TESTING LABORATORY
CERTIFICATE#4323.01

FCC PART 27

TEST REPORT

For

Shanghai MobileTek Communication Ltd.

Free Trade Zone No. 33, No. 17 building 6H Xiya Road, Shanghai, China 200131

FCC ID: 2AK9DL620

Report Type:	**Product Type:**
CIIPC	NB-IoT Module

Test Engineer:	Stone Zhang
Report Number:	RSHA191016004-00A
Report Date:	2019-11-14
Reviewed By:	Oscar Ye EMC Manager
Prepared By:	Bay Area Compliance Laboratories Corp. (Kunshan) No.248 Chenghu Road,Kunshan,Jiangsu province,China Tel: +86-0512-86175000 Fax: +86-0512-88934268 www.baclcorp.com.cn

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Applicant:	Shanghai MobileTek Communication Ltd.
Tested Model:	L620
Series Model:	L620DPG
Model Difference:	Model name
Product Type:	NB-IoT Module
Dimension:	17.6 mm (L) * 15.8 mm (W) * 2.3 mm (H)
Power Supply:	DC 3.3V
RF Function：	NB-IoT
Operating Band/Frequency：	NB-IoT Band 2： 1850-1910 MHz(TX), 1930-1990MHz(RX) NB-IoT Band 4： 1710-1755 MHz(TX), 2110-2155MHz(RX) NB-IoT Band 5： 824-849 MHz(TX),869-894MHz(RX) NB-IoT Band 12： 699-716 MHz(TX), 729-746MHz(RX)
Power Class：	Class 3
Modulation Type：	QPSK, BPSK

**All measurement and test data in this report was gathered from production sample serial number: 20191016004. (Assigned by the BACL. The EUT supplied by the applicant was received on 2019-10-16)*

Objective

This type approval report is prepared on behalf of *Shanghai MobileTek Communication Ltd.* in accordance with Part 2 and Part 27 of the Federal Communication Commission's rules.

The objective is to determine the compliance of EUT with FCC rules for output power, modulation characteristic, occupied bandwidth, and spurious emission at antenna terminal, spurious radiated emission, frequency stability, and band edge.

This is a CIIPC report base on the original report RSHA180611001-00A with FCC ID: 2AK9DL620, grand on 2018-11-22, the differences between the original device and the current one are as follows:

1. Added series model: L620DPG.

2. Added NB-IoT Band 4 by upgrading firmware.

For above differences ,we test all items of band 4, other bands data were referred to the original report.

Related Submittal(s)/Grant(s)

N/A

Test Methodology

All tests and measurements indicated in this document were performed in accordance with the Code of Federal Regulations Title 47 Part 2, Sub-Part J as well as the following parts:

Part 27 – Miscellaneous wireless communications services

Applicable Standards: TIA/EIA 603-D.

All radiated and conducted emissions measurements were performed at Bay Area Compliance Laboratories Corp. (Kunshan). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Item		Uncertainty
AC Power Lines Conducted Emissions		3.19dB
RF conducted test with spectrum		0.9dB
RF Output Power with Power meter		0.5dB
Radiated emission	30MHz~1GHz	5.91dB
	1GHz~6GHz	4.68dB
	6GHz~18GHz	4.92dB
	18GHz~40GHz	5.21dB
Occupied Bandwidth		0.5kHz
Temperature		1.0℃
Humidity		6%

Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

Test Facility

The test site used by Bay Area Compliance Laboratories Corp. (Kunshan) to collect test data is located on the No.248 Chenghu Road, Kunshan, Jiangsu province, China.

Bay Area Compliance Laboratories Corp. (Kunshan) Lab is accredited to ISO/IEC 17025 by A2LA (Lab code: 4323.01) and the FCC designation No. CN1185 under the FCC KDB 974614 D01 and CAB identifier CN0004 under the ISED requirement. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

SYSTEM TEST CONFIGURATION

Justification

The EUT was configured for testing according to TIA/EIA-603-D.

The final qualification test was performed with the EUT operating at normal mode.

Channel List

Mode	Channel		Frequency (MHz)
NB-IoT Band 4	Low	19957	1710.1
	Middle	20175	1732.5
	High	20393	1754.9

Equipment Modifications

No modifications were made to the EUT.

Support Equipment List and Details

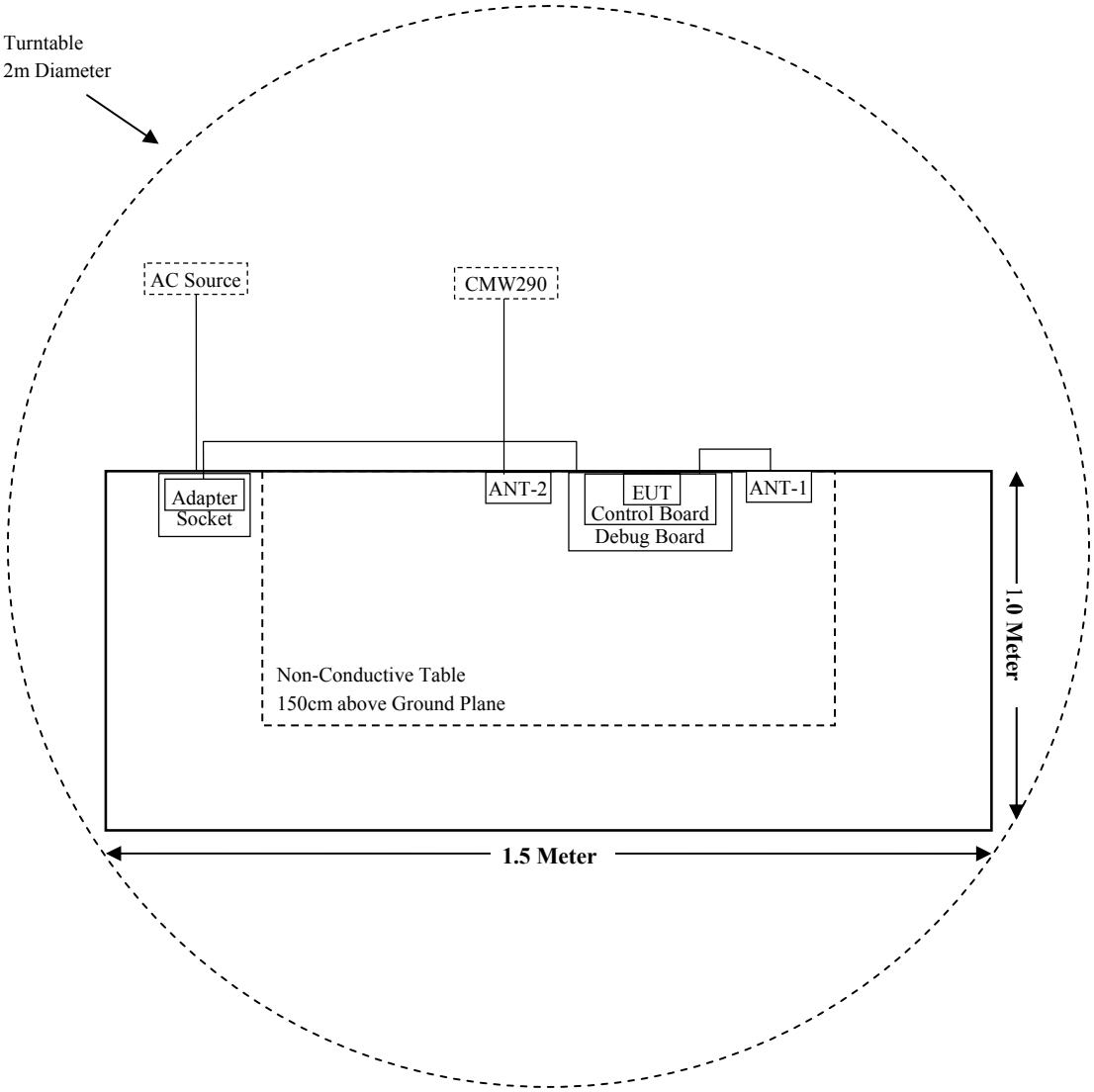
Manufacturer	Description	Model	Serial Number
Shanghai MobileTek	Debug Board	L620_EVB_V1_180201	/
Shanghai MobileTek	Control Board	L620_SUB_V1_170807	/
Shanghai MobileTek	Antenna-1	/	/
Aihuaixin Technology	Antenna-2	/	/
Shanghai MobileTek	Adapter	/	/
Rohde & Schwarz	Functional Radio Communication Tester	CMW290	1201.0002k29/101743

External I/O Cable

Cable Description	Length (m)	From Port	To
RF Cable-1	0.1	Control Board	Antenna-1
RF Cable-2	1.2	Antenna-2	CMW290
Power Cable	1.0	Debug Board	Adapter

Block Diagram of Test Setup

For Radiated Emissions(Below 1GHz & Above 1GHz):



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§1.1307 & §2.1091	Maximum Permissible Exposure (MPE)	Compliant
§2.1046; § 27.50 (d)	RF Output Power	Compliant
§ 2.1047	Modulation Characteristics	Not Applicable
§ 2.1049; §27.53	Occupied Bandwidth	Compliant
§ 2.1051; §27.53 (h)	Spurious Emissions at Antenna Terminal	Compliant
§ 2.1053; §27.53 (h)	Spurious Radiated Emissions	Compliant
§27.53 (h)	Band Edge	Compliant
§ 2.1055; §27.54	Frequency stability	Compliant

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test（Chamber 1#）					
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2018-11-30	2019-11-29
HP	Signal Generator	HP 8341B	2624A00116	2018-11-30	2019-11-29
Sunol Sciences	Broadband Antenna	JB3	A090413-1	2016-12-26	2019-12-25
Sunol Sciences	Bilog antenna	JB3	A060217	2017-08-04	2020-08-03
Sonoma Instrunent	Pre-amplifier	310N	171205	2019-08-14	2020-08-13
Rohde & Schwarz	Auto test Software	EMC32	100361	/	/
MICRO-COAX	Coaxial Cable	Cable-6	006	2019-08-15	2020-08-14
MICRO-COAX	Coaxial Cable	Cable-8	008	2019-08-15	2020-08-14
MICRO-COAX	Coaxial Cable	Cable-9	009	2019-08-15	2020-08-14
MICRO-COAX	Coaxial Cable	Cable-10	010	2019-08-15	2020-08-14
Rohde & Schwarz	Functional Radio Communication Tester	CMW290	1201.0002k29/101743	2018-11-30	2019-11-29
Radiated Emission Test（Chamber 2#）					
HP	Signal Generator	HP 8341B	2624A00116	2018-11-30	2019-11-29
Rohde & Schwarz	EMI Test Receiver	ESU40	100207	2019-08-27	2020-08-26
ETS-LINDGREN	Horn Antenna	3115	9207-3900	2017-07-15	2020-07-14
ETS-LINDGREN	Horn Antenna	3115	6229	2016-12-12	2019-12-11
ETS-LINDGREN	Horn Antenna	3116	00084159	2016-12-12	2019-12-11
ETS-LINDGREN	Horn Antenna	3116	2516	2016-12-12	2019-12-11
A.H.Systems, inc	Amplifier	2641-1	491	2019-02-20	2020-02-19
EM Electronics Corporation	Amplifier	EM18G40G	060726	2019-03-22	2020-03-21
Rohde & Schwarz	Auto test Software	EMC32	100361	/	/
MICRO-COAX	Coaxial Cable	Cable-6	006	2019-08-15	2020-08-14
MICRO-COAX	Coaxial Cable	Cable-11	011	2019-08-15	2020-08-14
MICRO-COAX	Coaxial Cable	Cable-12	012	2019-08-15	2020-08-14
MICRO-COAX	Coaxial Cable	Cable-13	013	2019-08-15	2020-08-14
MICRO-COAX	Coaxial Cable	Cable-16	016	2019-08-15	2020-08-14
Rohde & Schwarz	Functional Radio Communication Tester	CMW290	1201.0002k29/101743	2018-11-30	2019-11-29

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RF Conducted Test					
Rohde & Schwarz	Signal Analyzer	FSIQ26	836131/009	2018-11-30	2019-11-29
Rohde & Schwarz	Signal Analyzer	FSV40	101116	2019-07-23	2020-07-22
Narda	Attenuator	6dB	006	2019-01-10	2020-01-09
Rohde & Schwarz	Functional Radio Communication Tester	CMW290	1201.0002k29/101743	2018-11-30	2019-11-29
Mini-Ciruits	Power splitter	ZFRSC-14-S+	SF019411452	2018-11-10	2019-11-09
Mini-Ciruits	Power splitter	ZFRSC-14-S+	SF019411452	2019-11-10	2020-11-09
BACL	Temperature & Humidity Chamber	BTH-150	30023	2018-12-20	2019-12-19
EAST	Regulated DC Power Supply	MCH-303D-II	14070562	2019-10-10	2020-10-09
Shanghai MobileTek	RF Cable	MobileTekC01	C01	Each Time	/

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Kunshan) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC §1.1307 & §2.1091 –MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart §2.1091 and subpart §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (minutes)**
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f²)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz; * = Plane-wave equivalent power density;

According to §1.1310 and §2.1091 RF exposure is calculated.

Calculated Formulary:
Predication of MPE limit at a given distance
$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. mW/cm^2);
P = power input to the antenna (in appropriate units, e.g., mW);
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

Calculated Data:

Calculation of maximum antenna gain based on EIRP

Mode	Max Tune-up Power (dBm)	EIRP Limit (dBm)	Max Antenna Gain
NB-IoT Band 4	24.00	30.00	6.0 dBi

Calculation of maximum antenna gain based on MPE

Mode	Frequency Range	Tune-up Conducted Power		Power Density Limit	Maximum Power Density	Evaluation Distance	Maximum Antenna Gain Allowed based on MPE	
	(MHz)	(dBm)	(mW)	(mW/cm^2)	(mW/cm^2)	(cm)	(dBi)	(numeric)
NB-IoT Band 4	1710.1-1754.9	24.00	251.19	1.0000	0.9995	20	13.01	20.00

Mode	Max Allowed Antenna Gain
NB-IoT (Band 4) Frequency Range: 1710.1-1754.9MHz	6.0 dBi

Result: For NB-IoT mode, to meet RF exposure EIRP, the maximum net gains of antennas allowed is 6.0 dBi @ NB-IoT (Band 4). The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

FCC §2.1047 - MODULATION CHARACTERISTIC

According to FCC § 2.1047(d), Part 27 there is no specific requirement for digital modulation, therefore modulation characteristic is not presented.

FCC §2.1046; §27.50 (d) - RF OUTPUT POWER

Applicable Standards

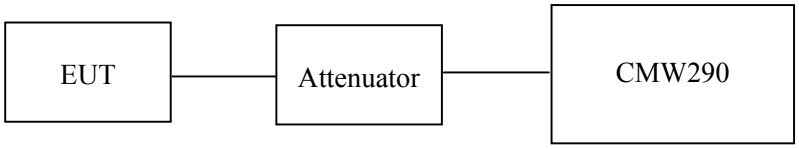
According to §27.50(d), the maximum EIRP must not exceed 1Watts (30dBm) for 1710-1755MHz.

The peak-to-average power ratio (PAPR) of the transmitter output power must not exceed 13 dB.

Test Procedure

Conducted method:

The RF output of the transmitter was connected to the CMW290 through sufficient attenuation.



Radiated Output Power:

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

a) Connect the equipment as illustrated. Mount the equipment with the manufacturer specified antenna in a vertical orientation on a manufacturer specified mounting surface located on a non-conducting rotating platform of a RF anechoic chamber (preferred) or a standard radiation site.

b) Key the transmitter, then rotate the EUT 360o azimuthally and record spectrum analyzer power level (LVL) measurements at angular increments that are sufficiently small to permit resolution of all peaks. If a standard radiation test site is used, raise and lower the test antenna to obtain a maximum reading at each angular increment. (Note: several batteries may be needed to offset the effect of battery voltage droop, which should not exceed 5% of the manufactured specified battery voltage during transmission).

c) Replace the transmitter under test with a vertically polarized half-wave dipole (or an antenna whose gain is known relative to an ideal half-wave dipole). The center of the antenna should be at the same location as the center of the antenna under test.

d) Connect the antenna to a signal generator with a known output power and record the path loss (in dB) as LOSS. If a standard radiation test site is used,raise and lower the test antenna to obtain a maximum reading.
LOSS = Generator Output Power (dBm) – Analyzer reading (dBm)

e) Determine the effective radiated output power at each angular position from the readings in steps b) and d) using the following equation:
ERP (dBm) = LVL (dBm) + LOSS (dB)

f) The maximum ERP is the maximum value determined in the preceding step.
(Note: Effective Isotropic Radiated Power (EIRP) can be computed using the following:
EIRP (dBm) = ERP (dBm) + 2.15 (dB)

Test Data

Environmental Conditions

Temperature:	22.1 ℃
Relative Humidity:	49 %
ATM Pressure:	101.6 kPa

The testing was performed by Stone Zhang on 2019-11-07.

Maximum Output Power:

NB-IoT Band 4

Test Modulation	Sub-carrier Spacing	Resource Block & RB offset	Low Channel (dBm)	Middle Channel (dBm)	High Channel (dBm)
BPSK	3.75kHz	1#0	23.43	22.32	22.10
		1#47	23.44	22.25	22.11
	15kHz	1#0	23.09	22.31	22.18
		1#11	23.12	22.35	22.20
QPSK	3.75kHz	1#0	23.90	22.30	22.13
		1#47	23.86	22.29	22.13
	15kHz	1#0	23.28	22.41	22.22
		1#11	23.35	22.38	22.24
		12#0	20.51	20.30	20.24

Peak-to-average ratio (PAR):

NB-IoT Band 4

Modulation	Sub-carrier Spacing	Middle Channel (dB)	PAR Limit (dB)	Result
BPSK	3.75kHz	1.32	≤ 13	Pass
	15kHz	1.06	≤ 13	Pass
QPSK	3.75kHz	1.24	≤ 13	Pass
	15kHz	1.12	≤ 13	Pass

FCC §2.1049, §27.53- OCCUPIED BANDWIDTH

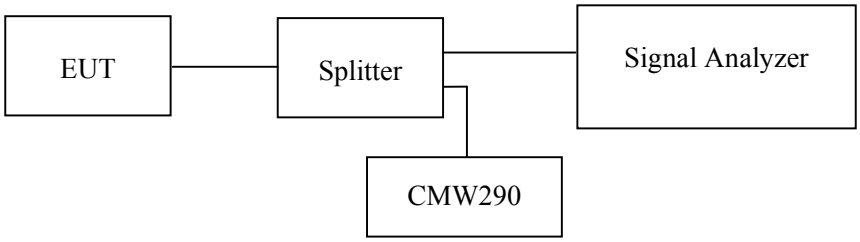
Applicable Standards

FCC 47 §2.1049 and §27.53.

Test Procedure

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

The resolution bandwidth of the spectrum analyzer was set at 2 kHz, and the 26 dB & 99% bandwidth was recorded.



Test Data

Environmental Conditions

Temperature:	22.5-23.2 ℃
Relative Humidity:	49-51 %
ATM Pressure:	101.0-101.3 kPa

The testing was performed by Stone Zhang from 2019-11-07 to 2019-11-14.

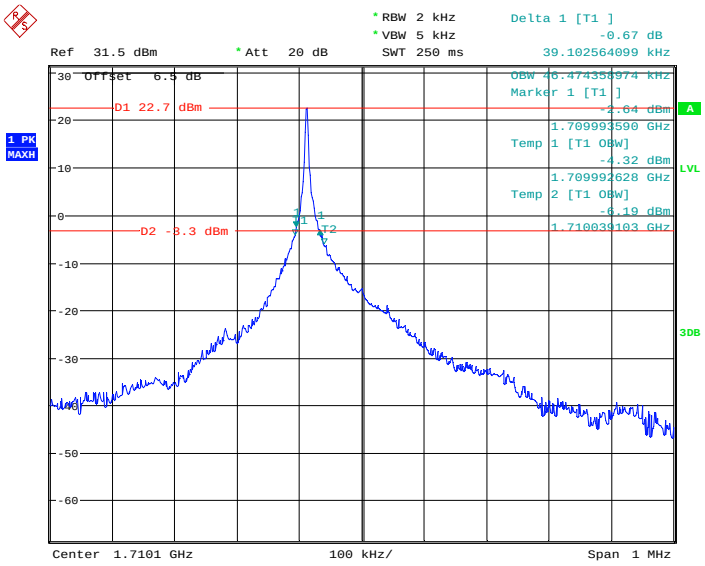
EUT operation mode: Transmitting

Test Result: Compliant.

NB-IoT Band 4:

Test Modulation	Sub-carrier Spacing	Resource Block & RB offset	Test Channel	26 dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
BPSK	3.75kHz	1#0	Low	0.039	0.046
	15kHz	1#0		0.113	0.103
	3.75kHz	1#0	Middle	0.042	0.044
	15kHz	1#0		0.119	0.103
	3.75kHz	1#0	High	0.042	0.046
	15kHz	1#0		0.118	0.103
QPSK	3.75kHz	1#0	Low	0.044	0.050
	15kHz	1#0		0.116	0.098
	15kHz	12#0		0.264	0.184
	3.75kHz	1#0	Middle	0.043	0.050
	15kHz	1#0		0.119	0.103
	15kHz	12#0		0.242	0.181
	3.75kHz	1#0	High	0.044	0.051
	15kHz	1#0		0.119	0.101
	15kHz	12#0		0.237	0.179

BPSK (3.75kHz,1#0) - 99% Occupied & 26 dB Emissions Bandwidth, Low channel



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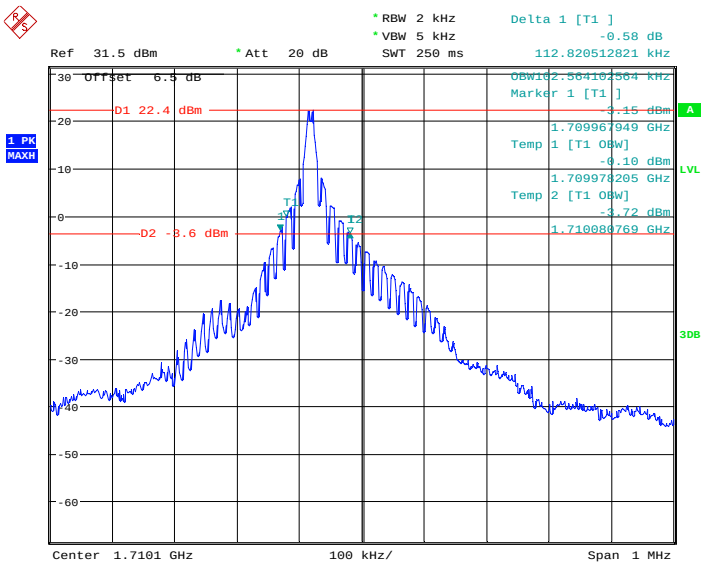
BPSK (15kHz,1#0) - 99% Occupied & 26 dB Emissions Bandwidth, Low channel



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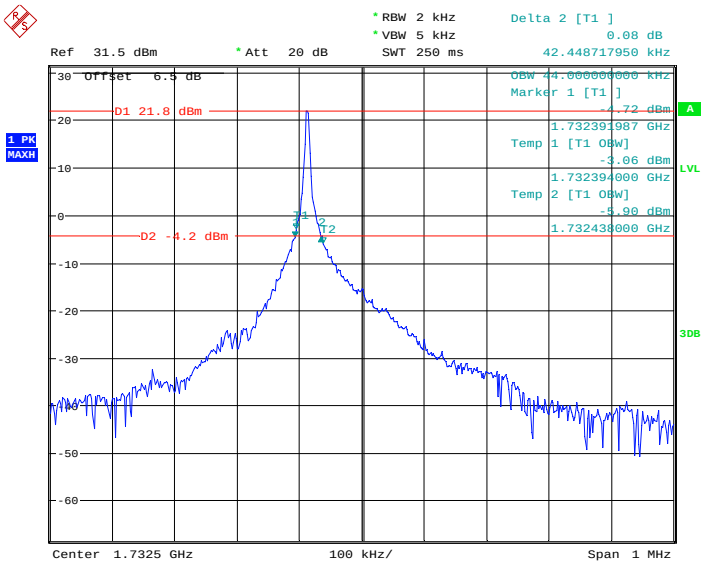
BPSK (3.75kHz,1#0) - 99% Occupied & 26 dB Emissions Bandwidth, Middle channel



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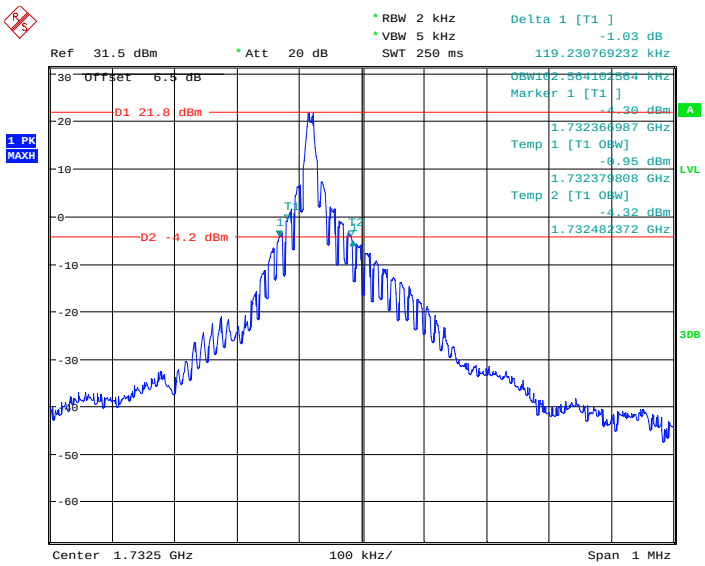
BPSK (15kHz,1#0) - 99% Occupied & 26 dB Emissions Bandwidth, Middle channel



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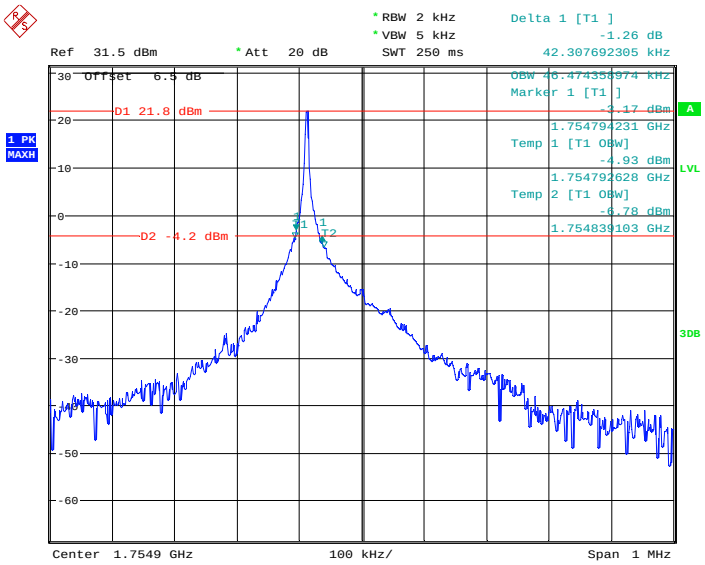
BPSK (3.75kHz,1#0) - 99% Occupied & 26 dB Emissions Bandwidth, High channel



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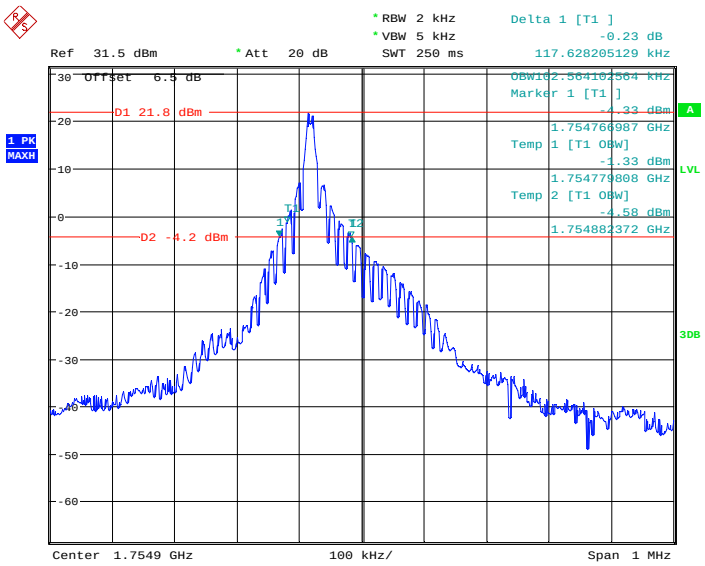
BPSK (15kHz,1#0) - 99% Occupied & 26 dB Emissions Bandwidth, High channel



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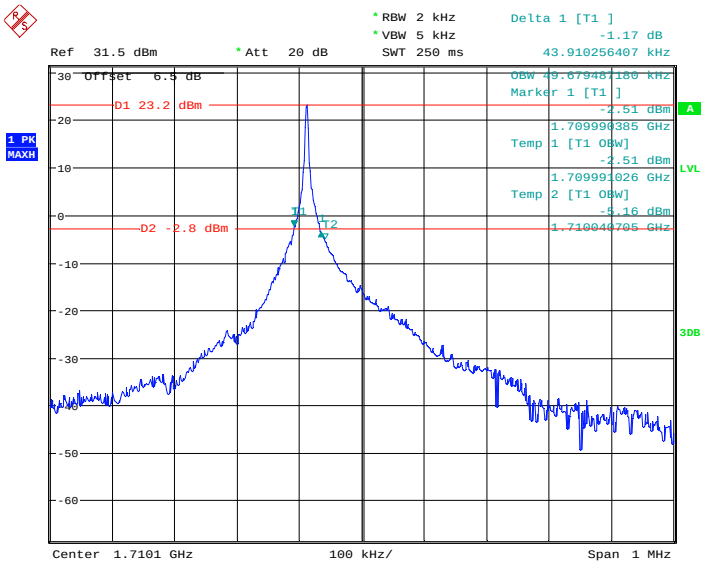
QPSK (3.75kHz,1#0) - 99% Occupied & 26 dB Emissions Bandwidth, Low channel



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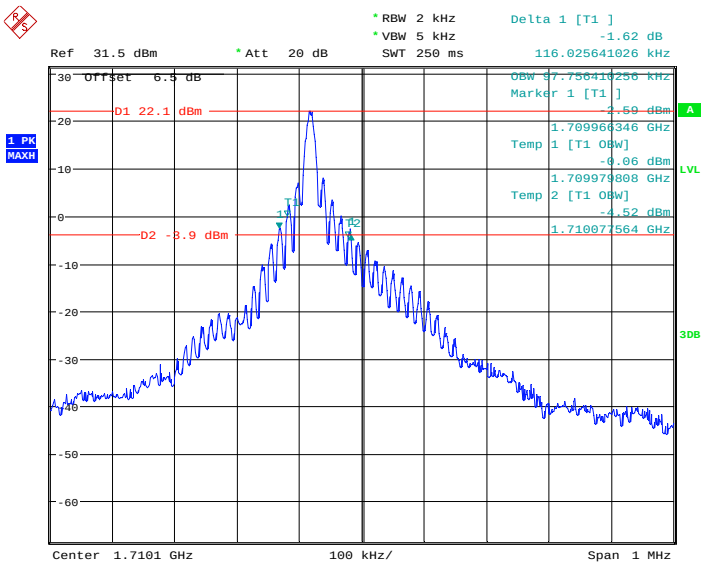
QPSK (15kHz,1#0) - 99% Occupied & 26 dB Emissions Bandwidth, Low channel



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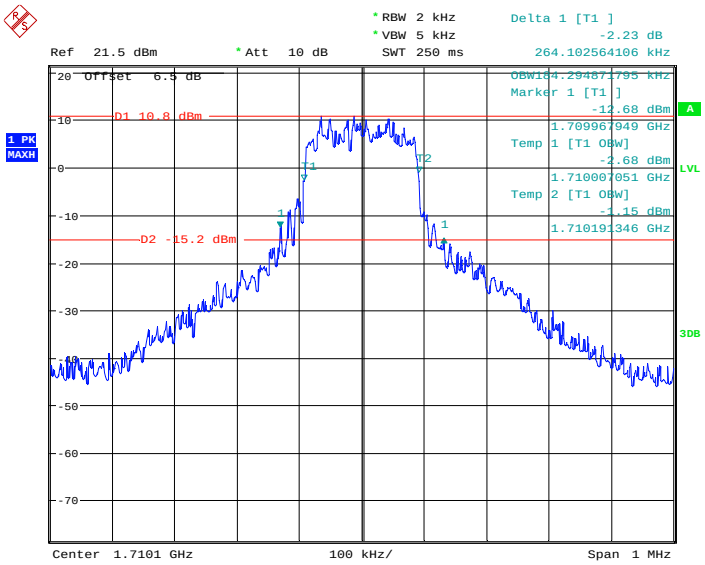
QPSK (15kHz,12#0) - 99% Occupied & 26 dB Emissions Bandwidth, Low channel



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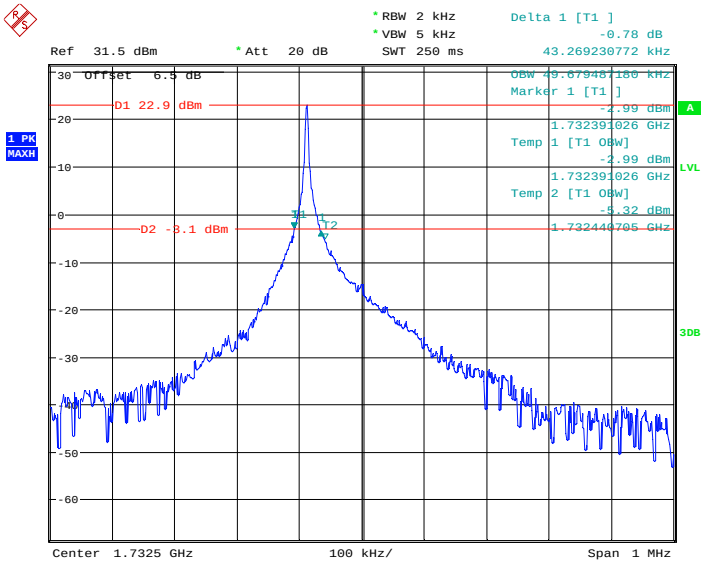
QPSK (3.75kHz,1#0) - 99% Occupied & 26 dB Emissions Bandwidth, Middle channel



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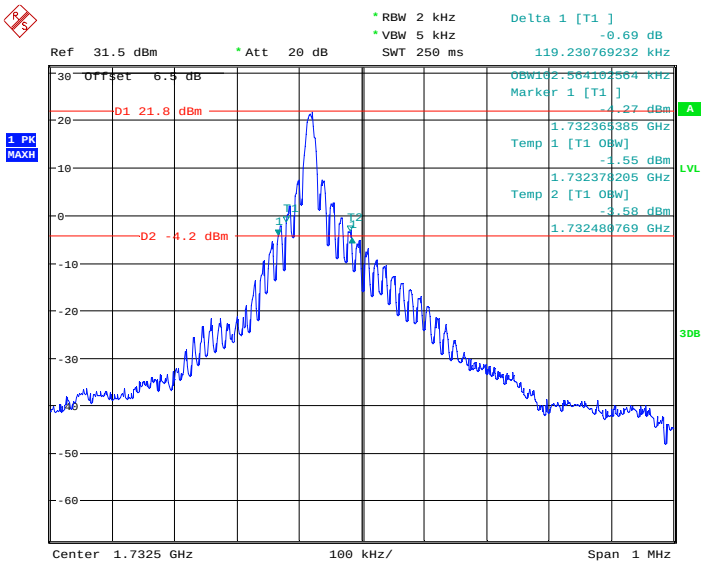
QPSK (15kHz,1#0) - 99% Occupied & 26 dB Emissions Bandwidth, Middle channel



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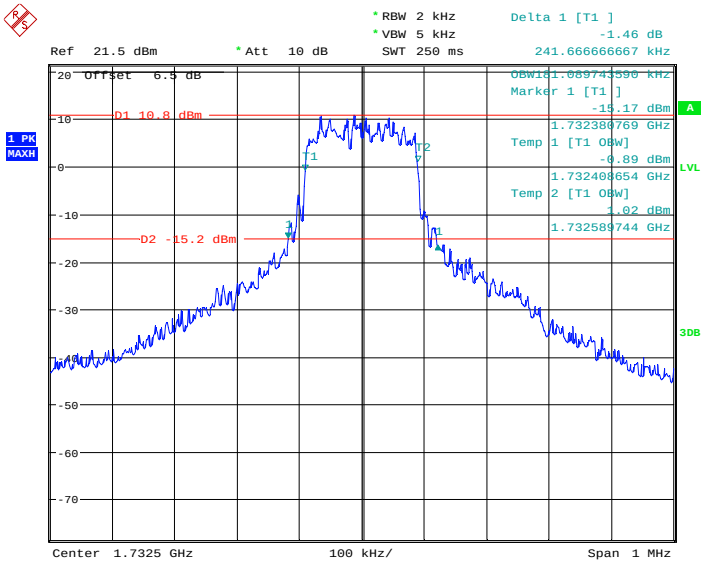
QPSK (15kHz,12#0) - 99% Occupied & 26 dB Emissions Bandwidth, Middle channel



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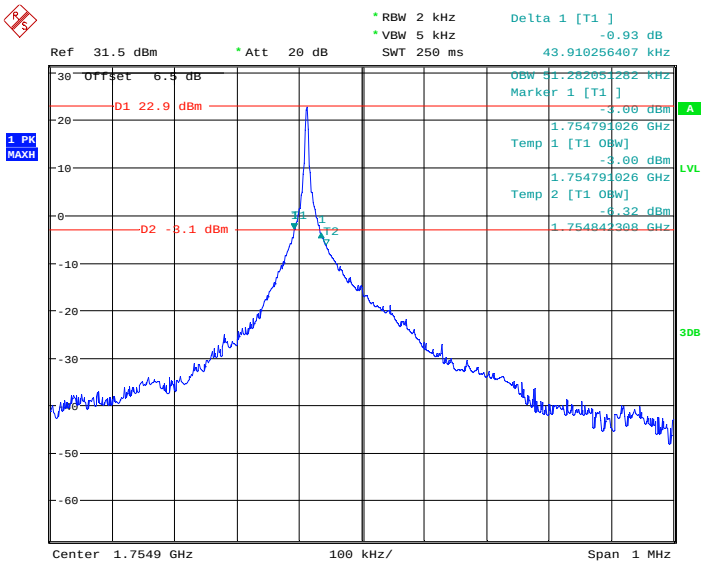
QPSK (3.75kHz,1#0) - 99% Occupied & 26 dB Emissions Bandwidth, High channel



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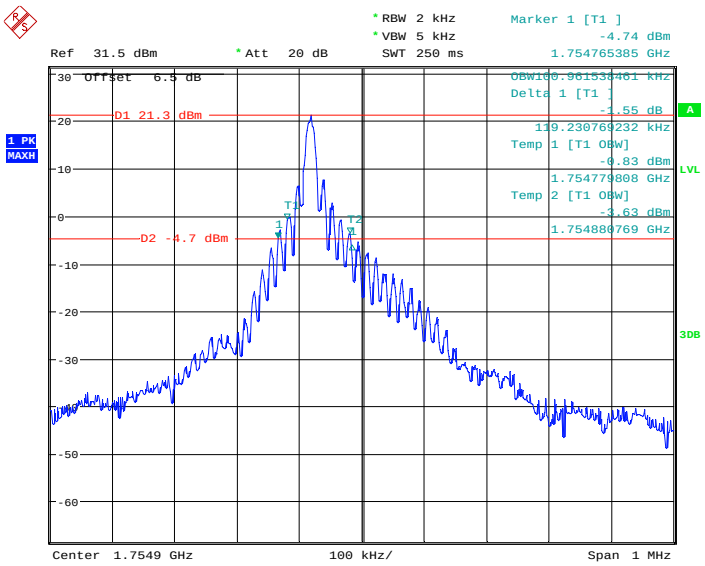
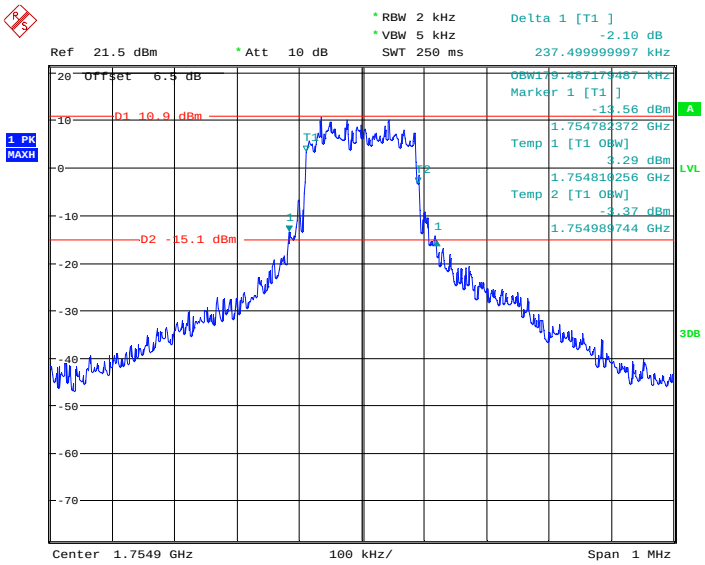
QPSK (15kHz,1#0) - 99% Occupied & 26 dB Emissions Bandwidth, High channel



Date: 7.NOV.2019 12:18:00

QPSK (15kHz,12#0) - 99% Occupied & 26 dB Emissions Bandwidth, High channel



Date: 7.NOV.2019 10:18:55

FCC § 2.1051; §27.53 (h) - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

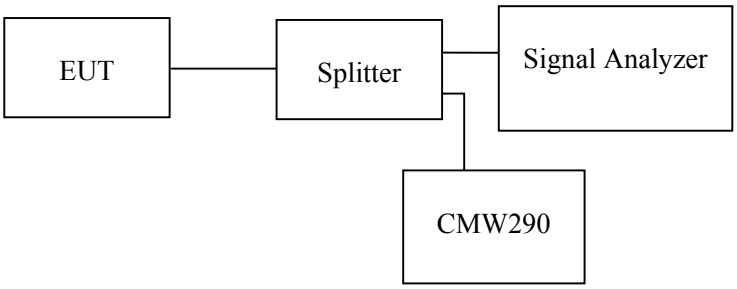
Applicable Standards

FCC §2.1051 and §27.53 (h).

The spectrum was to be investigated to the tenth harmonics of the highest fundamental frequency as specified in § 2.1051.

Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer and simulator through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz for below 1GHz & 1MHz for above 1GHz. sufficient scans were taken to show any out of band emissions up to 10th harmonic.



Test Data

Environmental Conditions

Temperature:	23.2 ℃
Relative Humidity:	51 %
ATM Pressure:	101.3 kPa

The testing was performed by Stone Zhang on 2019-11-07.

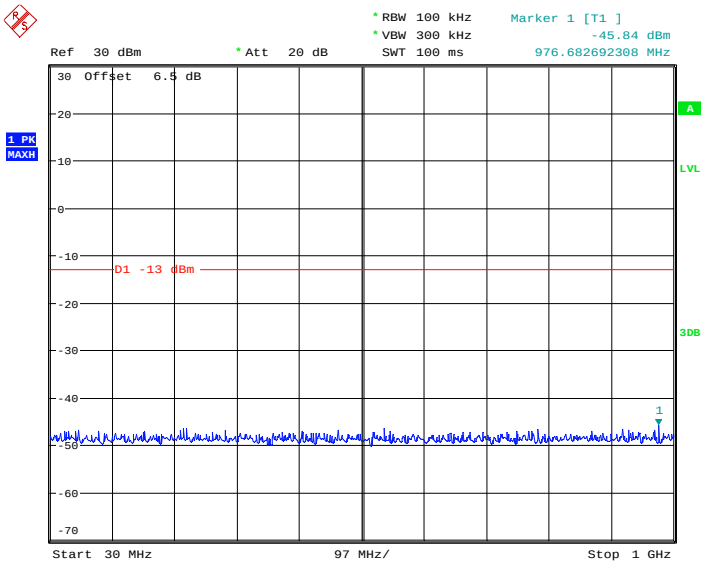
EUT operation mode: Transmitting

*(Data for the **worst case** with **3.75 kHz subcarrier spacing and QPSK mode** was recorded)*

Test Result: Compliant.

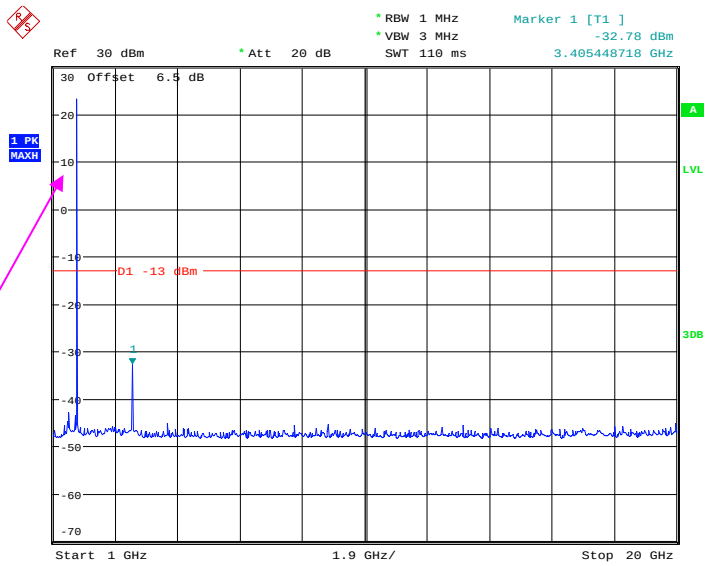
NB-IoT Band 4:

30 MHz - 1 GHz, Low Channel



Date: 7.NOV.2019 13:05:38

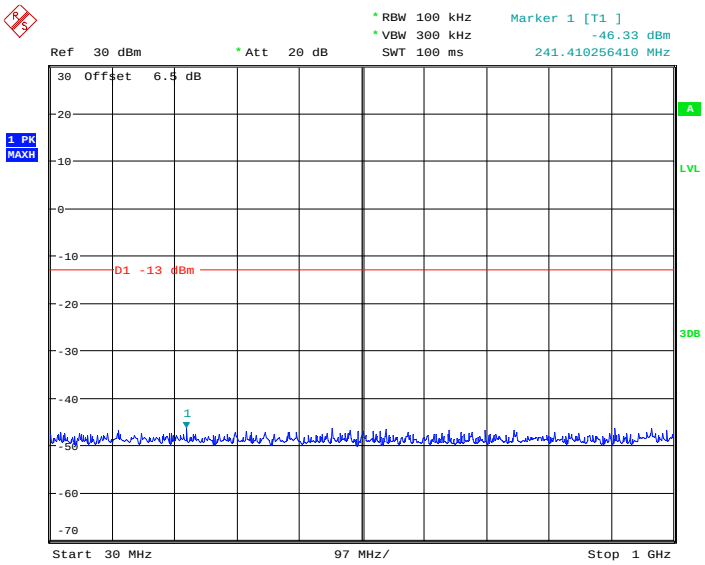
1 GHz – 20 GHz, Low Channel



Fundamental

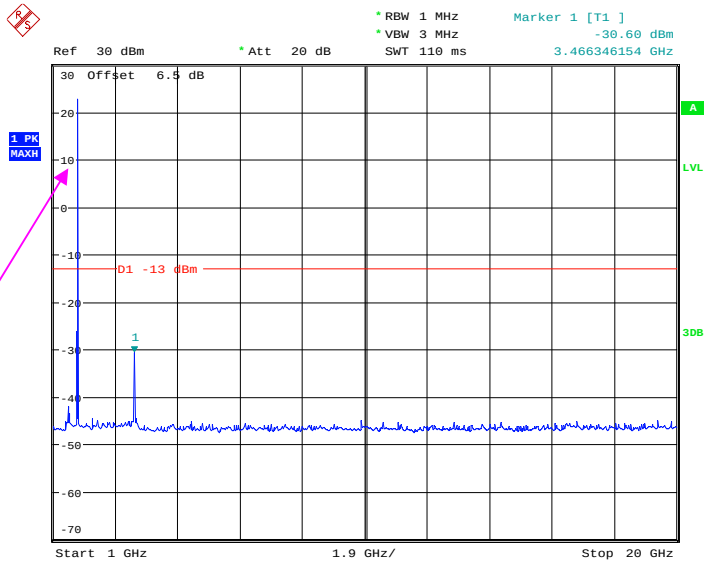
Date: 7.NOV.2019 13:06:10

30 MHz - 1 GHz, Middle Channel



Date: 7.NOV.2019 13:04:11

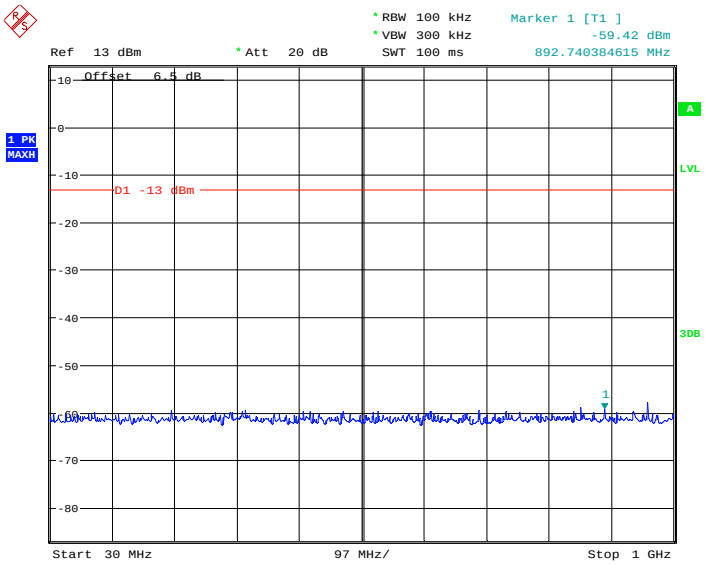
1 GHz – 20 GHz, Middle Channel



Fundamental

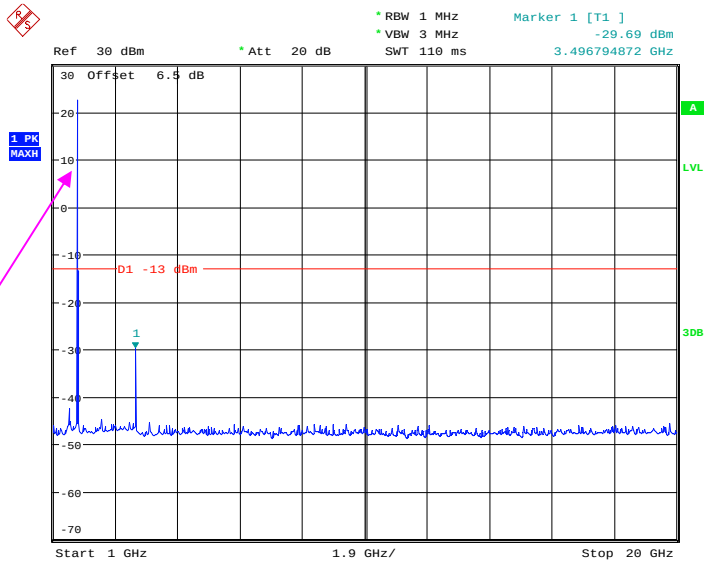
Date: 7.NOV.2019 13:03:46

30 MHz - 1 GHz, High Channel



Date: 7.NOV.2019 12:54:45

1 GHz – 20 GHz, High Channel



Fundamental

Date: 7.NOV.2019 13:00:42

FCC § 2.1053; §27.53 (h) - SPURIOUS RADIATED EMISSIONS

Applicable Standards

FCC § 2.1053 and § 27.53 (h)

According to FCC 27.53 (h), the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}$ (P) dB

Test Procedure

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious emissions in dB = 10 lg (TX pwr in Watts/0.001) – the absolute level

Spurious attenuation limit in dB = $43 + 10 \text{ Log}_{10}$ (power out in Watts)

Test Data

Environmental Conditions

Temperature:	23.2℃
Relative Humidity:	51 %
ATM Pressure:	101.3 kPa

The testing was performed by Stone Zhang on 2019-11-09.

Test mode: Transmitting (Pre-scan with low, middle and high channels, and the worse case data as below)

30 MHz ~ 20 GHz:

NB-IoT Band 4

Frequency (MHz)	Receiver Reading (dBμV)	Turntable Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (cm)	Polar (H/V)	Submitted Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd/dBi)			
BPSK, 3.75kHz, Middle Channel										
382.70	36.58	327	240	H	-62.9	1.08	0.0	-63.98	-13	50.98
382.70	36.41	247	200	V	-61.9	1.08	0.0	-62.98	-13	49.98
3465.00	50.23	19	180	H	-51.3	1.50	12.0	-40.80	-13	27.80
3465.00	49.62	34	170	V	-52.6	1.50	12.0	-42.10	-13	29.10
BPSK, 15kHz, Middle Channel										
382.70	36.67	297	250	H	-62.8	1.08	0.0	-63.88	-13	50.88
382.70	36.32	27	210	V	-62.0	1.08	0.0	-63.08	-13	50.08
3465.00	48.57	352	160	H	-52.9	1.50	12.0	-42.40	-13	29.40
3465.00	47.10	51	160	V	-55.1	1.50	12.0	-44.60	-13	31.60
QPSK, 3.75kHz, Middle Channel										
382.70	36.10	71	200	H	-63.4	1.08	0.0	-64.48	-13	51.48
382.70	36.07	132	150	V	-62.2	1.08	0.0	-63.28	-13	50.28
3465.00	49.53	198	220	H	-52.0	1.50	12.0	-41.50	-13	28.50
]3465.00	48.71	168	230	V	-53.5	1.50	12.0	-43.00	-13	30.00
QPSK, 15kHz, Middle Channel										
382.70	35.71	77	240	H	-63.8	1.08	0.0	-64.88	-13	51.88
382.70	36.24	31	110	V	-62.1	1.08	0.0	-63.18	-13	50.18
3465.00	49.21	68	160	H	-52.3	1.50	12.0	-41.80	-13	28.80
3465.00	47.44	224	240	V	-54.8	1.50	12.0	-44.30	-13	31.30

Note:
1) The unit of antenna gain is dBd for frequency below 1GHz and is dBi for frequency above 1GHz.
2) Absolute Level (dBm) = Submitted Level (dBm) - Cable loss (dB) + Antenna Gain (dBd/dBi)
3) Margin (dB) = Limit (dBm) - Absolute Level (dBm)

FCC §27.53 (h) - BAND EDGES

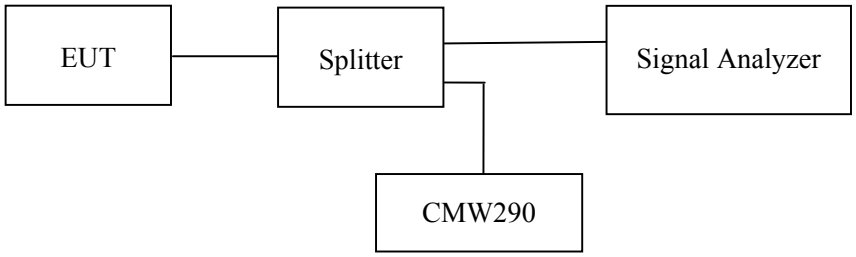
Applicable Standards

According to FCC §27.53 (h), 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.

Test Procedure

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

The center of the spectrum analyzer was set to block edge frequency.



Test Data

Environmental Conditions

Temperature:	23.4 ℃
Relative Humidity:	51 %
ATM Pressure:	101.3 kPa

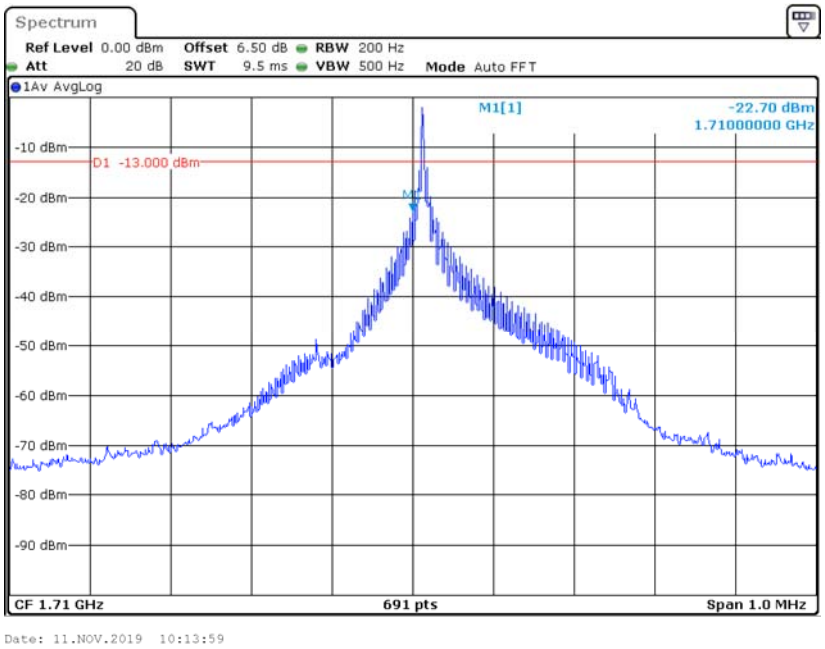
The testing was performed by Stone Zhang on 2019-11-11.

EUT operation mode: Transmitting

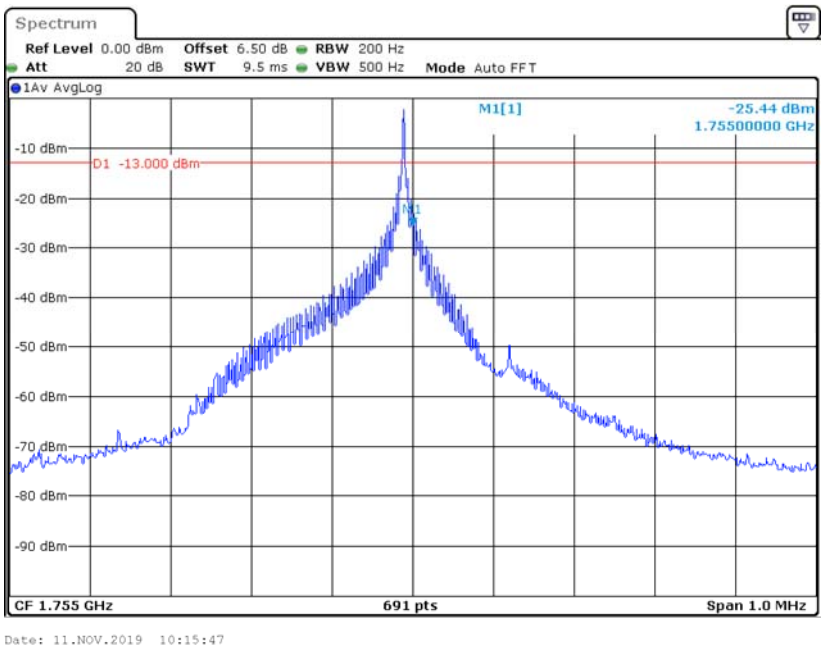
Test Result: Compliant.

NB-IoT Band 4:

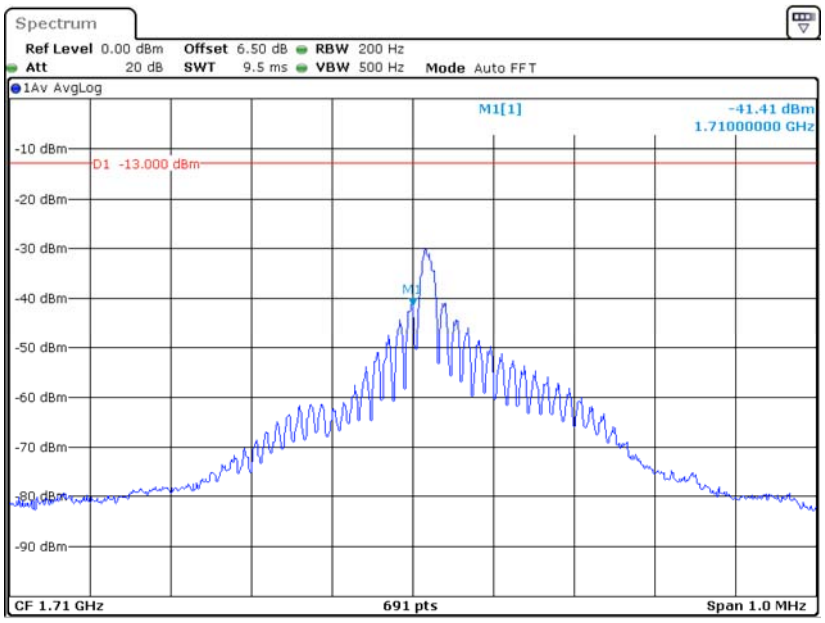
BPSK (3.75kHz, 1#0) - Left Band Edge



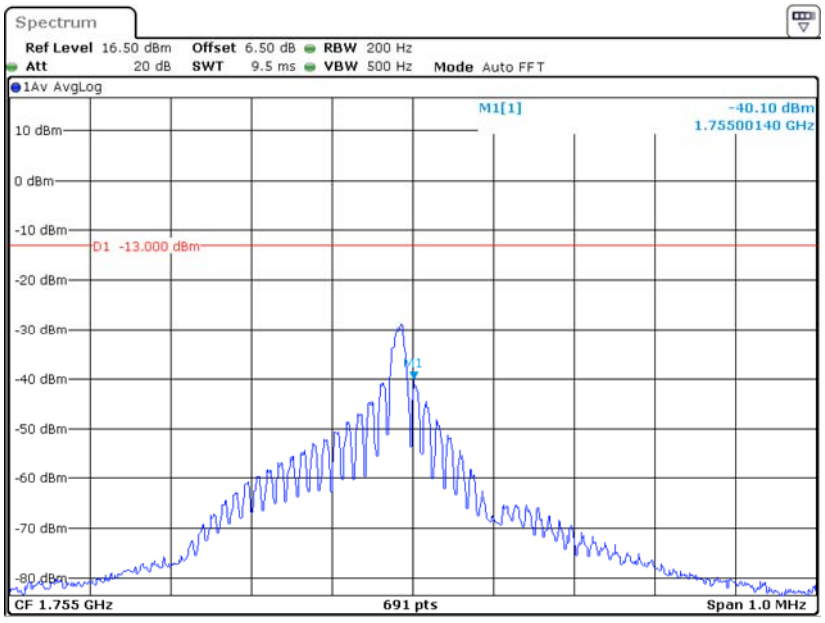
BPSK (3.75kHz, 1#47) - Right Band Edge



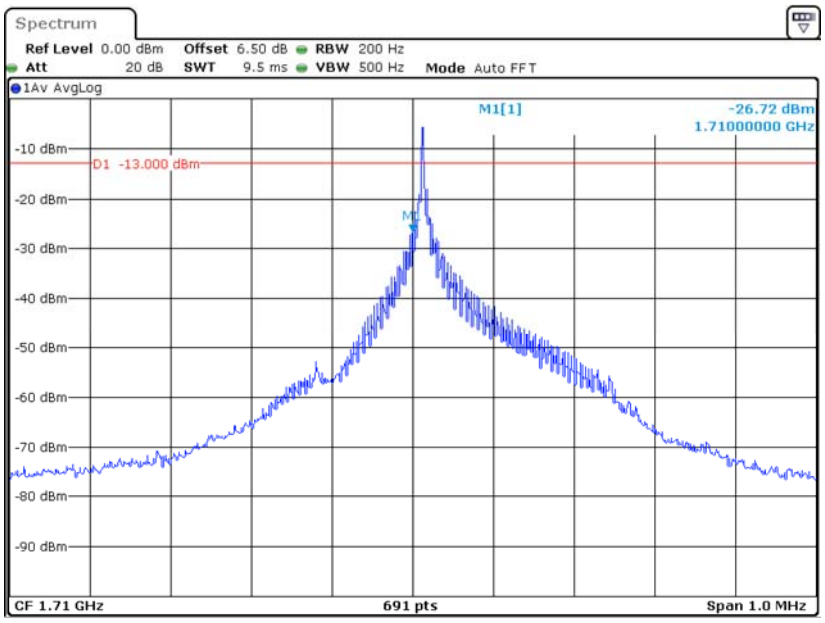
BPSK (15kHz, 1#0) - Left Band Edge



BPSK (15kHz, 1#11) - Right Band Edge

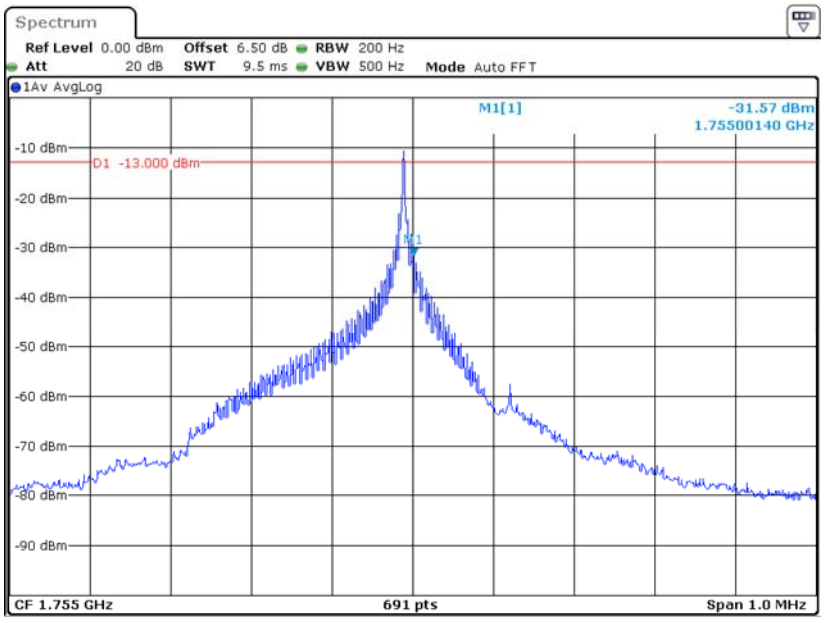


QPSK (3.75kHz, 1#0) - Left Band Edge



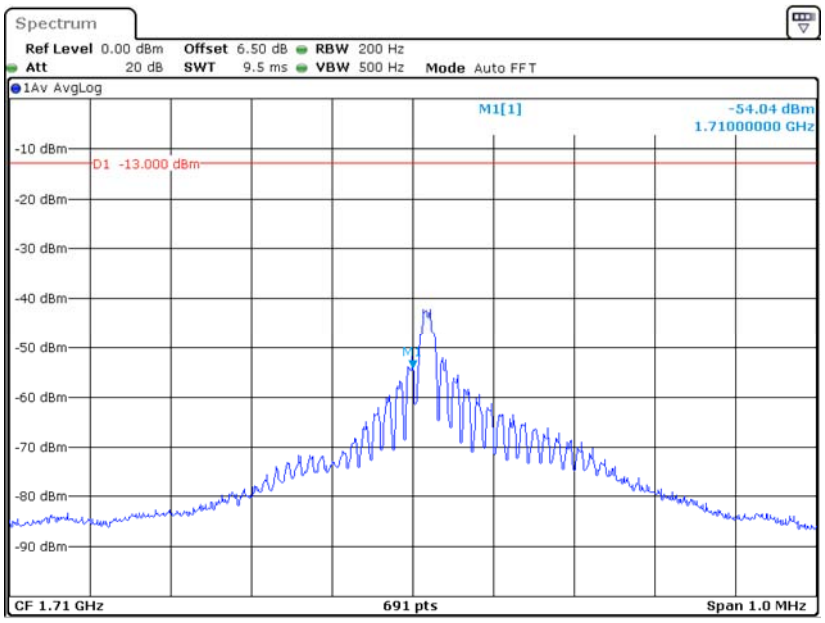
Date: 11.NOV.2019 10:12:53

QPSK (3.75kHz, 1#47) - Right Band Edge



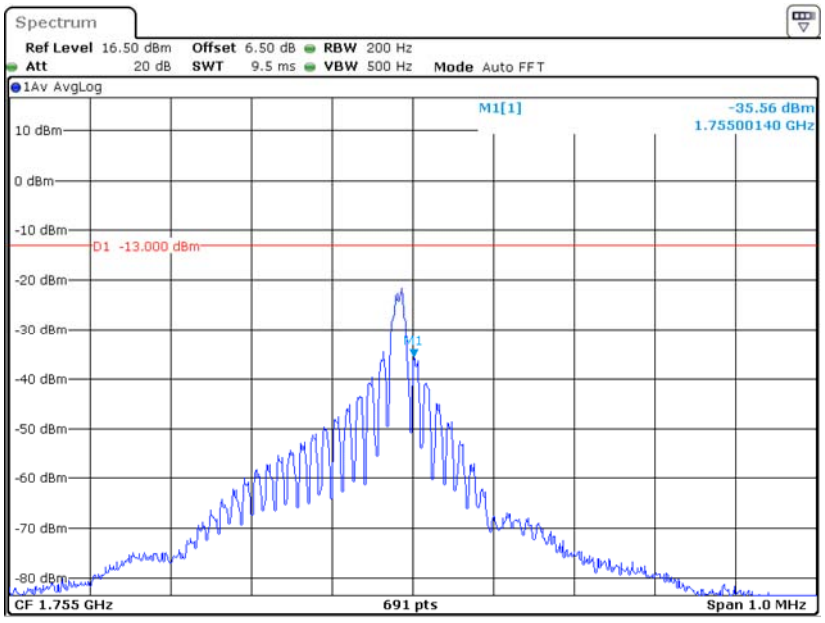
Date: 11.NOV.2019 10:16:57

QPSK (15kHz, 1#0) - Left Band Edge



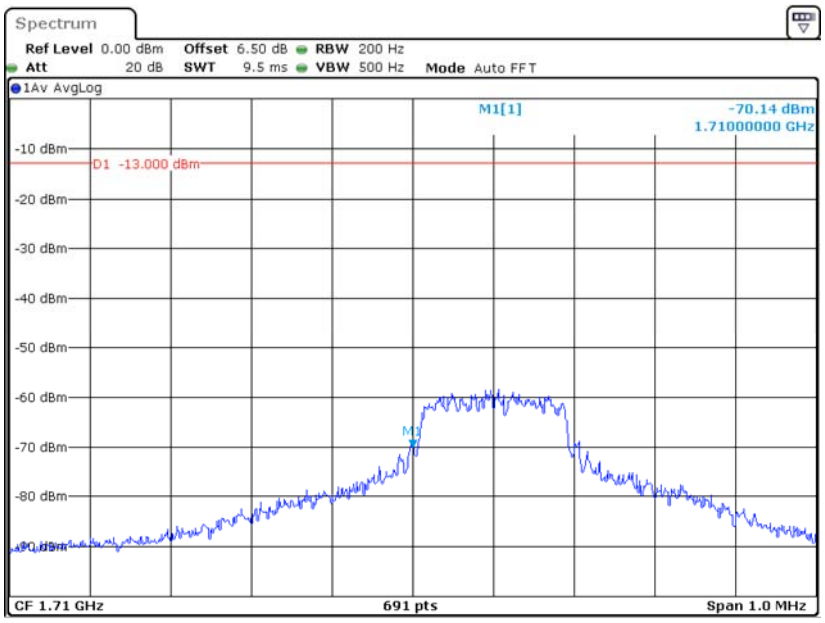
Date: 11.NOV.2019 10:10:35

QPSK (15kHz, 1#11) - Right Band Edge

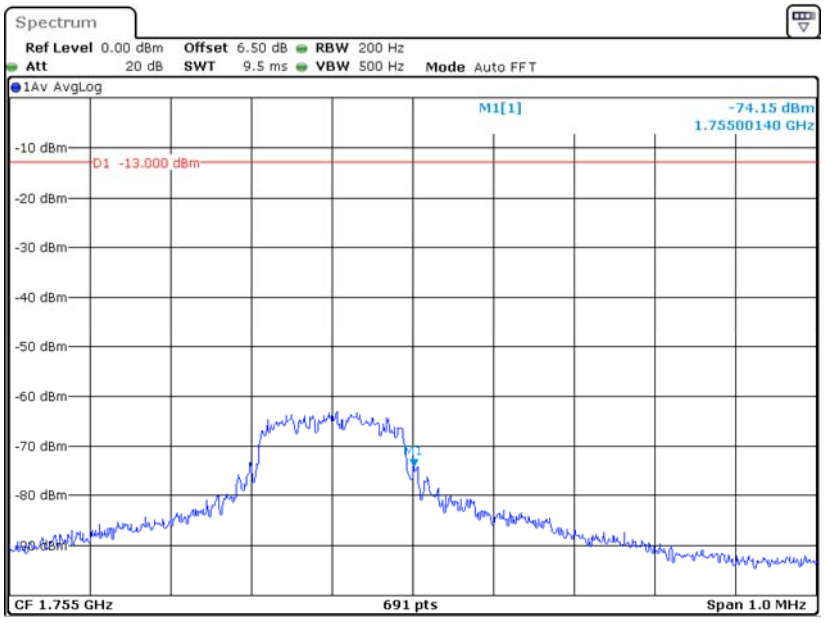


Date: 11.NOV.2019 10:04:10

QPSK (15kHz, 12#0) - Left Band Edge



QPSK (15kHz, 12#0) - Right Band Edge



FCC § 2.1055; §27.54- FREQUENCY STABILITY

Applicable Standards

FCC § 2.1055 and §27.54.

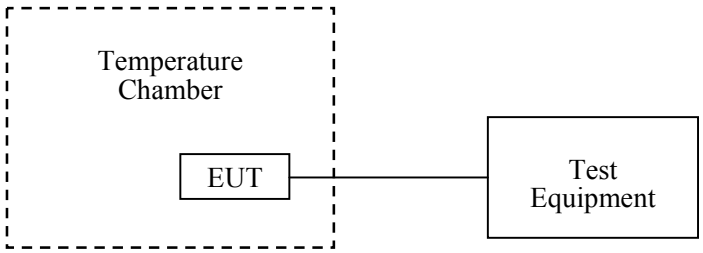
According to §27.54, the frequency stability shall be sufficient to ensure that the fundamental emissions stays within the authorized frequency block.

Test Procedure

Frequency Stability vs. Temperature: The equipment under test was connected to an external DC power supply and the RF output was connected to communication test set via feed-through attenuators. The EUT was placed inside the temperature chamber. The DC leads and RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the communication test set.

Frequency Stability vs. Voltage: For hand carried, battery powered equipment; reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.



Test Data

Environmental Conditions

Temperature:	23.2 ℃
Relative Humidity:	51 %
ATM Pressure:	101.3 kPa

The testing was performed by Stone Zhang on 2019-11-07.

EUT operation mode: Transmitting

Test Result: Compliant.

NB-IoT Band 4:

3.75kHz Low Channel & High Channel (BPSK)					
Temperature (℃)	**Power Supplied (V_{DC})**	**F_L (MHz)**	**F_H (MHz)**	**F_L Limit (MHz)**	**F_H Limit (MHz)**
-30	3.3	1710.1079	1754.8998	1710	1755
-20		1710.1045	1754.8007	1710	1755
-10		1710.1078	1754.8963	1710	1755
0		1710.1033	1754.8988	1710	1755
10		1710.1034	1754.8973	1710	1755
20		1710.1076	1754.8991	1710	1755
30		1710.1062	1754.8973	1710	1755
40		1710.1074	1754.8012	1710	1755
50		1710.1053	1754.8945	1710	1755
20	V min.= 2.8	1710.1022	1754.8002	1710	1755
20	V max.= 3.8	1710.1028	1754.8966	1710	1755

3.75kHz Low Channel & High Channel (QPSK)					
Temperature (℃)	**Power Supplied (V_{DC})**	**F_L (MHz)**	**F_H (MHz)**	**F_L Limit (MHz)**	**F_H Limit (MHz)**
-30	3.3	1710.1013	1754.8988	1710	1755
-20		1710.1031	1754.8972	1710	1755
-10		1710.1007	1754.8965	1710	1755
0		1710.1030	1754.8028	1710	1755
10		1710.1023	1754.8986	1710	1755
20		1710.1007	1754.8015	1710	1755
30		1710.1997	1754.8033	1710	1755
40		1710.1051	1754.8031	1710	1755
50		1710.1020	1754.8970	1710	1755
20	V min.= 2.8	1710.1021	1754.8957	1710	1755
20	V max.= 3.8	1710.1058	1754.8011	1710	1755

15kHz Low Channel & High Channel (BPSK)					
Temperature (℃)	**Power Supplied (V_{DC})**	**F_L (MHz)**	**F_H (MHz)**	**F_L Limit (MHz)**	**F_H Limit (MHz)**
-30	3.3	1710.1079	1754.8998	1710	1755
-20		1710.1045	1754.8007	1710	1755
-10		1710.1078	1754.8963	1710	1755
0		1710.1033	1754.8988	1710	1755
10		1710.1034	1754.8973	1710	1755
20		1710.1076	1754.8991	1710	1755
30		1710.1062	1754.8973	1710	1755
40		1710.1074	1754.8012	1710	1755
50		1710.1053	1754.8945	1710	1755
20	V min.= 2.8	1710.1022	1754.8002	1710	1755
20	V max.= 3.8	1710.1028	1754.8966	1710	1755

15kHz Low Channel & High Channel (QPSK)					
Temperature (℃)	**Power Supplied (V_{DC})**	**F_L (MHz)**	**F_H (MHz)**	**F_L Limit (MHz)**	**F_H Limit (MHz)**
-30	3.3	1710.1074	1754.8992	1710	1755
-20		1710.1071	1754.8026	1710	1755
-10		1710.1023	1754.8997	1710	1755
0		1710.1050	1754.8004	1710	1755
10		1710.1053	1754.8983	1710	1755
20		1710.1048	1754.8016	1710	1755
30		1710.1058	1754.8989	1710	1755
40		1710.1025	1754.8999	1710	1755
50		1710.1064	1754.8003	1710	1755
20	V min.= 2.8	1710.1052	1754.8985	1710	1755
20	V max.= 3.8	1710.1087	1754.8028	1710	1755

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