 10°C increments from -40°C to +85°C. Allow at least 1.5 hours at each temperature, un-powered, before making measurements. Frequency Stability (Voltage Variation)

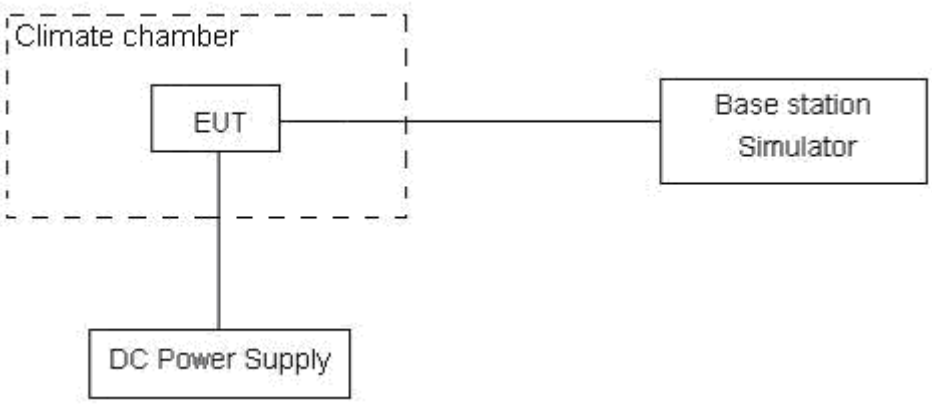
The frequency stability shall be measured with variation of primary supply voltage as follows:

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

(2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery-operating end point which shall be specified by the manufacturer.

This transceiver is specified to operate with an input voltage of between 2.1 V and 3.63 V, with a nominal voltage of 3.3V. The extreme voltage condition was adjusted by MOB COMMS DC Supply.

Test setup



Limits

According to the Sec. 22.355, the frequency stability of the carrier shall be accurate to within 2.5 ppm of the received frequency for mobile stations.

Limits	≤ 2.5 ppm

Measurement Uncertainty

The assessed measurement uncertainty to ensure 99.75% confidence level for the normal distribution is with the coverage factor k = 3, U= 0.01ppm.

Test Result

NB-IoT Band 5(836.5MHz)						
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability （ppm）	Frequency Stability （ppm）	Verdict
Subcarrier Spacing	3.75					
Temperature	Voltage	BPSK	QPSK	BPSK	QPSK	
Normal（25℃）	Normal	8.19	10.07	0.00435	0.00535	PASS
Extreme（85℃）		13.93	4.01	0.00741	0.00213	PASS
Extreme（80℃）		8.59	15.26	0.00457	0.00812	PASS
Extreme（70℃）		1.85	15.83	0.00099	0.00842	PASS
Extreme（60℃）		3.92	14.32	0.00209	0.00762	PASS
Extreme（50℃）		3.51	11.24	0.00187	0.00598	PASS
Extreme（40℃）		12.76	13.00	0.00679	0.00691	PASS
Extreme（30℃）		6.14	12.06	0.00327	0.00641	PASS
Extreme（20℃）		10.83	9.06	0.00576	0.00482	PASS
Extreme（10℃）		17.76	8.45	0.00945	0.00449	PASS
Extreme（0℃）		14.16	9.25	0.00753	0.00492	PASS
Extreme（-10℃）		6.73	2.99	0.00358	0.00159	PASS
Extreme（-20℃）		3.55	11.11	0.00189	0.00591	PASS
Extreme（-30℃）		14.31	1.48	0.00761	0.00079	PASS
Extreme（-40℃）		16.53	12.05	0.00879	0.00641	PASS
25℃	LV	1.49	15.21	0.00079	0.00809	PASS
	HV	5.60	6.05	0.00298	0.00322	PASS

NB-IoT Band 5(836.5MHz)						
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability （ppm）	Frequency Stability （ppm）	Verdict
Subcarrier Spacing	15					
Temperature	Voltage	BPSK	QPSK	BPSK	QPSK	
Normal（25℃）	Normal	14.73	12.94	0.00784	0.00688	PASS
Extreme（85℃）		1.26	8.03	0.00067	0.00427	PASS
Extreme（80℃）		9.48	1.49	0.00505	0.00079	PASS
Extreme（70℃）		13.63	8.45	0.00725	0.00449	PASS
Extreme（60℃）		11.57	15.99	0.00616	0.00851	PASS
Extreme（50℃）		10.11	2.97	0.00538	0.00158	PASS
Extreme（40℃）		10.97	9.40	0.00583	0.00500	PASS
Extreme（30℃）		5.04	10.33	0.00268	0.00549	PASS
Extreme（20℃）		9.98	13.88	0.00531	0.00738	PASS
Extreme（10℃）		9.37	14.44	0.00498	0.00768	PASS
Extreme（0℃）		9.84	17.65	0.00524	0.00939	PASS
Extreme（-10℃）		15.51	13.35	0.00825	0.00710	PASS
Extreme（-20℃）		10.98	17.21	0.00584	0.00915	PASS
Extreme（-30℃）		7.76	2.06	0.00413	0.00109	PASS
Extreme（-40℃）		9.51	13.88	0.00506	0.00738	PASS
25℃	LV	3.86	3.80	0.00205	0.00202	PASS
	HV	12.53	5.83	0.00666	0.00310	PASS

5.6. Spurious Emissions at Antenna Terminals

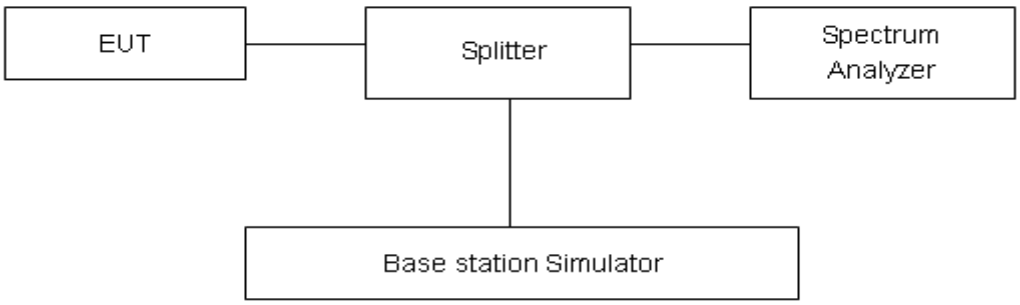
Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

The EUT was connected to Spectrum Analyzer and Base Station Simulator via power Splitter. The measurement is carried out using a spectrum analyzer. The spectrum analyzer scans from 9kHz to the 10th harmonic of the carrier.
The peak detector is used. RBW are set to 100 kHz and VBW are set to 300 kHz for below 1G, RBW are set to 1MHz and VBW are set to 3MHz for above 1G, Sweep is set to ATUO.
The modulation mode and RB allocation refer to section 5.1, using the maximum output power configuration.

Test setup



Limits

Rule Part 22.917(a) specifies that “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.”

Limit	-13 dBm

Measurement Uncertainty

The assessed measurement uncertainty to ensure 99.75% confidence level for the normal distribution is with the coverage factor k = 1.96.

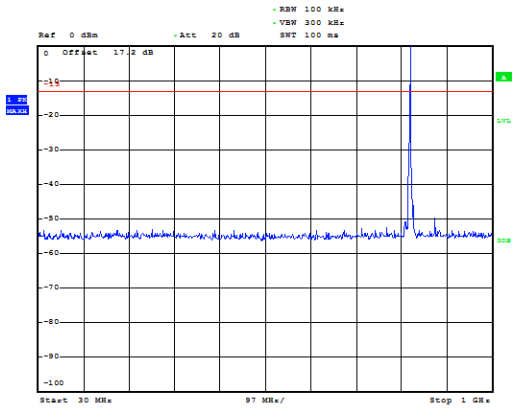
Frequency	Uncertainty
9kHz-1GHz	0.684 dB
1GHz-18GHz	1.407 dB

Test Result

Sweep the whole frequency band through the range from 9kHz to the 10th harmonic of the carrier, the emissions more than 20 dB below the limit are not reported.

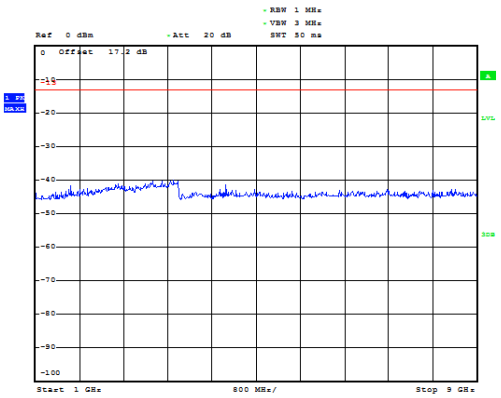
The signal beyond the limit is carrier.

NB-IoT Band 5 CH-Low 30MHz-1GHz



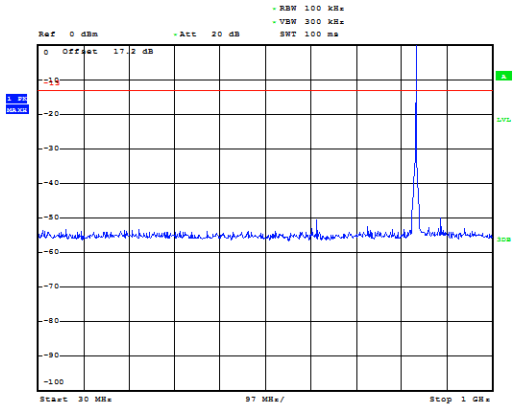
Date: 29.OCT.2018 11:21:53

NB-IoT NB-IoT Band 5 CH-Low 1GHz-9GHz



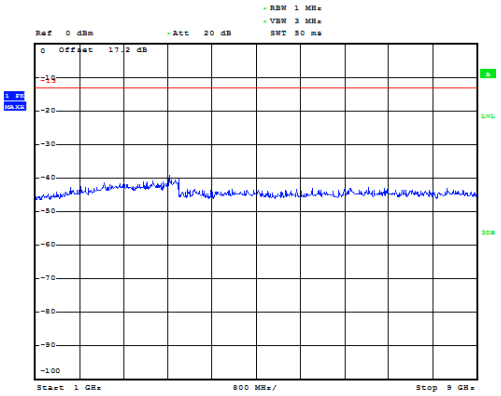
Date: 29.OCT.2018 11:22:32

NB-IoT Band 5 CH-Middle 30MHz-1GHz



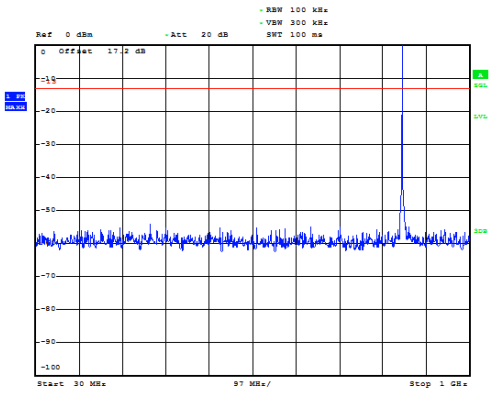
Date: 29.OCT.2018 11:26:58

NB-IoT Band 5 CH-Middle 1GHz-9GHz



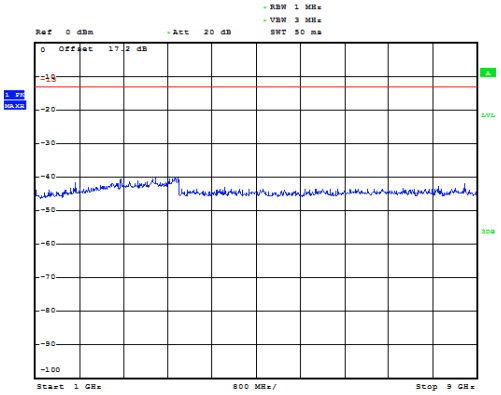
Date: 29.OCT.2018 11:27:27

NB-IoT Band 5 CH-High 30MHz-1GHz



Date: 29.OCT.2018 11:28:55

NB-IoT Band 5 CH-High 1GHz-9GHz



Date: 29.OCT.2018 11:28:28

5.7. Radiates Spurious Emission

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

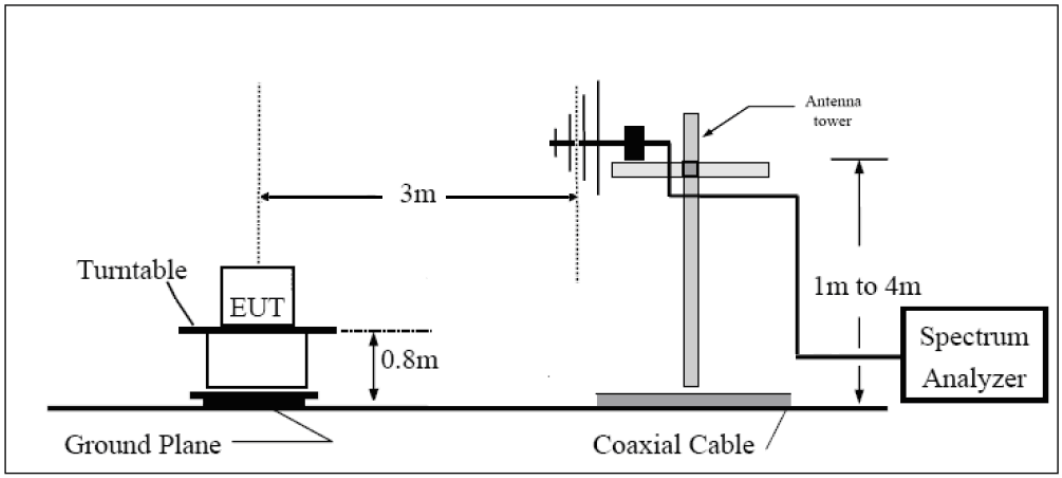
1. The testing follows FCC KDB 971168 v03r01 Section 5.8 and ANSI C63.26 (2015).
2. Above 30MHz: The EUT is placed on a turntable 0.8 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, the height range of antenna is 1 m to 4 m, the azimuth range of turntable is 0° to 360°, and the receive antenna has two polarizations Vertical (V) and Horizontal (H). Above 1GHz: (Note: the FCC's permission to use 1.5m as an alternative per TCBC Conf call of Dec. 2, 2014.) The EUT is placed on a turntable 1.5 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, the height range of antenna is 1 m to 4 m, the azimuth range of turntable is 0° to 360°, and the receive antenna has two polarizations Vertical (V) and Horizontal (H).
3. A log-periodic antenna or horn antenna shall be substituted in place of the EUT. The log-periodic antenna will be driven by a signal generator and the level will be adjusted till the same power value on the spectrum analyzer or receiver. The level of the spurious emissions can be calculated through the level of the signal generator, cable loss, the gain of the substitution antenna and the reading of the spectrum analyzer or receiver.
4. The EUT is then put into continuously transmitting mode at its maximum power level during the test.Set Test Receiver or Spectrum RBW=1MHz,VBW=3MHz for above 1GHz and RBW=100kHz,VBW=300kHz for 30MHz to 1GHz,, And the maximum value of the receiver should be recorded as (Pr).
5. The EUT shall be replaced by a substitution antenna. In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power (PMea) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded (Pr). The power of signal source (PMea) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.
6. A amplifier should be connected to the Signal Source output port. And the cable should be connect between the Amplifier and the Substitution Antenna. The cable loss (Pcl) ,the Substitution Antenna Gain (Ga) and the Amplifier Gain (PAg) should be recorded after test.
7. The measurement results are obtained as described below:
Power(EIRP)=PMea- PAg - Pcl + Ga
The measurement results are amend as described below:
Power(EIRP)=PMea- Pcl + Ga
8. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi)

and known input power. ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP = EIRP-2.15dBi.

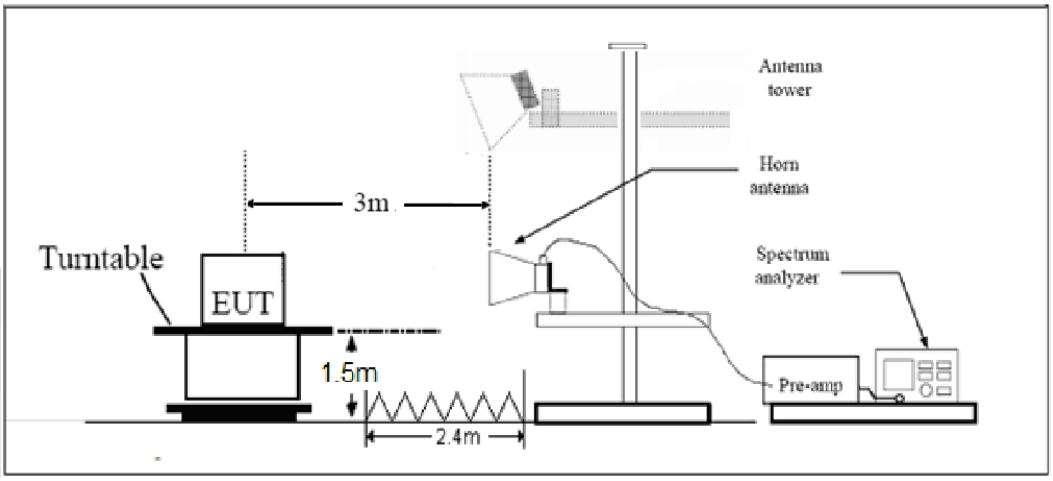
The modulation mode and RB allocation refer to section 5.1, using the maximum output power configuration.

Test setup

30MHz~~~ 1GHz



Above 1GHz



Note: Area side:2.4mX3.6m

Limits

Rule Part 22.917(a) specifies that “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.”

Limit	-13 dBm

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95％ confidence level for the normal distribution is with the coverage factor k = 1.96, U= 3.55 dB.

Test Result

Sweep the whole frequency band through the range from 30MHz to the 10th harmonic of the carrier, the emissions below the noise floor will not be recorded in the report.

NB-IoT Band 5 CH-Low

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1648.0	-59.71	1.70	8.70	Horizontal	-54.86	-13.00	41.86	45
3	2439.5	-65.76	2.30	12.00	Horizontal	-58.21	-13.00	45.21	90
4	3316.0	-68.30	2.70	12.70	Horizontal	-60.45	-13.0	47.45	135
5	4145.0	-64.62	3.00	12.50	Horizontal	-57.27	-13.0	44.27	45
6	4974.0	-63.54	3.40	12.50	Horizontal	-56.59	-13.0	43.59	90
7	5803.0	-63.51	3.40	12.80	Horizontal	-56.26	-13.0	43.26	315
8	6632.0	-56.90	4.10	11.50	Horizontal	-51.65	-13.0	38.65	90
9	7461.0	-55.37	4.20	12.20	Horizontal	-49.52	-13.0	36.52	45
10	8290.0	-54.72	4.30	12.50	Horizontal	-48.67	-13.0	35.67	90
Note: 1.The other Spurious RF Radiated emissions level is no more than noise floor. 2.The worst emission was found in the antenna is Horizontal position.									

NB-IoT Band 5 CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1673.0	-57.64	1.70	8.70	Horizontal	-52.79	-13.00	39.79	90
3	2509.5	-64.17	2.30	12.00	Horizontal	-56.62	-13.00	43.62	90
4	3346.0	-66.49	2.70	12.70	Horizontal	-58.64	-13.00	45.64	45
5	4182.5	-63.29	3.00	12.50	Horizontal	-55.94	-13.00	42.94	225
6	5019.0	-60.54	3.40	12.50	Horizontal	-53.59	-13.00	40.59	180
7	5855.5	-60.21	3.40	12.80	Horizontal	-52.96	-13.00	39.96	180
8	6692.0	-55.56	4.10	11.50	Horizontal	-50.31	-13.00	37.31	90
9	7528.5	-55.53	4.20	12.20	Horizontal	-49.68	-13.00	36.68	45
10	8365.0	-55.54	4.30	12.50	Horizontal	-49.49	-13.00	36.49	90
Note: 1.The other Spurious RF Radiated emissions level is no more than noise floor. 2.The worst emission was found in the antenna is Horizontal position.									

NB-IoT Band 5 CH-High

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1697.5	-58.58	1.70	8.70	Horizontal	-53.73	-13.00	40.73	45
3	2547.0	-59.77	2.30	12.00	Horizontal	-52.22	-13.00	39.22	270
4	3376.0	-66.64	2.70	12.70	Horizontal	-58.79	-13.00	45.79	135
5	4220.0	-63.61	3.00	12.50	Horizontal	-56.26	-13.00	43.26	180
6	5064.0	-59.21	3.40	12.50	Horizontal	-52.26	-13.00	39.26	315
7	5908.0	-60.36	3.40	12.80	Horizontal	-53.11	-13.00	40.11	135
8	6752.0	-56.64	4.10	11.50	Horizontal	-51.39	-13.00	38.39	225
9	7596.0	-55.54	4.20	12.20	Horizontal	-49.69	-13.00	36.69	90
10	8440.0	-55.50	4.30	12.50	Horizontal	-49.45	-13.00	36.45	90
Note: 1.The other Spurious RF Radiated emissions level is no more than noise floor. 2.The worst emission was found in the antenna is Horizontal position.									

6. Main Test Instruments

Date of Testing: October 29, 2018 ~ November 12, 2018

Name	Manufacturer	Type	Serial Number	Calibration Date	Expiration Date
Base Station Simulator	R&S	CMW500	113824	2018-05-20	2019-05-19
Power Splitter	Hua Xiang	SHX-GF2-2-13	10120101	/	/
Spectrum Analyzer	Agilent	N9010A	MY50210259	2018-05-20	2019-05-19
Universal Radio Communication Tester	Agilent	E5515C	MY48367192	2018-05-20	2019-05-19
Signal Analyzer	R&S	FSV30	100815	2017-12-17	2018-12-16
EMI Test Receiver	R&S	ESCI	100948	2018-05-20	2019-05-19
Loop Antenna	SCHWARZBECK	FMZB1519	1519-047	2017-09-26	2019-09-25
Trilog Antenna	SCHWARZBECK	VUBL 9163	9163-201	2017-11-18	2019-11-17
Horn Antenna	R&S	HF907	100126	2018-07-07	2020-07-06
Horn Antenna	ETS-Lindgren	3160-09	00102643	2018-06-20	2020-06-19
Signal generator	R&S	SMB 100A	102594	2018-05-20	2019-05-19
Climatic Chamber	ESPEC	SU-242	93000506	2017-12-17	2020-12-16
Preampflier	R&S	SCU18	102327	2018-05-20	2019-05-19
MOB COMMS DC SUPPLY	Keysight	66319D	MY43004105	2018-05-21	2019-05-20
RF Cable	Agilent	SMA 15cm	0001	/	/
Software	R&S	EMC32	9.26.0	/	/
Wireless Test Set	StarPoint	SP8315	SP8315-1202	2018-05-20	2019-05-19
Wireless Test Set	StarPoint	SP8315	SP8315-1203	2018-05-20	2019-05-19

Date of Testing: May 18, 2021~ June 11, 2021 and August 5, 2021

Name	Manufacturer	Type	Serial Number	Calibration Date	Expiration Date
Base Station Simulator	R&S	CMW500	113824	2021-05-15	2022-05-14
Power Splitter	Hua Xiang	SHX-GF2-2-13	10120101	/	/
Spectrum Analyzer	Key sight	N9010A	MY50210259	2021-05-15	2022-05-14
Universal Radio Communication Tester	Key sight	E5515C	MY48367192	2021-5-15	2022-5-14
Spectrum Analyzer	R&S	FSV3030	101411	2020-12-13	2021-12-12
Loop Antenna	SCHWARZBECK	FMZB1519	1519-047	2020-04-02	2023-04-01
TRILOG Broadband Antenna	SCHWARZBECK	VULB 9163	391	2019-12-16	2022-12-15
Horn Antenna	R&S	HF907	102723	2018-08-11	2021-08-10
Horn Antenna	ETS-Lindgren	3160-09	00102643	2018-06-20	2021-06-19
Signal generator	R&S	SMB 100A	102594	2021-05-15	2022-05-14
Climatic Chamber	ESPEC	SU-242	93000506	2020-12-13	2021-12-12
Preampflier	R&S	SCU18	102327	2021-05-15	2022-05-14
MOB COMMS DC SUPPLY	Keysight	66319D	MY43004105	2021-06-09	2021-12-08
RF Cable	Agilent	SMA 15cm	0001	2020-12-09	2021-06-08
				2021-06-09	2021-12-08
Software	R&S	EMC32	9.26.0	/	/

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

ANNEX A: The EUT Appearance

The EUT Appearance are submitted separately.

ANNEX B: Test Setup Photos

The Test Setup Photos are submitted separately.