DEKRA Testing and Certification, S.A.U.
Parque Tecnológico de Andalucía,
c/ Severo Ochoa nº 2 · 29590 Campanillas · Málaga · España
C.I.F. A29 507 456

Nº 51/LE147

Test report No:
NIE: 60375RRF.002

Test report

REFERENCE STANDARD:
USA FCC Part Part 27
CANADA RSS-130.

(*) Identification of item tested	LTE Module CATM and NB-IOT
(*) Trademark	Telit
(*) Model and /or type reference	ME910C1-WW
Other identification of the product	FCC ID: RI7ME910C1WW IC: 5131A-ME910C1WW IMEI TAC: 35308109
(*) Features	LTE CATM/NB-IOT /Quad Band 2G
Applicant	Telit Communications S.p.A Via Stazione di Prosecco 5/B, 34010 Sgonico, Trieste - ITALY
Test method requested, standard	USA FCC Part 27 10-1-18 Edition. CANADA RSS-130 Issue 1. Oct. 2013. ANSI C63.26 – 2015
Summary	IN COMPLIANCE
Approved by (name / position & signature)	A. Llamas RF Lab. Manager Firmado digitalmente por ALEJANDRO LLAMAS RODRIGUEZ Fecha: 2019.06.24 11:02:57 +02'00'
Date of issue	2019-06-24
Report template No	FDT08_20 (*) "Data provided by the client

Index

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Uncertainty

Uncertainty (factor k=2) was calculated according to the DEKRA Testing and Certification internal document PODT000.

Data provided by the client

The sample consist of a LTE module CAT M and NB-IOT with 2G Fallback.

DEKRA declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

Usage of samples

Sample S/01 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
57536/047	Module	ME910C1-WW	IMEI: 353081090002109	2018-09-25
53445B/017	Cradle	---	113990005439	2017-06-28
55696/011	Antenna	---	---	2017-11-16

1. Sample S/01 has undergone the following test(s):

All radiated tests indicated in appendixes A.

Sample S/02 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
57536/047	Module	ME910C1-WW	IMEI: 353081090002109	2018-09-25
53445B/017	Cradle	---	113990005439	2017-06-28

1. Sample S/02 has undergone the following test(s):

All conducted tests indicated in appendixes A.

Test sample description

Ports…… :	Port name and description	Cable			
		Specified max length [m]	Attached during test	Shielded	Coupled to patient(3)
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐

Supplementary information to the ports…… :							
Rated power supply ……:	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	☐	AC:	☐	☐	☐	☐	☐
	☐	AC:	☐	☐	☐	☐	☐
	☒	DC: 3.8 Vdc.					
	☐	DC:					
Rated Power ……:							
Clock frequencies ……:							
Other parameters……:							
Software version ……:	M0B.800004						
Hardware version……:	0.0						
Dimensions in cm (W x H x D)….:							
Mounting position……:	☐	Table top equipment					
	☐	Wall/Ceiling mounted equipment					
	☐	Floor standing equipment					
	☐	Hand-held equipment					
	☒	Other: Module					
Modules/parts ……:	Module/parts of test item			Type		Manufacturer	
Accessories (not part of the test item) ……:	Description			Type		Manufacturer	

Documents as provided by the applicant.....:	Description	File name	Issue date

Identification of the client

TELIT COMMUNICATIONS
Via Stazione di Prosecco 5/B, 34010 Sgonico,
Trieste – ITALY

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2019-02-07
Date (finish)	2019-06-07

Document history

Report number	Date	Description
60375RRF.002	2019-06-24	First release

Environmental conditions

In the control chamber. the following limits were not exceeded during the test:

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 75 %

In the semianechoic chamber. the following limits were not exceeded during the test.

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 75 %

In the chamber for conducted measurements. the following limits were not exceeded during the test:

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 35 %

Remarks and comments

The tests have been performed by the technical personnel: José Alberto Aranda.

Used instrumentation:

Conducted Measurements

		Last Cal. date	Cal. due date
1.	EMI Test Receiver R&S ESR7	2018/10	2020/10
2.	Vector signal analyzer Rohde & Schwarz FSQ8	2018/08	2020/08
3.	Climatic chamber HERAEUS VM 04/35	2018/06	2020/06
4.	DC power supply R&S NGPE 40/40	2018/02	2021/02
5.	Universal Radio communication Tester R&S CMW50	2019/02	2020/02
6.	Spectrum analyser Rohde & Schwarz FSV40	2017/07	2019/07

Radiated Measurements

		Last Cal. date	Cal. due date
1.	Semianechoic Absorber Lined Chamber ETS FACT3 200STP	N.A.	N.A.
2.	BiconicalLog antenna ETS LINDGREN 3142E	2017/09	2020/09
3.	Multi Device Controller MESSTECHNIK DAV-RR	N.A.	N.A.
4.	Double-ridge Guide Horn antenna 1-18 GHz SCHWARZBECK BBHA 9120 D	2018/01	2021/01
5.	Spectrum analyser Rohde & Schwarz FSV40	2018/02	2020/02
6.	EMI Test Receiver R&S ESR7	2018/10	2020/10
7.	RF pre-amplifier 1-18 GHz Bonn Elektronik BLMA 0118-3A	2019/04	2020/04

Testing verdicts

Not applicable :	N/A
Pass :	P
Fail :	F
Not measured :	N/M

Summary

FCC PART 27 / RSS-130 PARAGRAPH Requirement – Test case	Verdict	Remark
Clause 27.50 / RSS-130 Clause 4.4.: RF output power	P	
Clause 2.1047 / RSS-130 Clause 4.1.: Modulation characteristics	P	
Clause 27.54 / RSS-130 Clause 4.3.: Frequency stability	P	
Clause 2.1049: Occupied Bandwidth	P	
Clause 27.53 / RSS-130 Clause 4.6.: Spurious emissions at antenna terminals	P	
Clause 27.53 / RSS-130 Clause 4.6.: Radiated emissions	P	
Supplementary information and remarks: None.		

Appendix A: Test results for FCC Part 27 / RSS-130. NB-IoT

INDEX

TEST CONDITIONS

Power supply (V):

Vnominal = 3.8 Vdc

Vmax = 4.37 Vdc

Vmin = 3.23 Vdc

The subscripts nom. min and max indicate voltage test conditions (nominal. minimum and maximum respectively. as declared by the applicant).

Type of power supply = DC Voltage from external power supply

Type of antenna = External antenna.

Declared Gain for antenna = 2.14 dBi

TEST FREQUENCIES:

NBIoT. π/2 - BPSK AND π/4 - QPSK MODULATION (BAND 12)

Channel (Frequency. MHz)				
Lowest		Middle		Highest
23011 (699.1)	23012 (699.2)	23095 (707.5)	23178 (715.8)	23179 (715.9)

NBIoT. π/2 - BPSK AND π/4 - QPSK MODULATION (BAND 13)

Channel (Frequency. MHz)				
Lowest		Middle		Highest
23181 (777.1)	23182 (777.2)	23230 (782)	23278 (786.8)	23279 (786.9)

For compliance with FCC and ISED regulatory requirements, the operation with tones in the next configurations will not be used:

- Channel 23011 (Band 12) and 23181 (Band 13):
  - 1 tone 3.75 kHz with offset: from 0 to 46.
  - 3 tones 15 kHz with offset:0, 3, 6.
  - 6 tones 15 kHz
  - 12 tones 15 kHz
- Channel 23179 (band 12) and 23279 (Band 13):
  - 1 tone 3.75 kHz with offset: from 1 to 47.
  - 3 tones 15 kHz with offset:3, 6, 9.
  - 6 tones 15 kHz
  - 12 tones 15 kHz

For conducted spurious emissions at antenna terminals at Block Edges the lowest and highest channels have been used with configurations other than the above indicated, and also with all the configurations of the adjacent channels 23012 and 23178 for Band 12 and 23182 and 23278 for Band 13.

RF Output Power

SPECIFICATION

FCC §27.50 (c) (10).
Portable stations (hand-held devices) in the 600 MHz uplink band and the 698-746 MHz band. and fixed and mobile stations in the 600 MHz uplink band are limited to 3 watts ERP.

FCC §27.50 (b) (10).

Portable stations (hand-held devices) transmitting in the 746-757 MHz. 776-788 MHz. and 805-806 MHz bands are limited to 3 watts ERP.

RSS-130 Clause 4.4.
The e.i.r.p. shall not exceed 50 watts (46.99 dBm) for mobile equipment or for outdoor fixed subscriber equipment nor shall it exceed 5 watts (36.99 dBm) for portable equipment or for indoor fixed subscriber equipment.

The peak-to-average power ratio (PAPR) of the transmission shall not exceed 13 dB.

METHOD

The conducted RF output power measurements were made at the RF output terminals of the EUT using the power meter of the Universal Radio Communication tester R&S CMW500. selecting maximum transmission power of the EUT and different modes of modulation.

The maximum equivalent isotropically radiated power (e.i.r.p.) is calculated by adding the declared maximum antenna gain (dBi).

The maximum effective radiated power e.r.p. is calculated from the maximum equivalent isotropically radiated power (e.i.r.p.) by subtracting 2.15 dB:

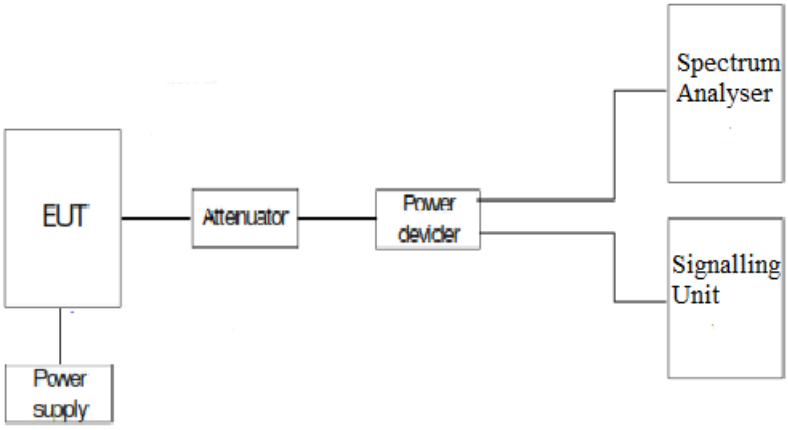
$$E.R.P. = E.I.R.P. – 2.15\ dB$$

The peak-to-average power ratio (PAPR) is measured using an attenuator. power splitter and spectrum analyser with a Complementary Cumulative Distribution Function implemented.
The EUT was controlled via the Universal Radio Communication tester R&S CMW500 selecting maximum transmission power of the EUT and different modes of modulation.

TEST SETUP

Conducted average power.

Peak-to-average power ratio (PAPR)



RESULTS

MAXIMUM OUTPUT POWER (CONDUCTED).

NBIoT. BAND 12.

Ch	Freq. (MHz)	Modulation	BW (kHz)	Num. tone	Offset Tone	Average Power (dBm)	PAPR (dB)
23012	699.2	π/2 - BPSK	3.75	1	0	22,58	(*)
				1	47	22,6	(*)
			15	1	0	22,77	(*)
				1	11	22,71	(*)
		π/4 - QPSK	3.75	1	0	22,58	(*)
				1	47	22,58	(*)
			15	1	0	22,76	(*)
				1	11	22,69	(*)
				3	0	22,77	4,23
				3	6	23,31	4,31
				6	0	22,38	6,17
				6	6	22,02	6,22
				12	0	21,34	6,3
23095	707.5	π/2 - BPSK	3.75	1	0	22,7	(*)
				1	47	22,69	(*)
			15	1	0	22,75	(*)
				1	11	22,71	(*)
		π/4 - QPSK	3.75	1	0	22,76	(*)
				1	47	22,75	(*)
			15	1	0	22,95	(*)
				1	11	22,94	(*)
				3	0	22,57	4,31
				3	6	23,3	4,34
				6	0	22,37	6,09
				6	6	22,42	5,96
				12	0	21,39	6,47
23178	715.8	π/2 - BPSK	3.75	1	0	22,47	(*)
				1	47	22,46	(*)
			15	1	0	22,58	(*)
				1	11	22,52	(*)
		π/4 - QPSK	3.75	1	0	22,44	(*)
				1	47	22,44	(*)
			15	1	0	22,54	(*)
				1	11	22,53	(*)
				3	0	22,51	4,25
				3	6	23,16	4,17
				6	0	22,22	6,03
				6	6	22,24	6,2
				12	0	21,54	6,57

(*): Preliminary measurements determined that 3. 6 or 12 tones of 15kHz as the worst case. The results in the next tables shows the results for this configuration.

NBIoT. BAND 13.

Ch	Freq. (MHz)	Modulation	BW (kHz)	Num. tone	Offset Tone	Average Power (dBm)	PAPR (dB)
23182	777.20	π/2 - BPSK	3.75	1	0	22,23	(*)
				1	47	22,21	(*)
			15	1	0	22,71	(*)
				1	11	22,21	(*)
		π/4 - QPSK	3.75	1	0	22,17	(*)
				1	47	22,15	(*)
			15	1	0	22,59	(*)
				1	11	22,61	(*)
				3	0	23,18	4.04
				3	6	23,25	3.89
				6	0	22,58	5.66
				6	6	22,72	6.26
				12	0	21,01	5.82
23230	782	π/2 - BPSK	3.75	1	0	22,64	(*)
				1	47	22,51	(*)
			15	1	0	22,69	(*)
				1	11	22,66	(*)
		π/4 - QPSK	3.75	1	0	22,58	(*)
				1	47	22,51	(*)
			15	1	0	22,7	(*)
				1	11	22,72	(*)
				3	0	23,01	4.04
				3	6	23,17	3.94
				6	0	22,27	6.06
				6	6	22,3	6.47
				12	0	21,07	5.91
23278	786.8	π/2 - BPSK	3.75	1	0	22,15	(*)
				1	47	22,16	(*)
			15	1	0	22,59	(*)
				1	11	22,57	(*)
		π/4 - QPSK	3.75	1	0	22,15	(*)
				1	47	22,14	(*)
			15	1	0	22,66	(*)
				1	11	22,6	(*)
				3	0	22,3	4.39
				3	6	22,95	4.70
				6	0	22,01	6.59
				6	6	22,05	6.49
				12	0	21,01	6.20

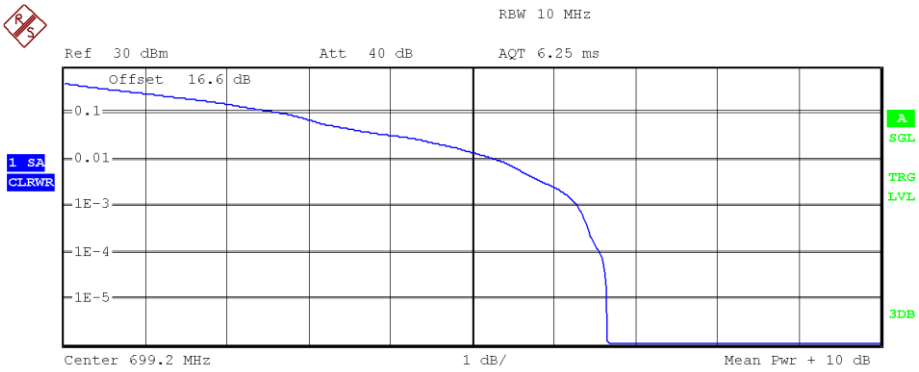
(*): Preliminary measurements determined that 3, 6 or 12 tones of 15kHz as the worst case. The results in the next tables shows the results for this configuration.

PEAK-TO-AVERAGE POWER RATIO (PAPR).

NBIoT BAND 12.

Preliminary measurements determined that 12 tones of 15kHz as the worst case. The results in the next tables shows the results for this configuration.

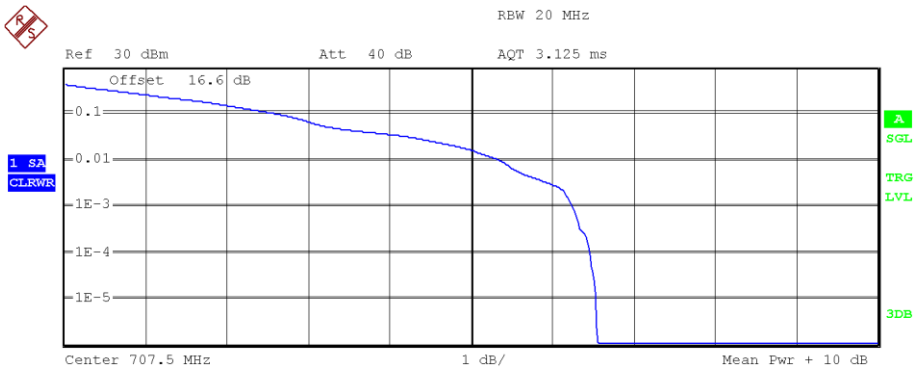
Channel Low:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 11.2MHz

	Trace 1
Mean	21.35 dBm
Peak	28.01 dBm
Crest	6.66 dB
10 %	2.68 dB
1 %	5.30 dB
.1 %	6.30 dB
.01 %	6.57 dB

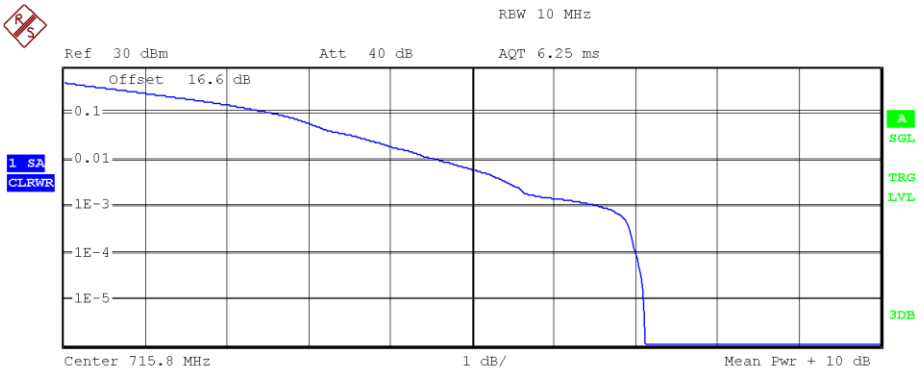
Channel Middle:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 23.7MHz

	Trace 1
Mean	21.14 dBm
Peak	27.69 dBm
Crest	6.55 dB
10 %	2.61 dB
1 %	5.35 dB
.1 %	6.25 dB
.01 %	6.47 dB

Channel High:



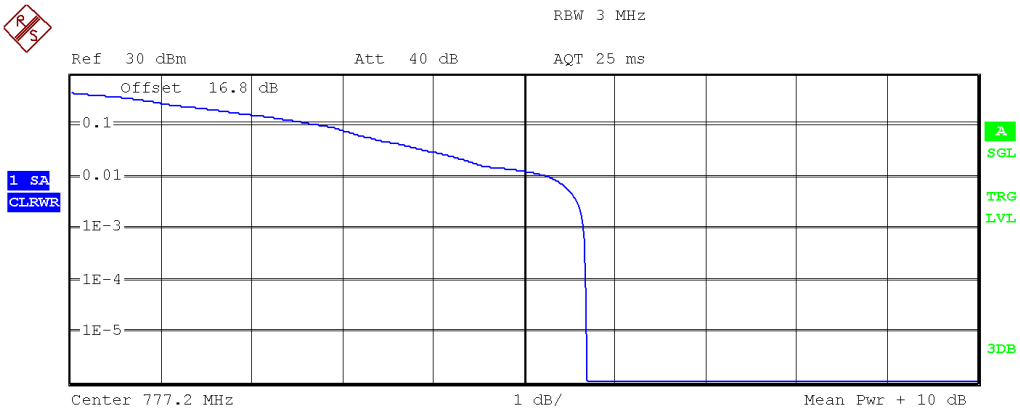
Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 11.2MHz

	Trace 1
Mean	20.75 dBm
Peak	27.86 dBm
Crest	7.11 dB
10 %	2.58 dB
1 %	4.58 dB
.1 %	6.57 dB
.01 %	7.02 dB

NBIoT. BAND 13.

Preliminary measurements determined that 6 tones of 15kHz as the worst case for channel . The results in the next tables shows the results for this configuration.

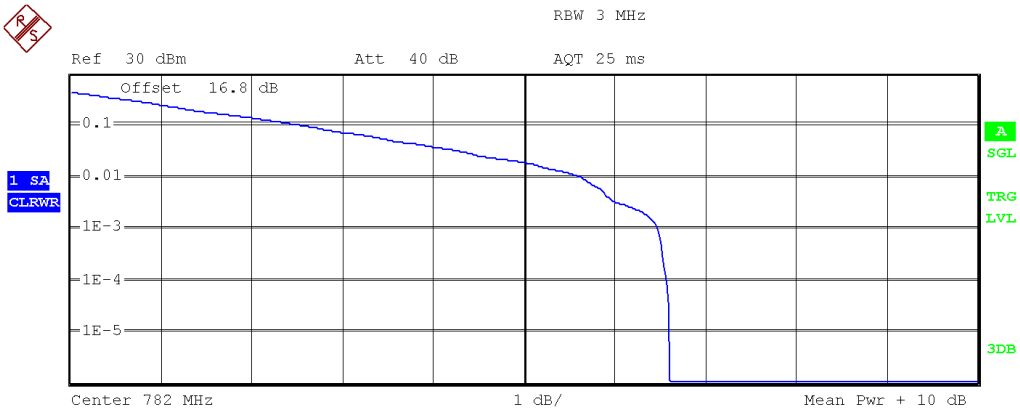
Channel Low:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 3.5MHz

	Trace 1
Mean	22.65 dBm
Peak	28.34 dBm
Crest	5.68 dB
10 %	2.77 dB
1 %	5.27 dB
.1 %	6.26 dB
.01 %	5.69 dB

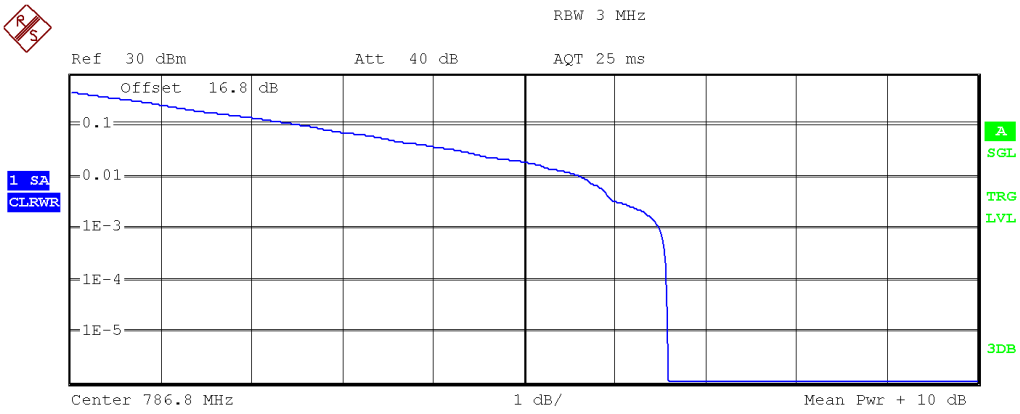
Channel Middle:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 3.5MHz

	Trace 1
Mean	20.53 dBm
Peak	27.14 dBm
Crest	6.60 dB
10 %	2.58 dB
1 %	5.63 dB
.1 %	6.47 dB
.01 %	6.59 dB

Channel High:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 3.5MHz

	Trace 1
Mean	20.42 dBm
Peak	27.00 dBm
Crest	6.58 dB
10 %	2.58 dB
1 %	5.64 dB
.1 %	6.49 dB
.01 %	6.59 dB

NBIoT BAND 12.

Channel	Measured maximum average power (dBm) at antenna port	Maximum declared antenna gain (dBi)	Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	Maximum effective radiated power E.R.P. (dBm)	PAPR (dB)
Lowest	23.31	2.14	25.45	23.30	6.30
Middle	22.01	2.14	24.15	22.00	6.25
Highest	23.16	2.14	25.30	23.15	6.57
Measurement uncertainty (dB)	<±1.11				

NBIoT BAND 13.

Channel	Measured maximum average power (dBm) at antenna port	Maximum declared antenna gain (dBi)	Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	Maximum effective radiated power E.R.P. (dBm)	PAPR (dB)
Lowest	22.53	2.14	24.67	22.52	6.26
Middle	21.69	2.14	23.83	21.68	6.47
Highest	22.80	2.14	24.94	22.79	6.59
Measurement uncertainty (dB)	<±1.11				

Verdict: PASS

Frequency Stability

SPECIFICATION

FCC §2.1055 and §27.54.

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

RSS-130. Clause 4.3.

The applicant shall ensure frequency stability by showing that fL minus the frequency offset and fH plus the frequency offset shall be within the frequency range in which the equipment is designed to operate.

METHOD

The frequency tolerance measurements over temperature variations were made over the temperature range of –30ºC to +50ºC. The EUT was placed inside a climatic chamber and the temperature was raised hourly in 10ºC steps from –30ºC up to +50ºC.
The supply voltage was varied between 85% and 115% of nominal voltage.

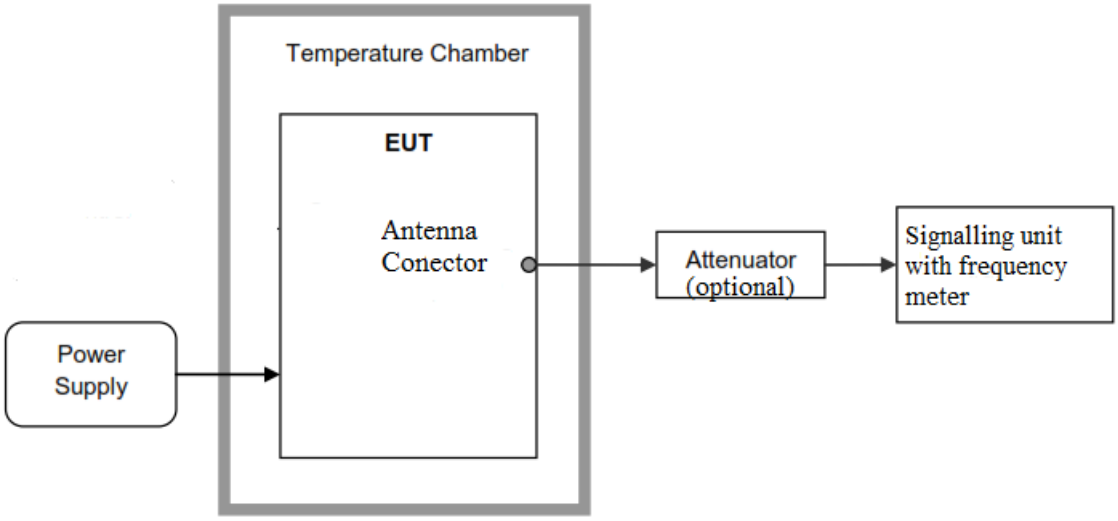
The EUT was set in “Radio Resource Control (RRC) mode” in the middle channel using the Universal Radio Communication tester R&S CMW500 and the maximum frequency error was measured using the built-in calibrated frequency meter.
The worst case NBIoT mode for conducted power was used for the test.

In order to check that the frequency stability is sufficient such that the fundamental emissions stay within the authorized bands of operation. a reference point is established at the applicable unwanted emissions limit using a RBW equal to the RBW required by the unwanted emissions specification of the applicable regulatory standard. These reference points measured using the lowest and highest channel of operation are identified as fL and fH respectively. The worst-case frequency offset determined in the above methods is added or subtracted from the values of fL and fH to check that the resulting frequencies remain within the band.

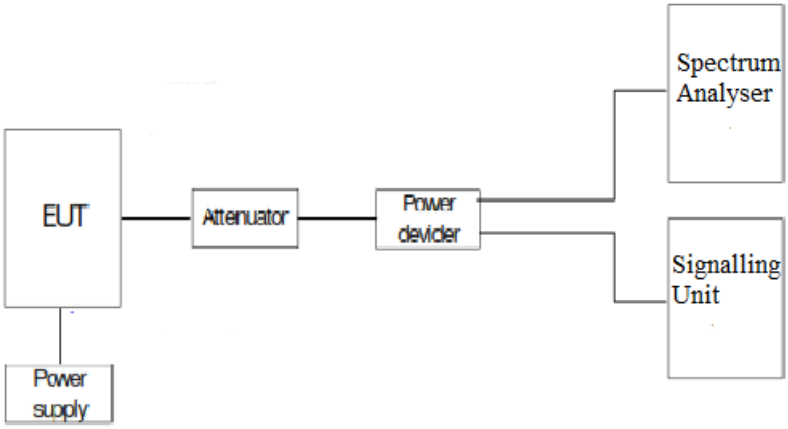
The reference point measurements were made at the RF output terminals of the EUT using an attenuator. power splitter and spectrum analyser. The EUT was controlled via the Universal Radio Communication tester R&S CMW500 selecting maximum transmission power of the EUT and different modes of modulation.

TEST SETUP

Frequency tolerance.



Reference points *f*L and *fH.*



RESULTS

Frequency stability over temperature variations.

NBIoT Band 12. π/2 - BPSK modulation. 1 tone 3.75 kHz. Channel: 707.5 MHz.

Temperature (ºC)	Frequency Error (Hz)	Frequency Error (ppm)
+50	-1.8	-0.00254417
+40	-4.59	-0.006487633
+30	6.97	0.00985159
+20	-2.15	-0.003038869
+10	1.76	0.002487633
0	0.92	0.001300353
-10	-2.13	-0.003010601
-20	-1.15	-0.001625442
-30	-1.85	-0.002614841

NBIoT Band 13. π/2 - BPSK modulation. 1 tone 3.75 kHz. Channel: 782 MHz.

Temperature (ºC)	Frequency Error (Hz)	Frequency Error (ppm)
+50	2.47	0.003158568
+40	-1.09	-0.001393862
+30	8.71	0.011138107
+20	-1.26	-0.001611253
+10	4.19	0.005358056
0	-1.13	-0.001445013
-10	-1.76	-0.002250639
-20	-1.25	-0.001598465
-30	-2.01	-0.002570332

Frequency stability over voltage variations.

NBIoT Band 12

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
Vmax	4.37	-3.52	-0.004975265
Vmin	3.23	3.79	0.00535689

NBIoT Band 13

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
Vmax	4.37	-3.08	-0.003938619
Vmin	3.23	-0.43	-0.000549872

points established at the applicable unwanted emissions limit (worst case):

	NBIoT Band 12
*f*L (MHz)	698.9397
fH (MHz)	715.9947

	NBIoT Band 13
*f*L (MHz)	777.0014
fH (MHz)	786.9928

Reference points *f*L and *fH* with the worst-case frequency offsets added or subtracted:

	NBIoT Band 12
*f*L (MHz)	698.9397
fH (MHz)	915.9947

	NBIoT Band 13
*f*L (MHz)	777.0014
fH (MHz)	786.9928

The reference frequency points stay within the authorized blocks.

Verdict: PASS

Modulation Characteristics

SPECIFICATION

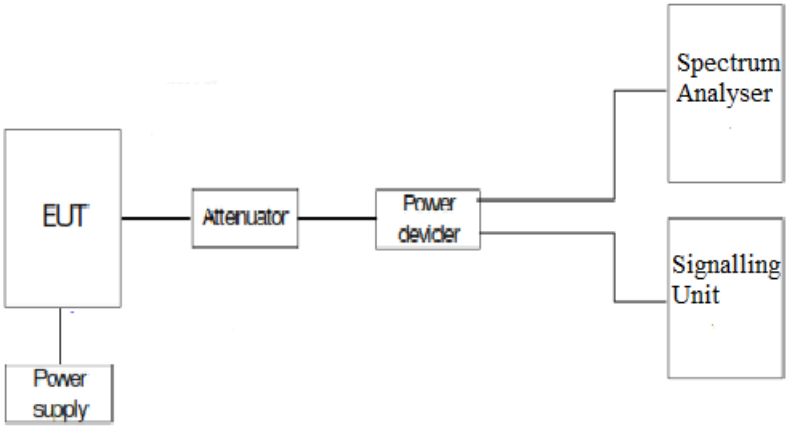
FCC §2.1047

RSS-130. Clause 4.1. Equipment certified under this standard shall use digital modulation.

METHOD

For NBIoT the EUT operates with π/2 - BPSK and π/4 - QPSK modulation modes in which the information is digitised and coded into a bit stream.

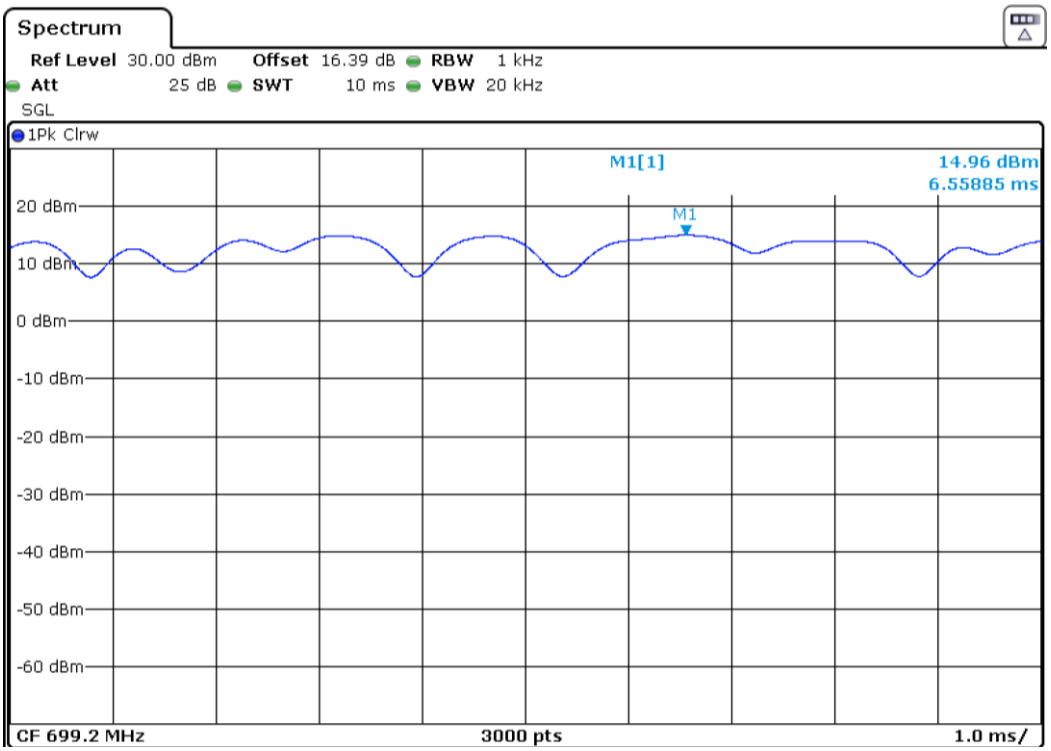
TEST SETUP



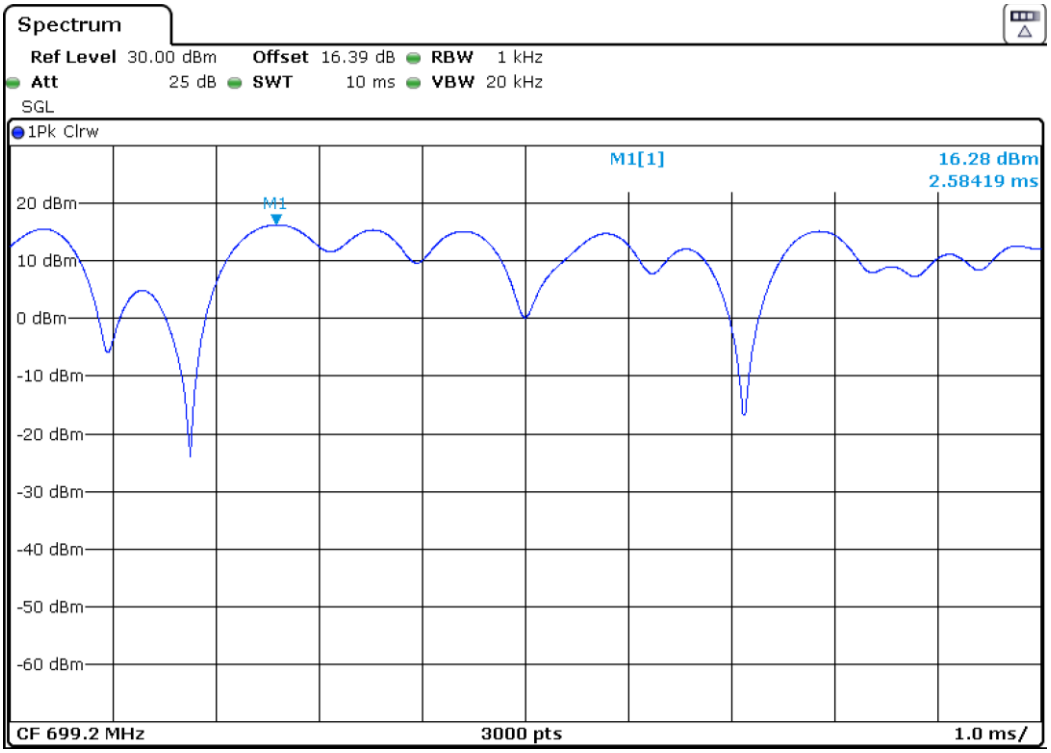
RESULTS

The following plot shows the modulation schemes in the EUT.

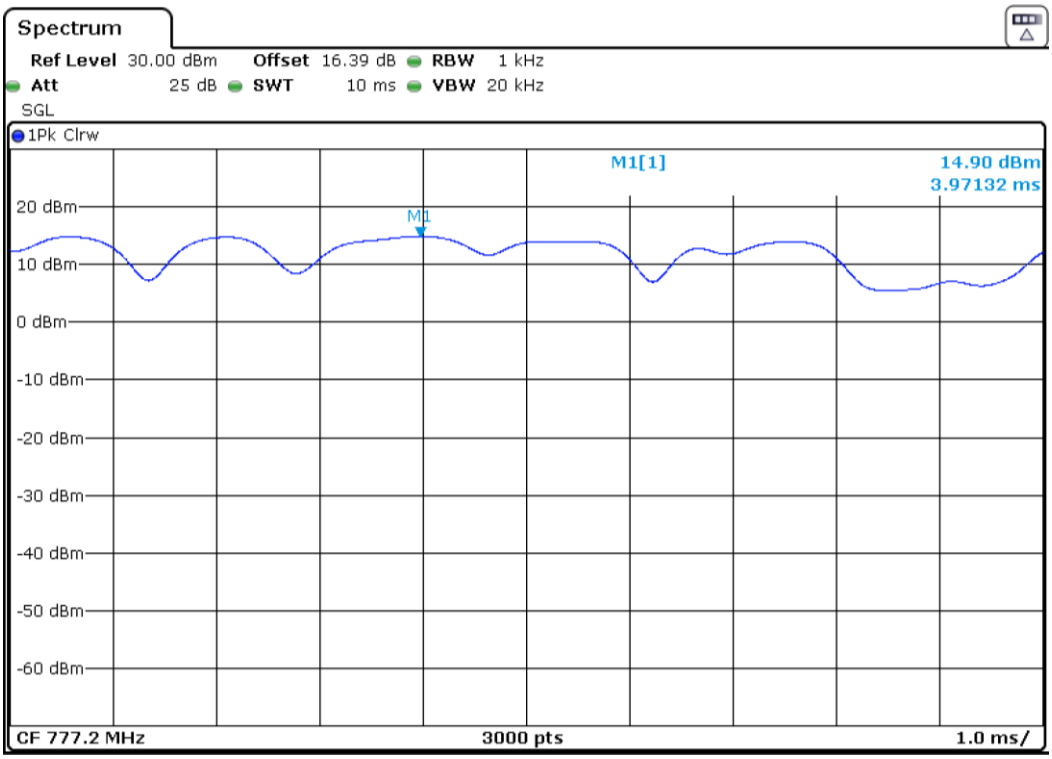
NBIoT MODULATION (Band 12). π/2 - BPSK.



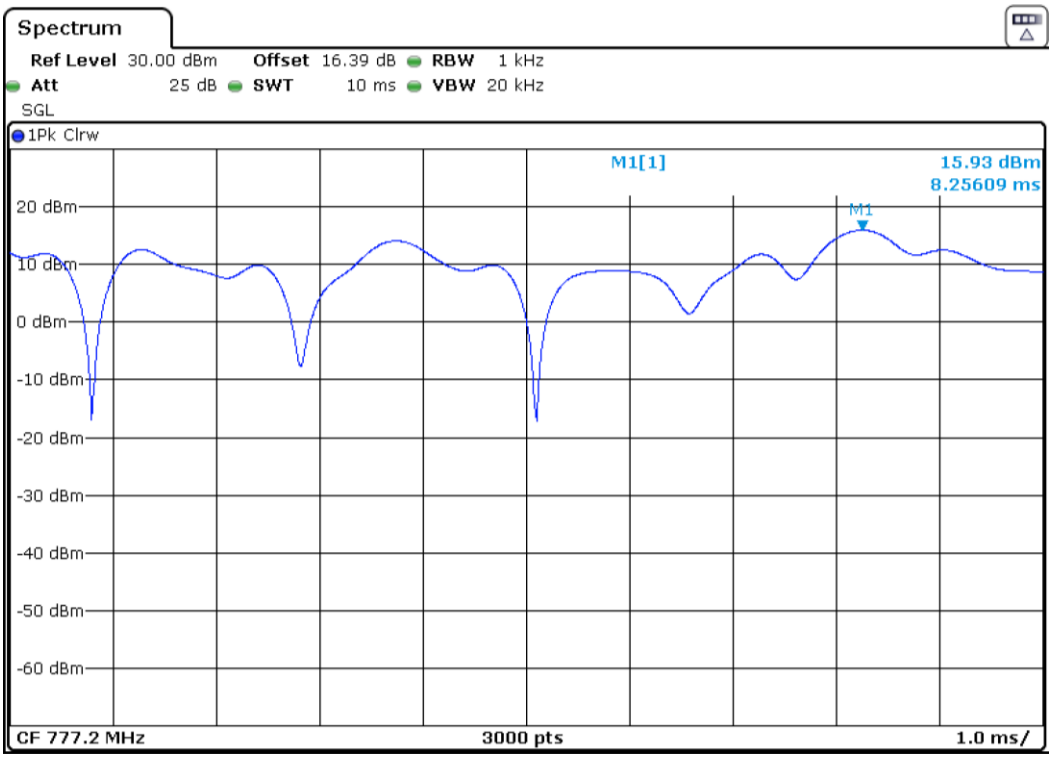
NBIoT MODULATION (Band 12). π/4 - QPSK.



NBIoT MODULATION (Band 13). π/2 - BPSK.



NBIoT MODULATION (Band 13). π/4 - QPSK.



Occupied Bandwidth

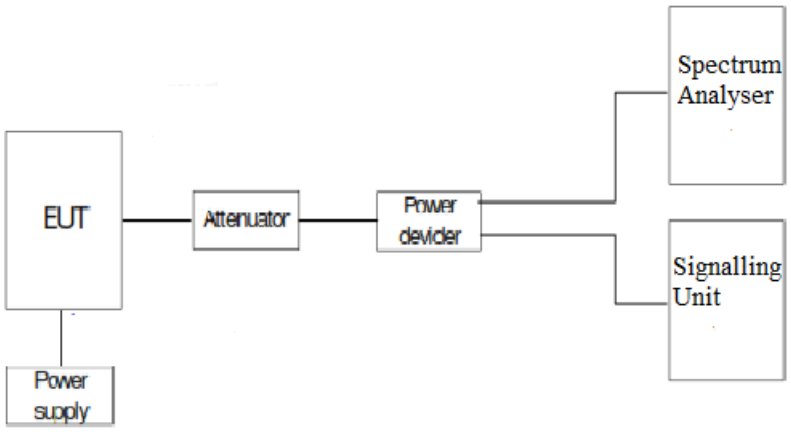
SPECIFICATION

§2.1049

METHOD

The occupied bandwidth measurement was performed at the output terminals of the EUT using an attenuator. power splitter and spectrum analyser. The EUT was controlled via the Universal Radio Communication tester R&S CMW500 selecting maximum transmission power of the EUT and different modes of modulation. The 99% occupied bandwidth and the -26 dBc bandwidth were measured directly using the built-in bandwidth measuring option of spectrum analyser.

TEST SETUP



RESULTS (see next plots)

NBIoT BAND 12.

Tone 3.75 kHz. π/2 - BPSK MODULATION

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	59.46	59.00	59.20
-26 dBc bandwidth (kHz)	41.01	40.84	40.95
Measurement uncertainty (kHz)	<±0.05		

Tone 3.75 kHz. π/4 - QPSK MODULATION

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	64.60	64.40	64.60
-26 dBc bandwidth (kHz)	41.65	41.64	41.62
Measurement uncertainty (kHz)	<±0.05		

Tone 15 kHz. π/2 - BPSK MODULATION

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	138.00	138.13	138.40
-26 dBc bandwidth (kHz)	134.98	134.78	134.55
Measurement uncertainty (kHz)	<±0.10		

12 Tones 15 kHz. π/4 - QPSK MODULATION

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	187.06	186.80	186.60
-26 dBc bandwidth (kHz)	251.70	252.04	251.93
Measurement uncertainty (kHz)	<±0.12		

NBIoT BAND 13.

Tone 3.75 kHz. π/2 - BPSK MODULATION

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	60.40	60.13	60.13
-26 dBc bandwidth (kHz)	41.20	41.13	41.13
Measurement uncertainty (kHz)	<±0.05		

Tone 3.75 kHz. π/4 - QPSK MODULATION

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	65.60	64.80	65.00
-26 dBc bandwidth (kHz)	41.78	41.83	41.73
Measurement uncertainty (kHz)	<±0.05		

Tone 15 kHz. π/2 - BPSK MODULATION

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	138.40	138.40	138.26
-26 dBc bandwidth (kHz)	134.67	134.67	134.67
Measurement uncertainty (kHz)	<±0.10		

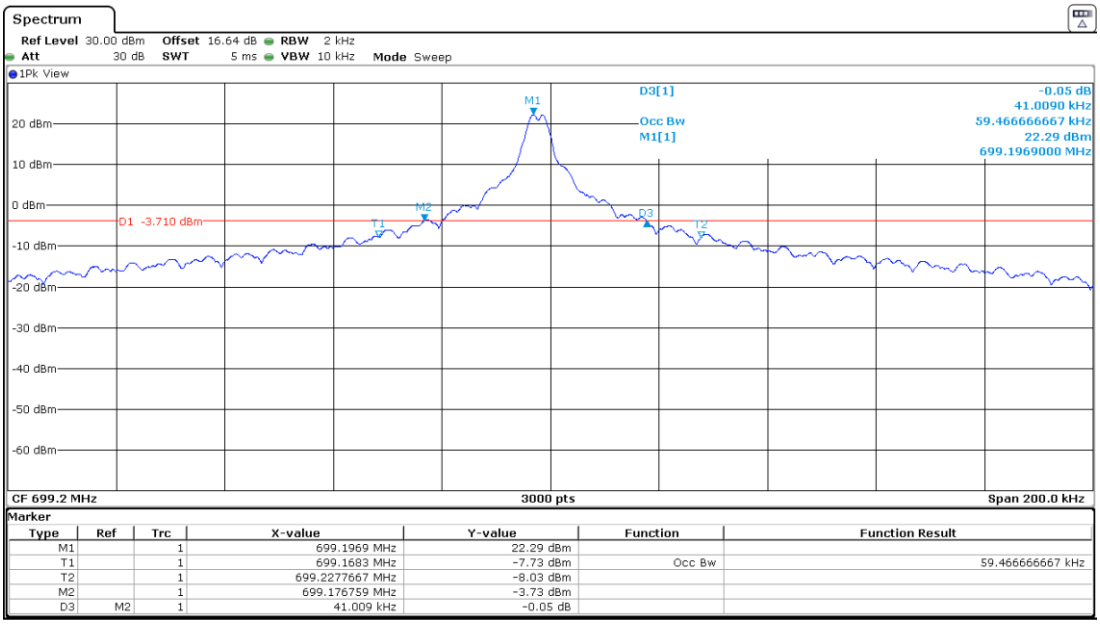
12 Tones 15 kHz. π/4 - QPSK MODULATION

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	185.86	185.86	186.00
-26 dBc bandwidth (kHz)	251.07	251.41	251.33
Measurement uncertainty (kHz)	<±0.12		

NBIoT BAND 12.

Tone 3.75 kHz. π/2 - BPSK MODULATION

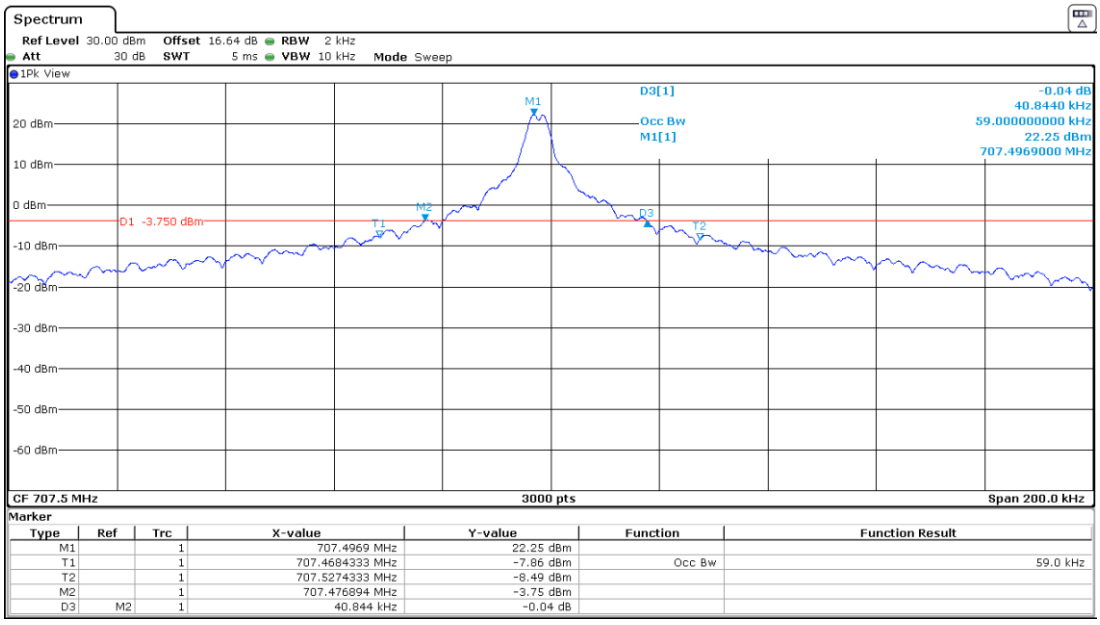
Lowest Channel



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	699.1969 MHz	22.29 dBm		
T1		1	699.1683 MHz	-7.73 dBm	Occ Bw	59.466666667 kHz
T2		1	699.2277667 MHz	-8.03 dBm		
M2		1	699.176759 MHz	-3.73 dBm		
D3	M2	1	41.009 kHz	-0.05 dB		

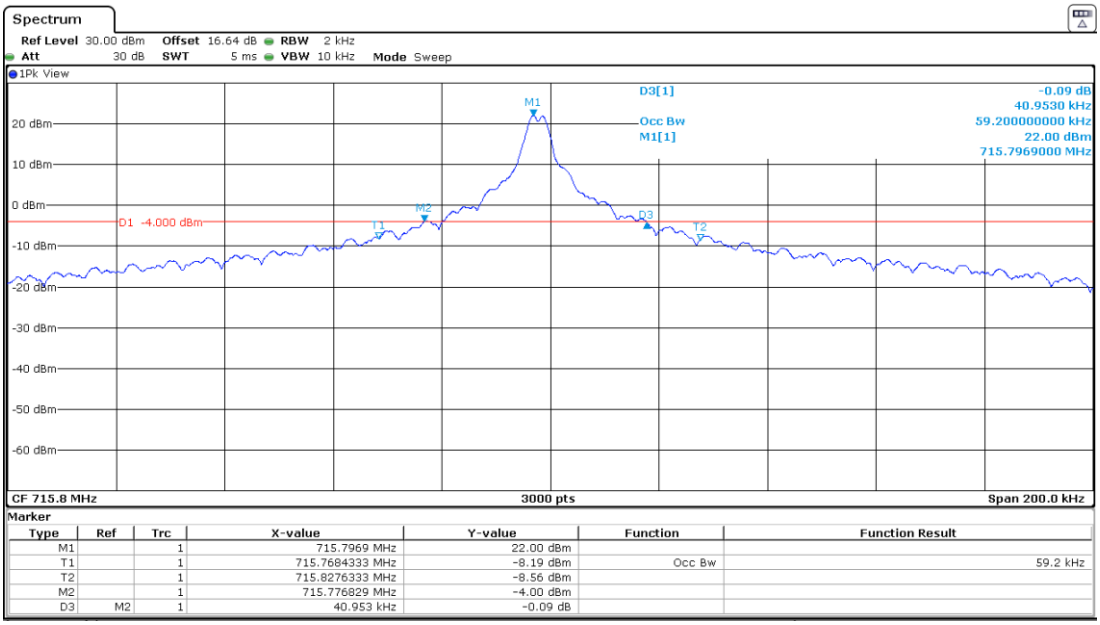
Middle Channel



Marker

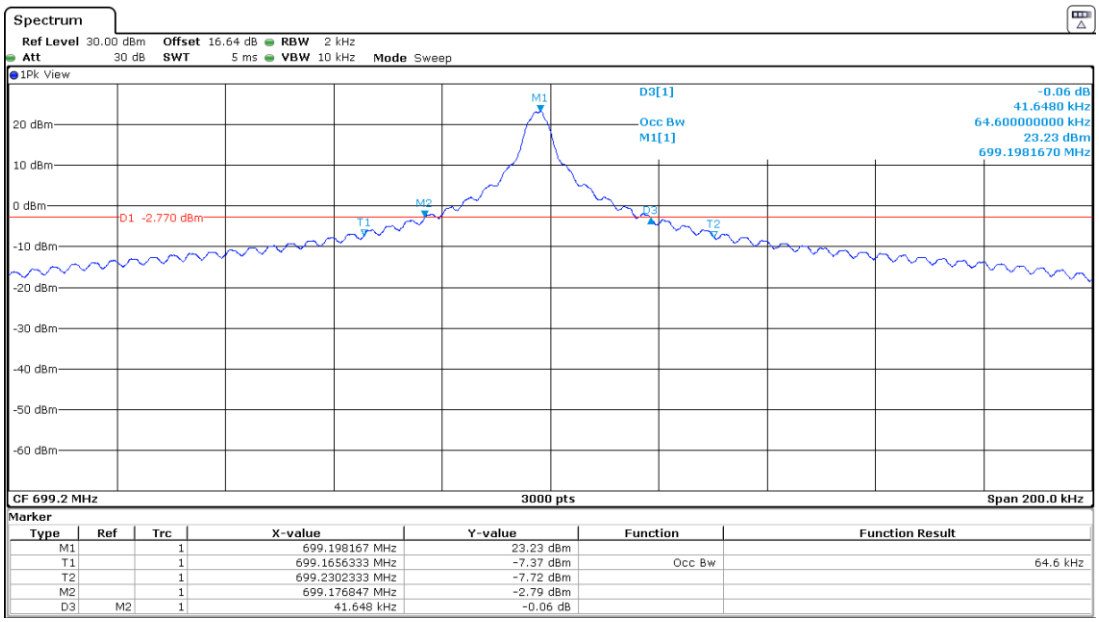
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	707.4969 MHz	22.25 dBm		
T1		1	707.4684333 MHz	-7.86 dBm	Occ Bw	59.0 kHz
T2		1	707.5274333 MHz	-8.49 dBm		
M2		1	707.476894 MHz	-3.75 dBm		
D3	M2	1	40.844 kHz	-0.04 dB		

Highest Channel

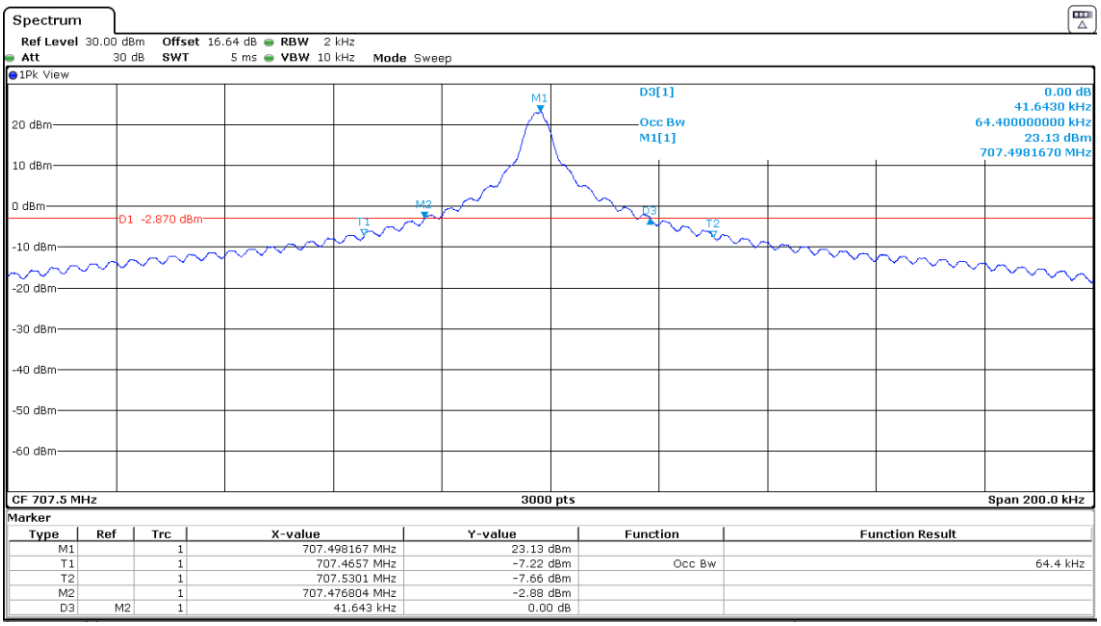


Tone 3.75 kHz. π/4 - QPSK MODULATION

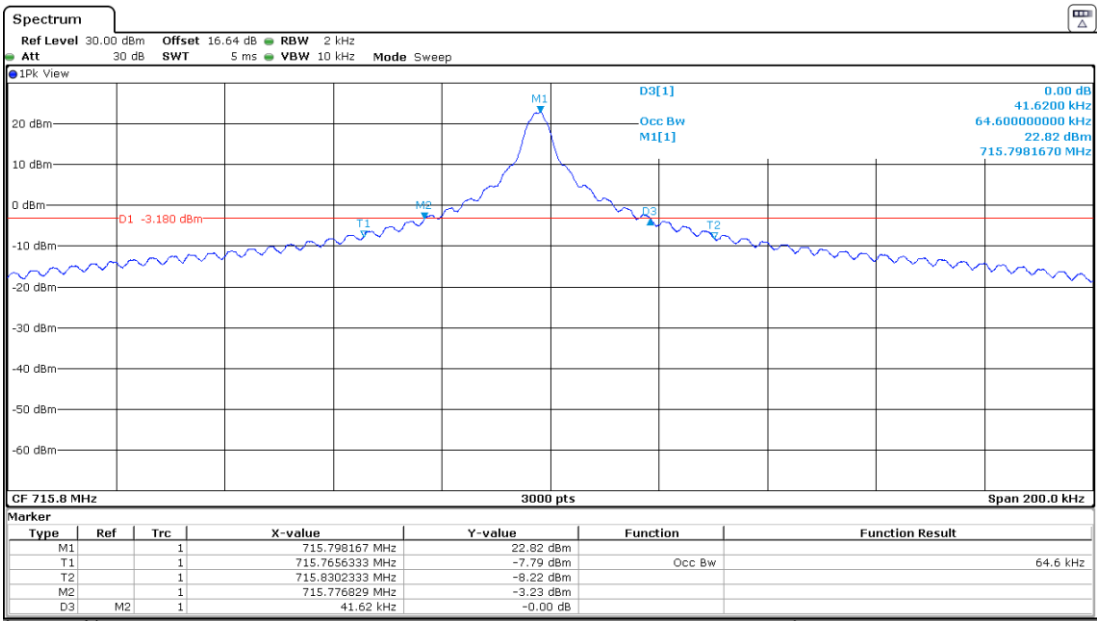
Lowest Channel



Middle Channel

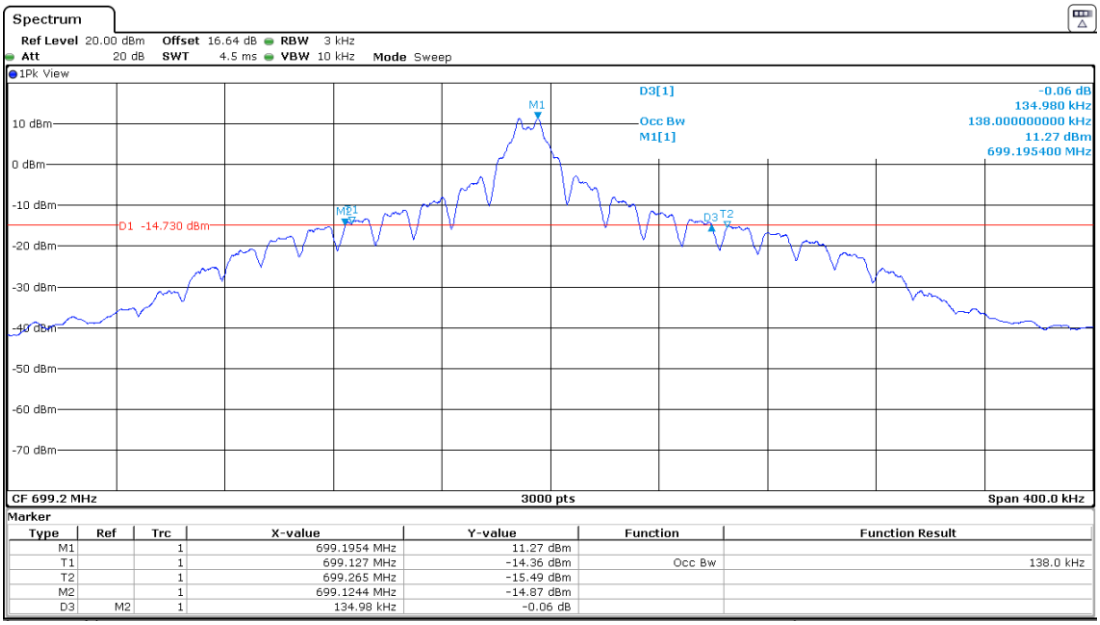


Highest Channel



Tone 15 kHz. π/2 - BPSK MODULATION

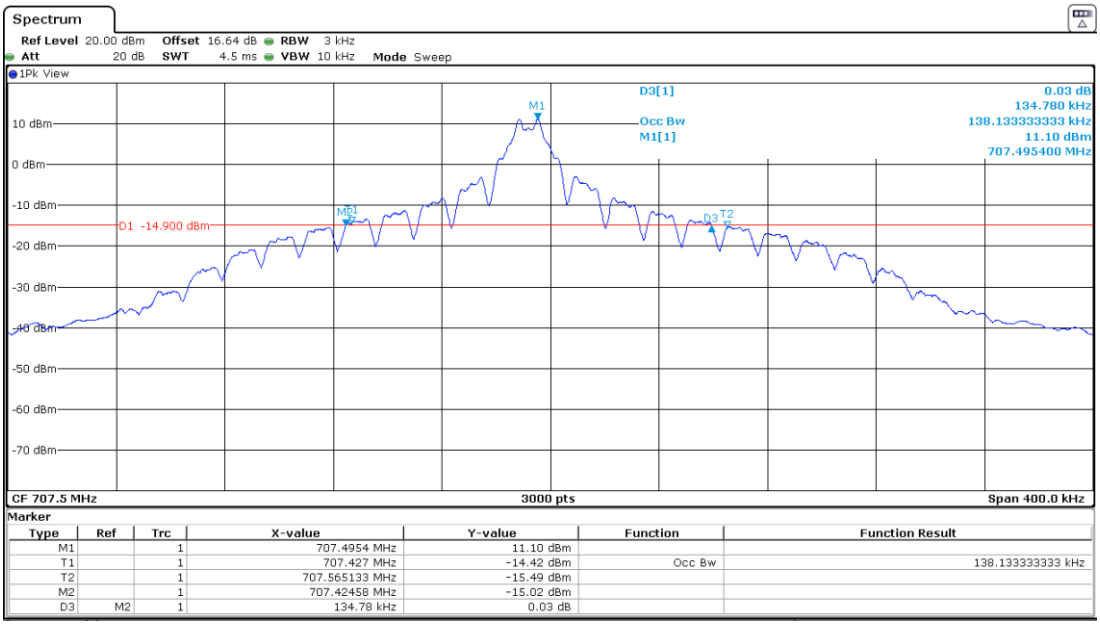
Lowest Channel



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	699.1954 MHz	11.27 dBm		
T1		1	699.127 MHz	-14.36 dBm	Occ Bw	138.0 kHz
T2		1	699.265 MHz	-15.49 dBm		
M2		1	699.1244 MHz	-14.87 dBm		
D3	M2	1	134.98 kHz	-0.06 dB		

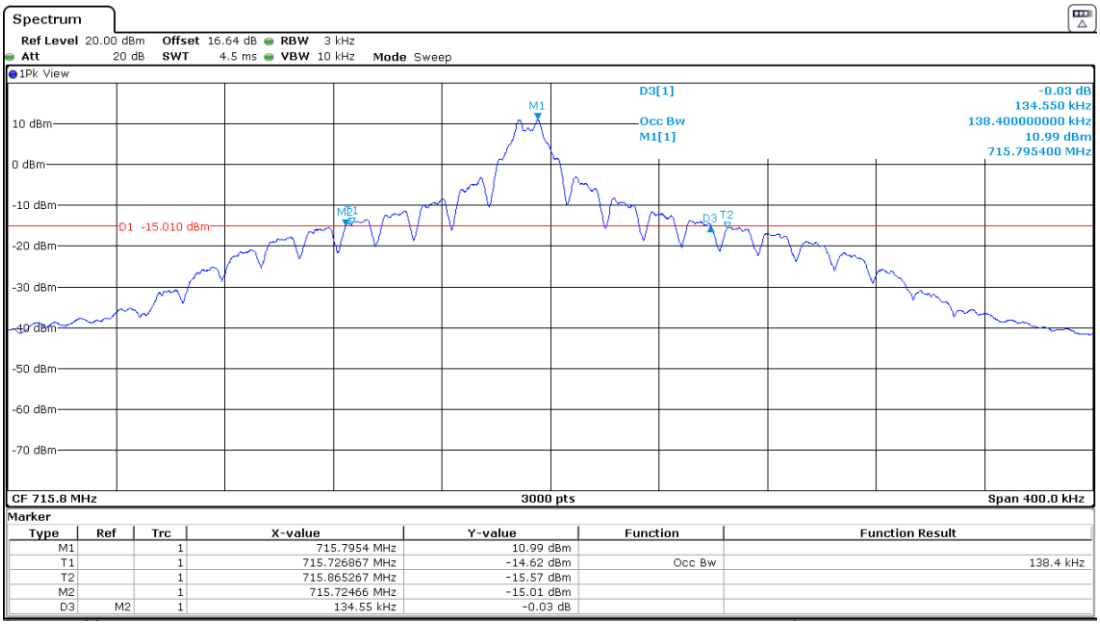
Middle Channel



Marker

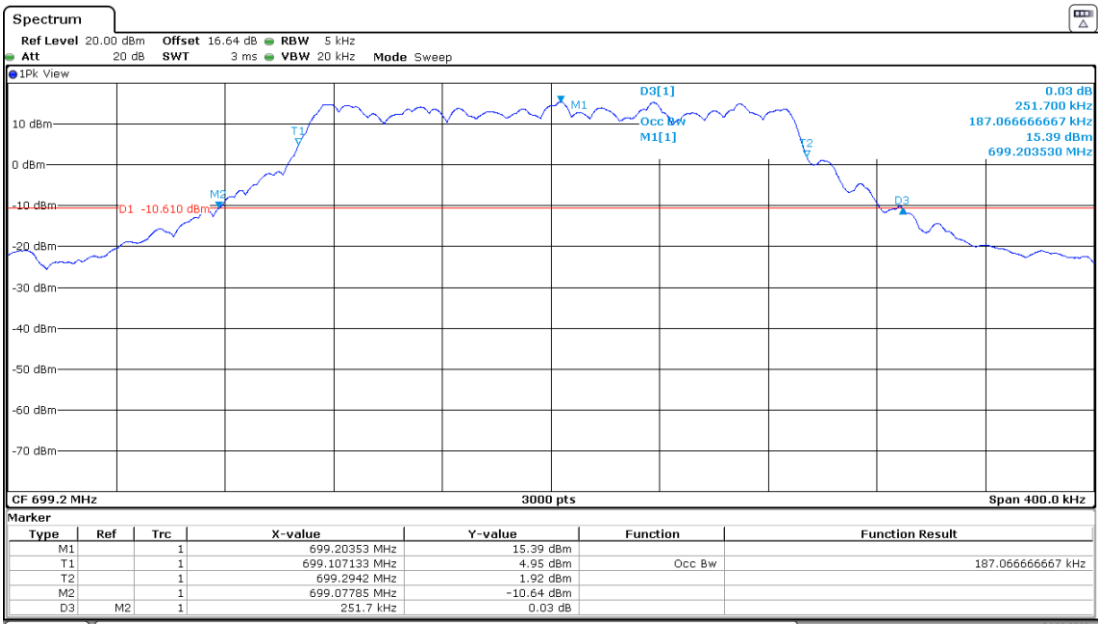
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	707.4954 MHz	11.10 dBm		
T1		1	707.427 MHz	-14.42 dBm	Occ Bw	138.133333333 kHz
T2		1	707.565133 MHz	-15.49 dBm		
M2		1	707.42458 MHz	-15.02 dBm		
D3	M2	1	134.78 kHz	0.03 dB		

Highest Channel

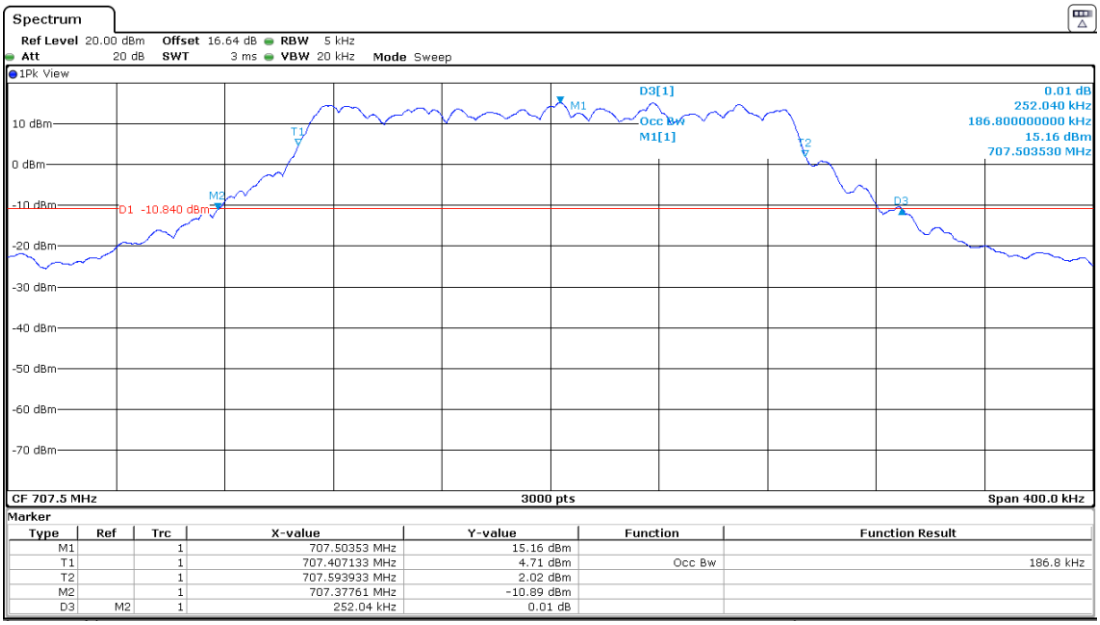


12 Tones 15 kHz. π/4 - QPSK MODULATION

Lowest Channel



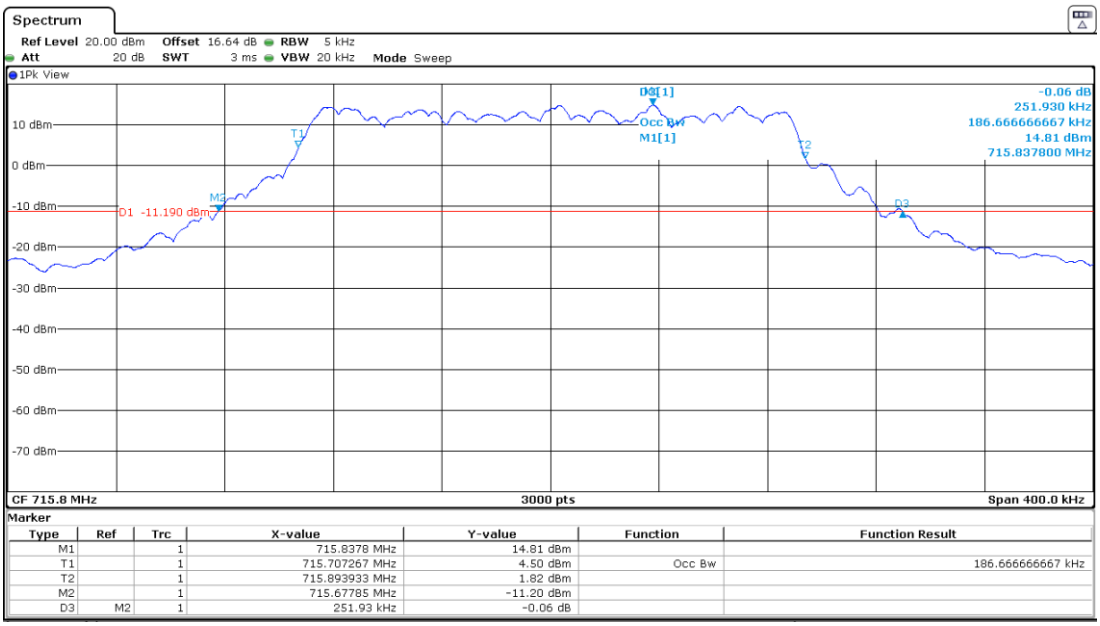
Middle Channel



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	707.50353 MHz	15.16 dBm		
T1		1	707.407133 MHz	4.71 dBm	Occ Bw	186.8 kHz
T2		1	707.593933 MHz	2.02 dBm		
M2		1	707.37761 MHz	-10.89 dBm		
D3	M2	1	252.04 kHz	0.01 dB		

Highest Channel



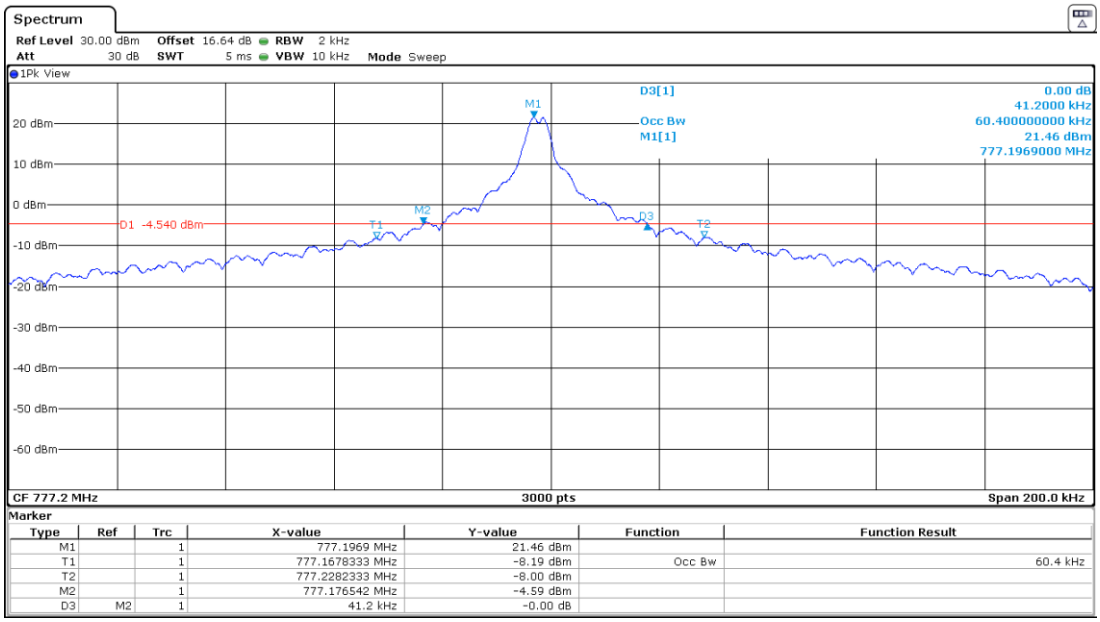
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	715.8378 MHz	14.81 dBm		
T1		1	715.707267 MHz	4.50 dBm	Occ Bw	186.666666667 kHz
T2		1	715.893933 MHz	1.82 dBm		
M2		1	715.67785 MHz	-11.20 dBm		
D3	M2	1	251.93 kHz	-0.06 dB		

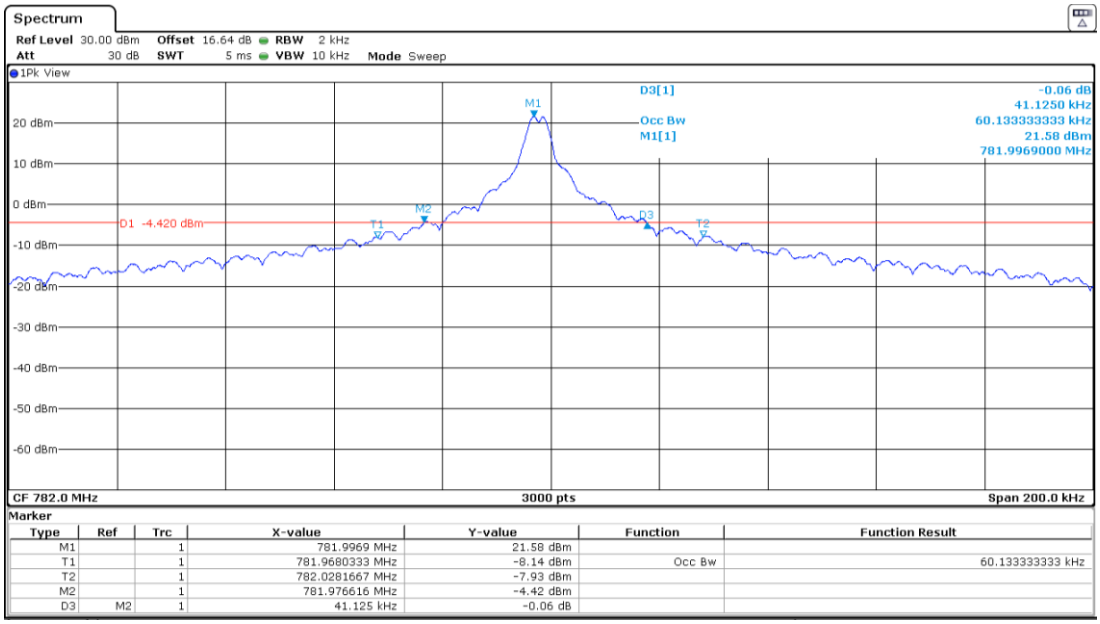
NBIoT BAND 13.

Tone 3.75 kHz. π/2 - BPSK MODULATION

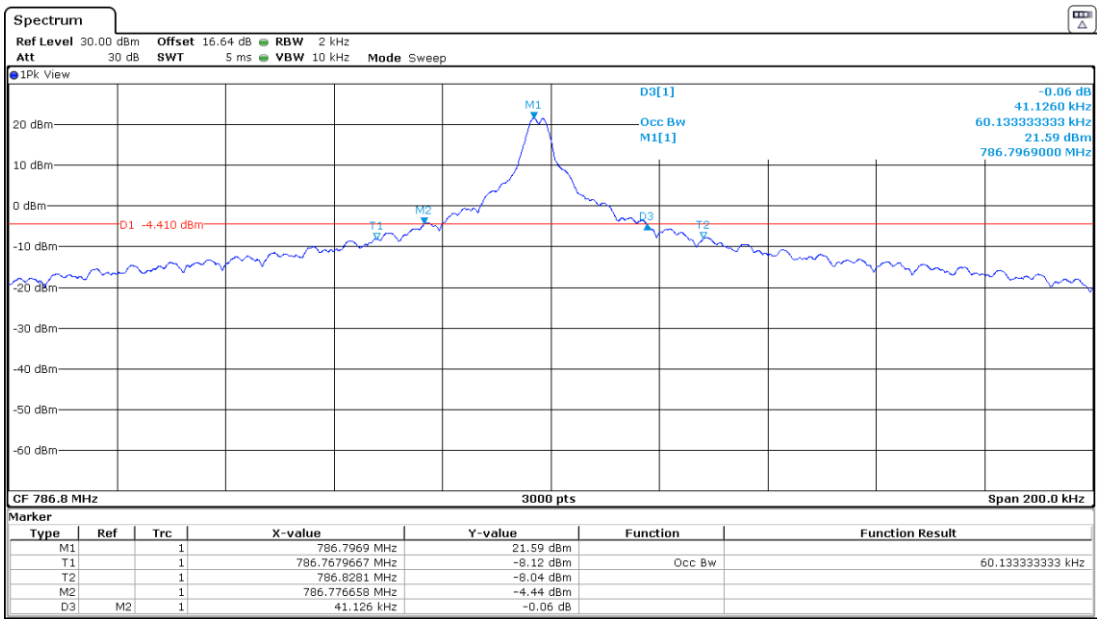
Lowest Channel



Middle Channel

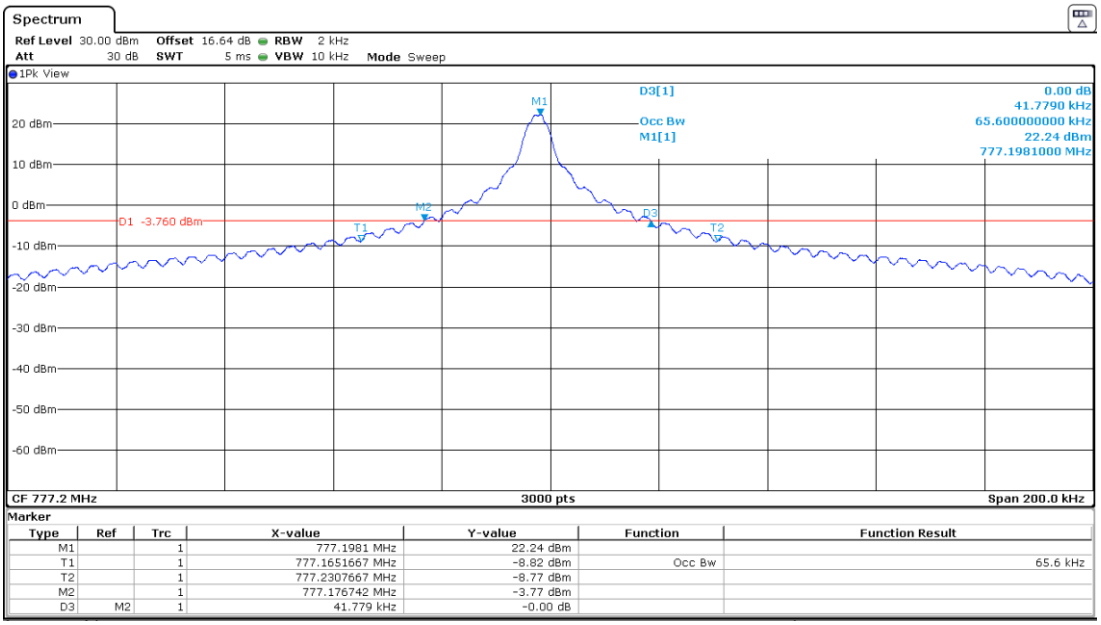


Highest Channel

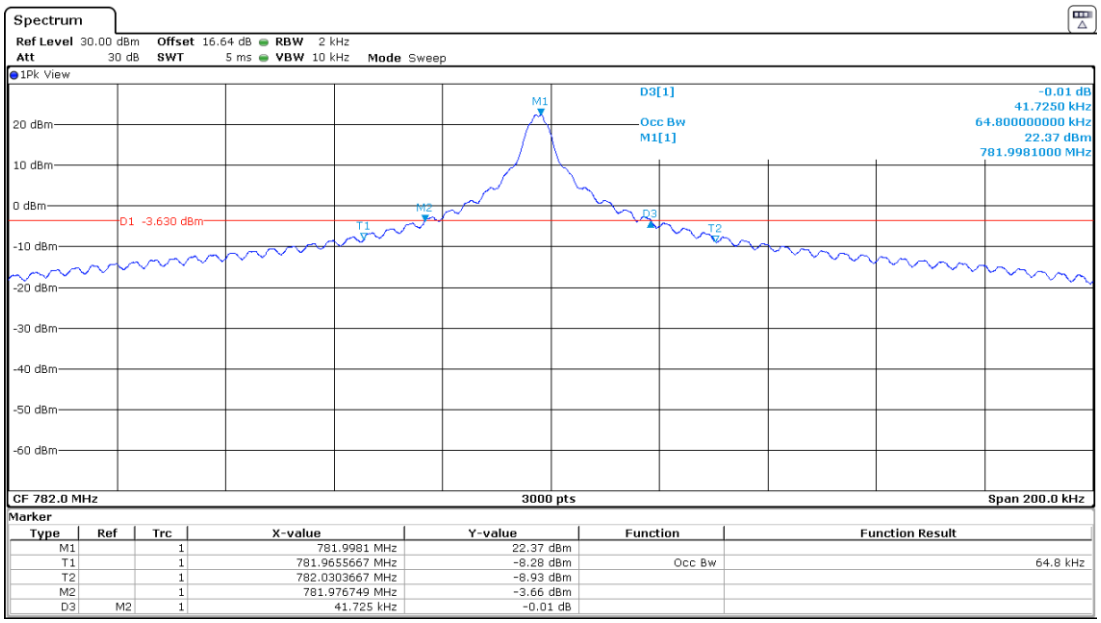


Tone 3.75 kHz. π/4 - QPSK MODULATION

Lowest Channel



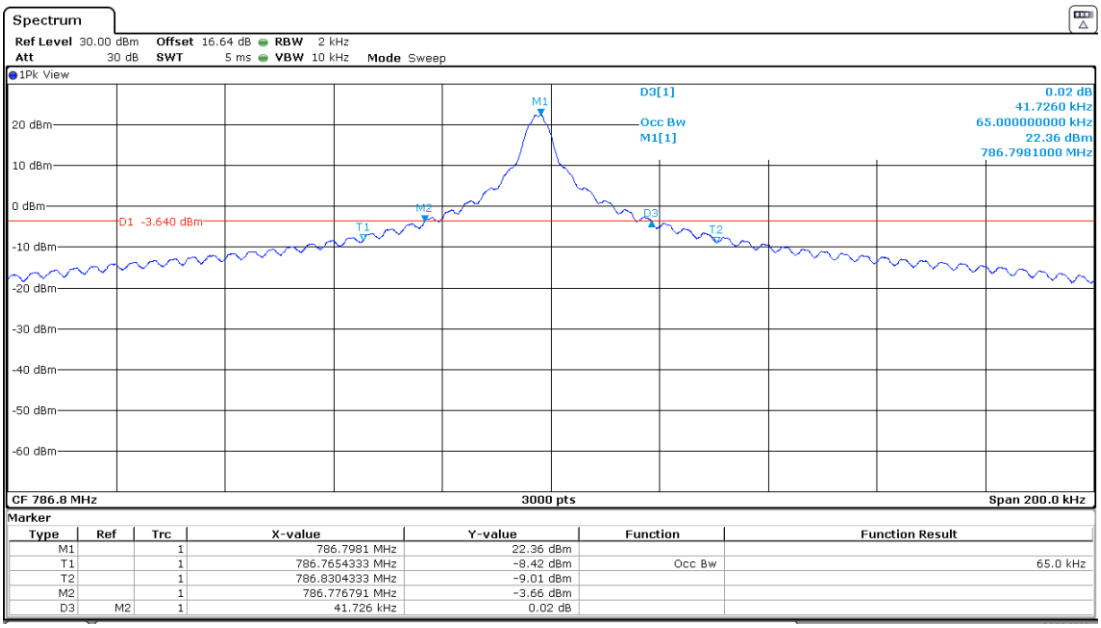
Middle Channel



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	781.9981 MHz	22.37 dBm		
T1		1	781.9655667 MHz	-8.28 dBm	Occ Bw	64.8 kHz
T2		1	782.0303667 MHz	-8.93 dBm		
M2		1	781.976749 MHz	-3.66 dBm		
D3	M2	1	41.725 kHz	-0.01 dB		

Highest Channel

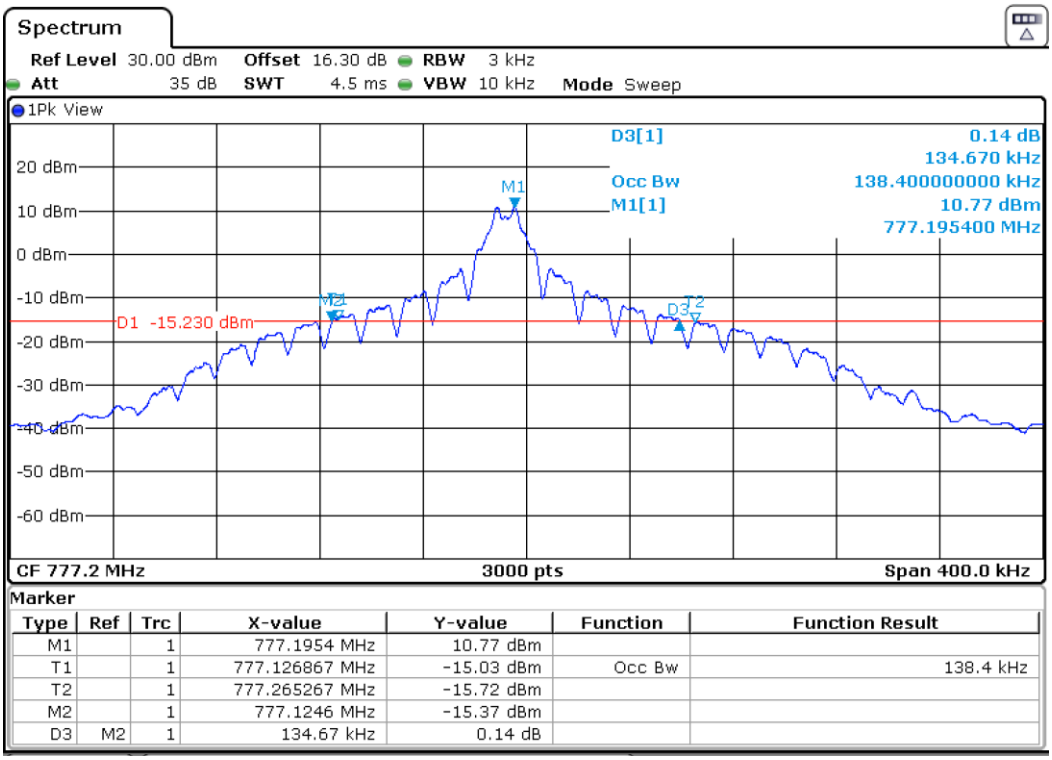


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	786.7981 MHz	22.36 dBm		
T1		1	786.7654333 MHz	-8.42 dBm	Occ Bw	65.0 kHz
T2		1	786.8304333 MHz	-9.01 dBm		
M2		1	786.776791 MHz	-3.66 dBm		
D3	M2	1	41.726 kHz	0.02 dB		

Tone 15 kHz. π/2 - BPSK MODULATION

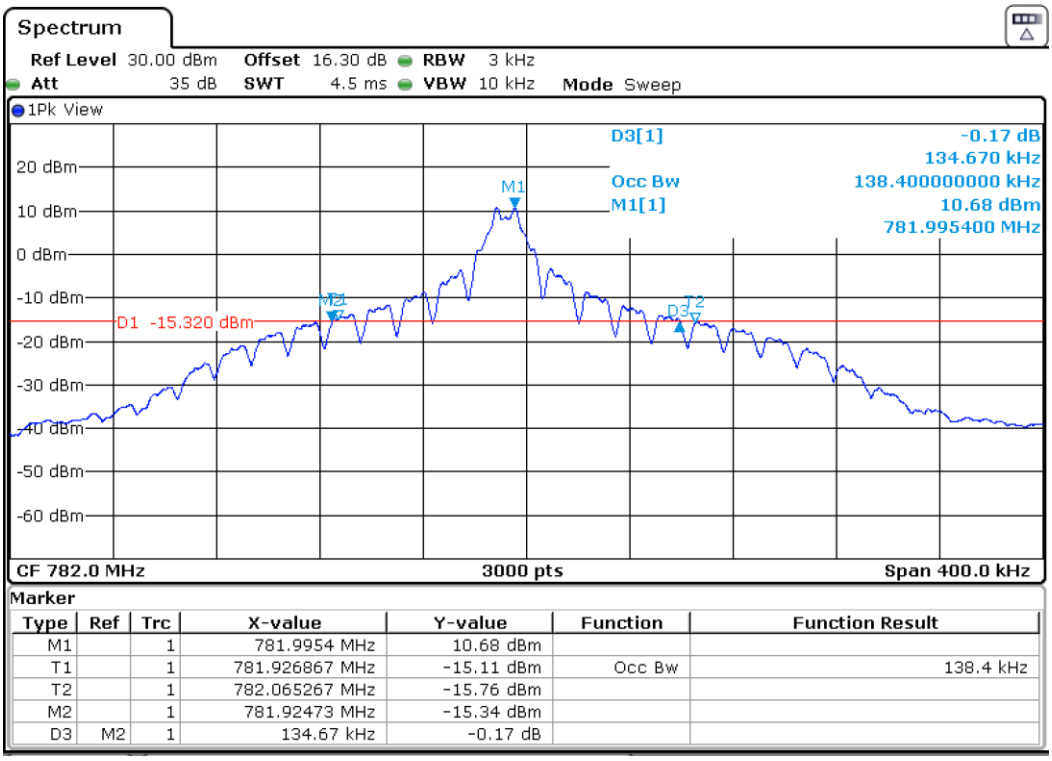
Lowest Channel



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	777.1954 MHz	10.77 dBm		
T1		1	777.126867 MHz	-15.03 dBm	Occ Bw	138.4 kHz
T2		1	777.265267 MHz	-15.72 dBm		
M2		1	777.1246 MHz	-15.37 dBm		
D3	M2	1	134.67 kHz	0.14 dB		

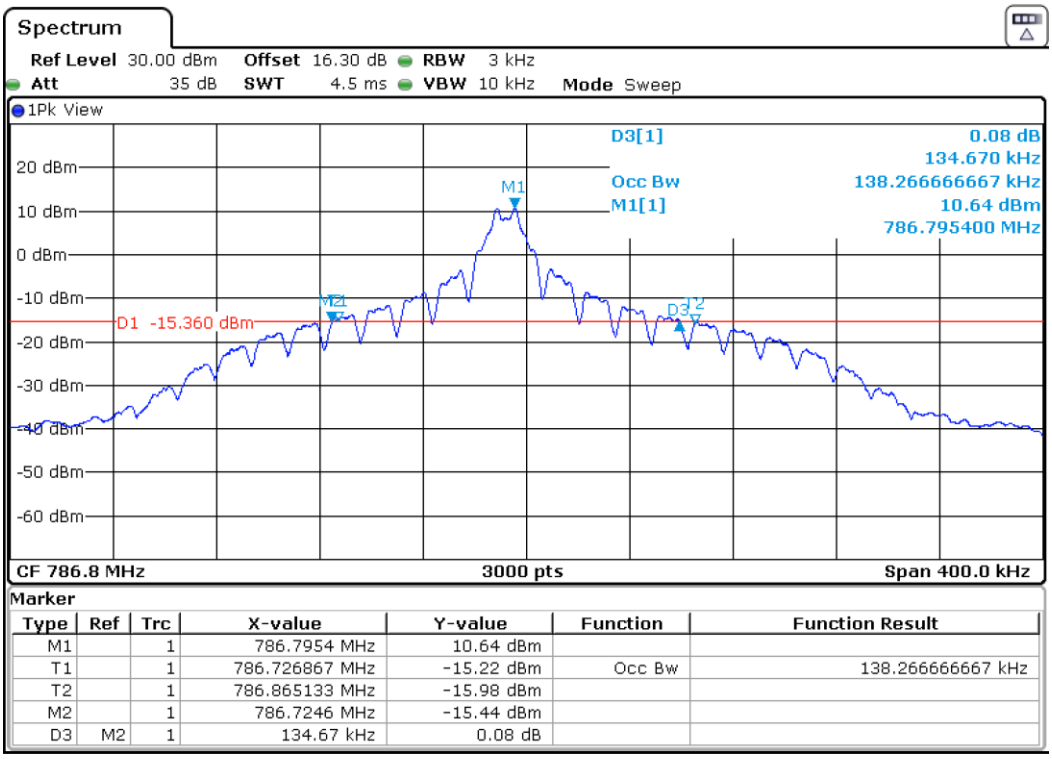
Middle Channel



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	781.9954 MHz	10.68 dBm		
T1		1	781.926867 MHz	-15.11 dBm	Occ Bw	138.4 kHz
T2		1	782.065267 MHz	-15.76 dBm		
M2		1	781.92473 MHz	-15.34 dBm		
D3	M2	1	134.67 kHz	-0.17 dB		

Highest Channel

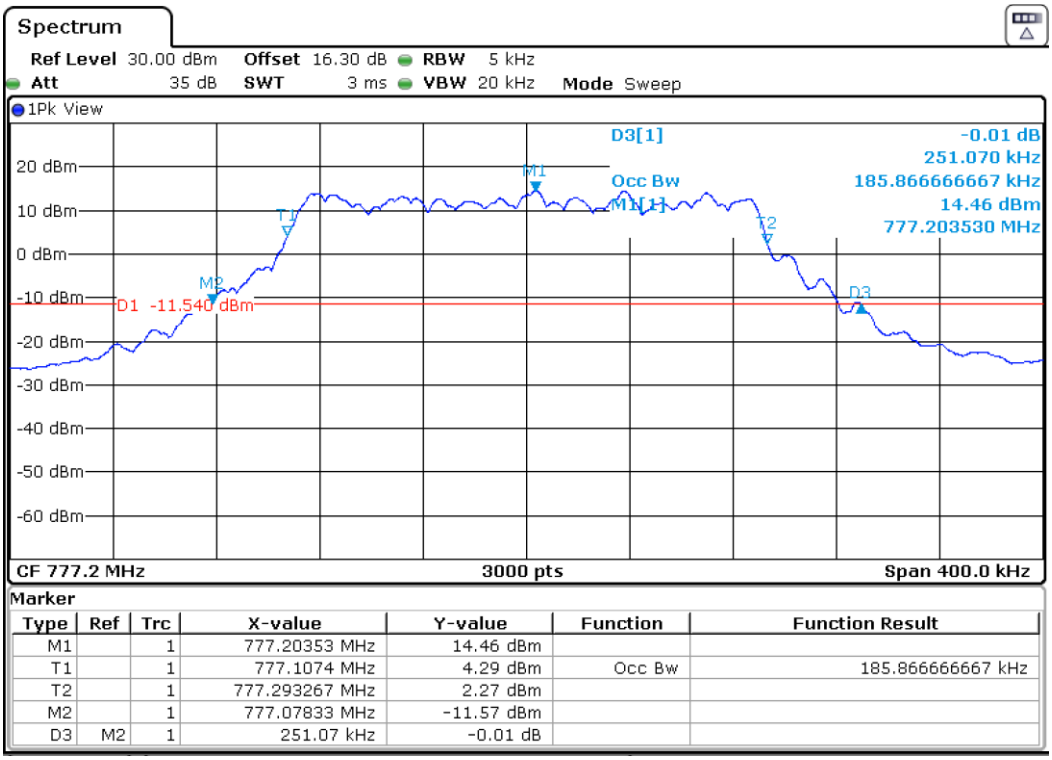


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	786.7954 MHz	10.64 dBm		
T1		1	786.726867 MHz	-15.22 dBm	Occ Bw	138.266666667 kHz
T2		1	786.865133 MHz	-15.98 dBm		
M2		1	786.7246 MHz	-15.44 dBm		
D3	M2	1	134.67 kHz	0.08 dB		

12 Tones 15 kHz. π/4 - QPSK MODULATION

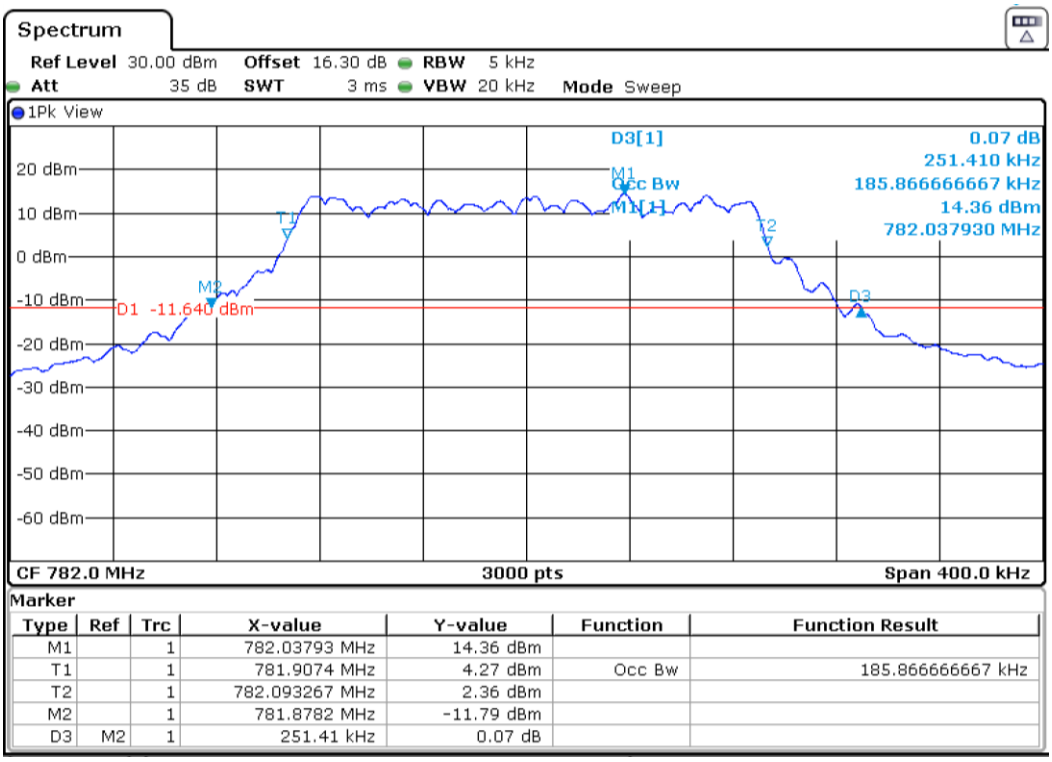
Lowest Channel



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	777.20353 MHz	14.46 dBm		
T1		1	777.1074 MHz	4.29 dBm	Occ Bw	185.866666667 kHz
T2		1	777.293267 MHz	2.27 dBm		
M2		1	777.07833 MHz	-11.57 dBm		
D3	M2	1	251.07 kHz	-0.01 dB		

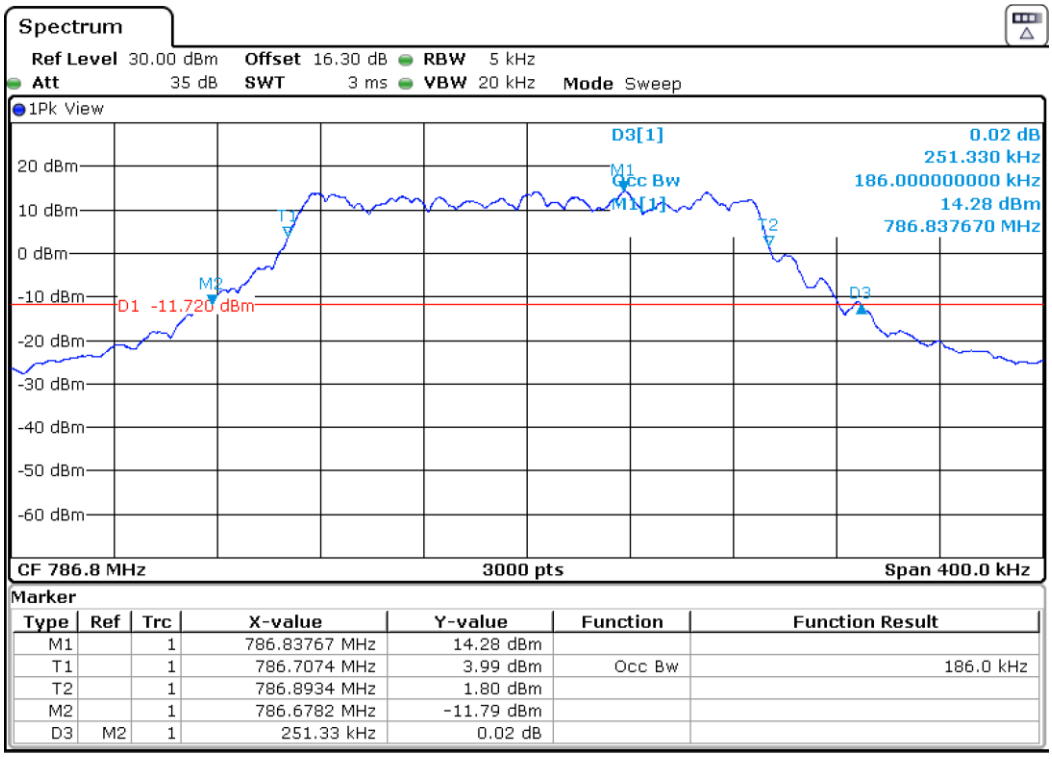
Middle Channel



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	782.03793 MHz	14.36 dBm		
T1		1	781.9074 MHz	4.27 dBm	Occ Bw	185.866666667 kHz
T2		1	782.093267 MHz	2.36 dBm		
M2		1	781.8782 MHz	-11.79 dBm		
D3	M2	1	251.41 kHz	0.07 dB		

Highest Channel



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	786.83767 MHz	14.28 dBm		
T1		1	786.7074 MHz	3.99 dBm	Occ Bw	186.0 kHz
T2		1	786.8934 MHz	1.80 dBm		
M2		1	786.6782 MHz	-11.79 dBm		
D3	M2	1	251.33 kHz	0.02 dB		

Spurious emissions at antenna terminals

SPECIFICATION

FCC §27.53 (g).

For operations in the 600 MHz band and the 698-746 MHz band. the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation. measured in watts. by at least 43 + 10 log (P) dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However. in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block. a resolution bandwidth of at least 30 kHz may be employed

FCC §27.53 (c).
On any frequency outside the 776-788 MHz band. the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB.

On all frequencies between 763-775 MHz and 793-805 MHz. by a factor not less than 65 + 10 log (P) dB in a 6.25 kHz band segment. for mobile and portable stations.

RSS-130 Clause 4.6.
The power of any unwanted emissions in any 100 kHz bandwidth on any frequency outside the frequency range(s) within which the equipment is designed to operate shall be attenuated below the transmitter power. P (dBW). by at least 43 + 10 log10 p (watts). dB.

The power of any unwanted emissions in any 6.25 kHz bandwidth for all frequencies between 763-775 MHz and 793-806 MHz shall be attenuated below the transmitter power. P (dBW). by at least 65 + 10 log10 p(watts). dB. for mobile and portable equipment.

At Po transmitting power. the specified minimum attenuation becomes 43+10 log (Po). and the level in dBm relative Po becomes:
Po (dBm) – [43 + 10 log (Po in mwatts) - 30] = -13 dBm.
At Po transmitting power. the specified minimum attenuation becomes 65+10 log (Po). and the level in dBm relative Po becomes:
Po (dBm) – [65 + 10 log (Po in mwatts) - 30] = -35 dBm.

METHOD

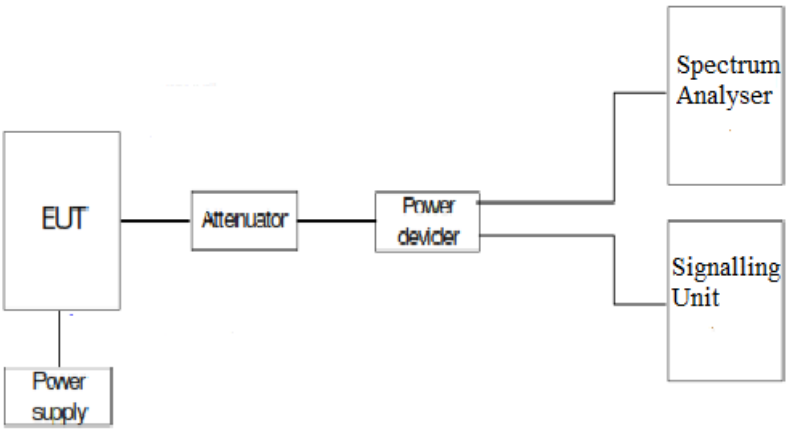
The EUT RF output connector was connected to a spectrum analyser and to the Universal Radio Communication tester R&S CMW500 (selecting maximum transmission power of the EUT and different modes of modulation) using a 50 ohm attenuator and a power divider.

The spectrum was investigated from 9 kHz to 8 GHz for NBIoT Band 12 and 13.

The reading of the spectrum analyser is corrected with the attenuation loss of connection between output terminal of EUT and input of the spectrum analyser.

The configuration of tones and modulation which is the worst case for conducted power was used.

TEST SETUP



RESULTS (see plots in next pages)

NBIoT Band 12

1. CHANNEL: LOWEST
No spurious signals were found at less than 20dB respect to the limit in all the range.

2. CHANNEL: MIDDLE
No spurious signals were found at less than 20dB respect to the limit in all the range.

3. CHANNEL: HIGHEST
No spurious signals were found at less than 20dB respect to the limit in all the range.

NBIoT Band 13

1. CHANNEL: LOWEST

Frequency (MHz)	Level (dBm)	Limit (dBm)
774.80	-49.46	-35
796.40	-47.27	-35

2. CHANNEL: MIDDLE

Frequency (MHz)	Level (dBm)	Limit (dBm)
801.20	-48.85	-35

3. CHANNEL: HIGHEST

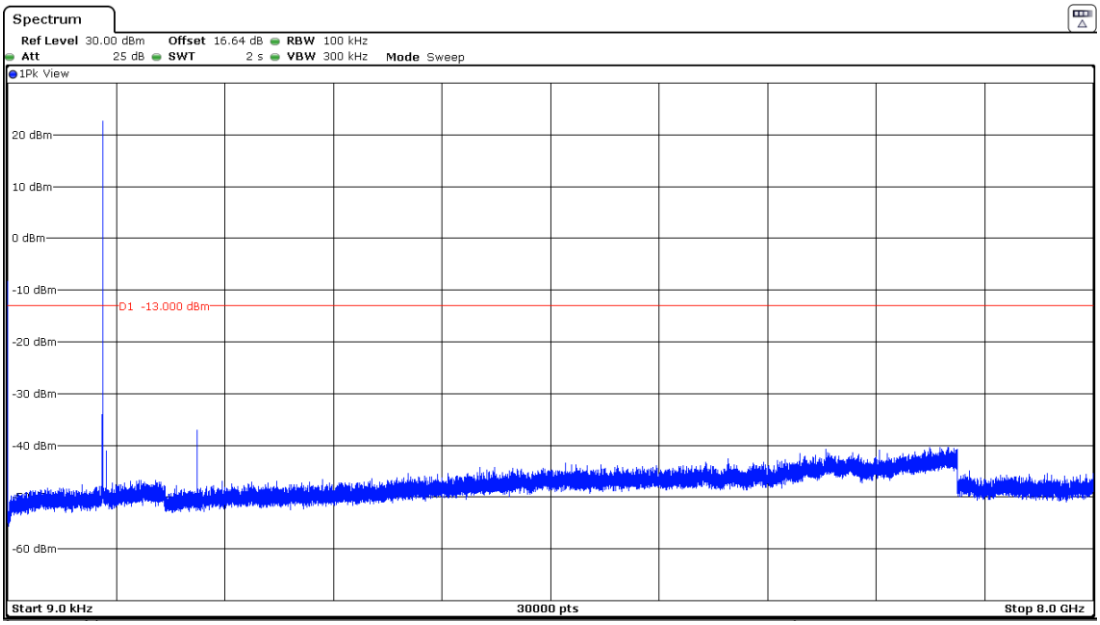
Frequency (MHz)	Level (dBm)	Limit (dBm)
767.60	-45.84	-35

Verdict: PASS

NBIoT Band 12

1. CHANNEL: LOWEST

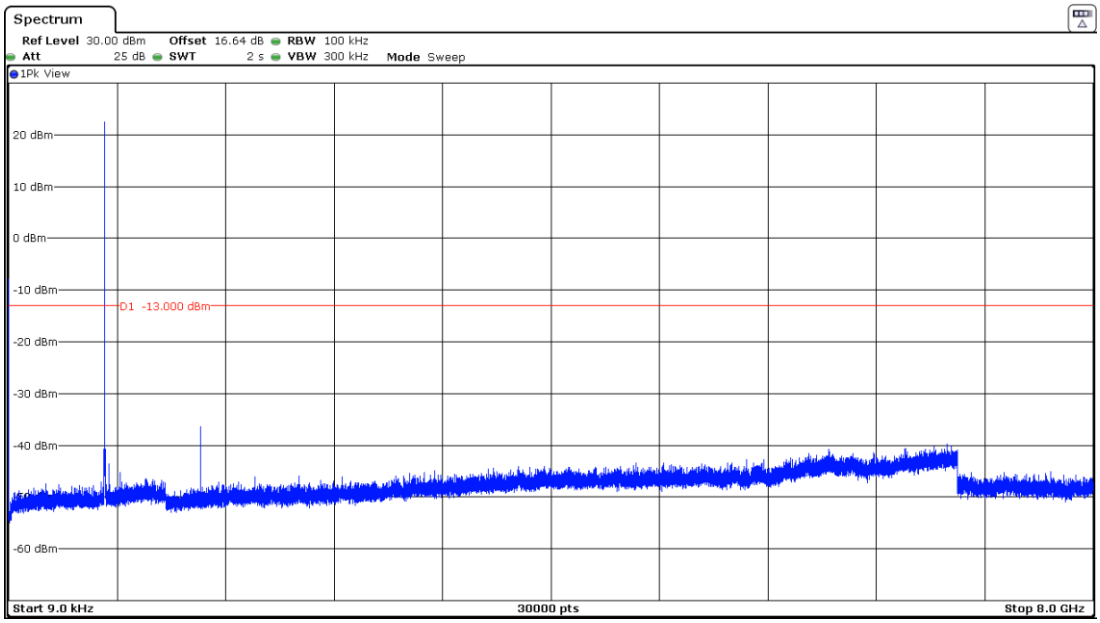
Frequency Range 9 kHz – 8 GHz



Note: The peak above the limit is the carrier frequency.

2. CHANNEL: MIDDLE

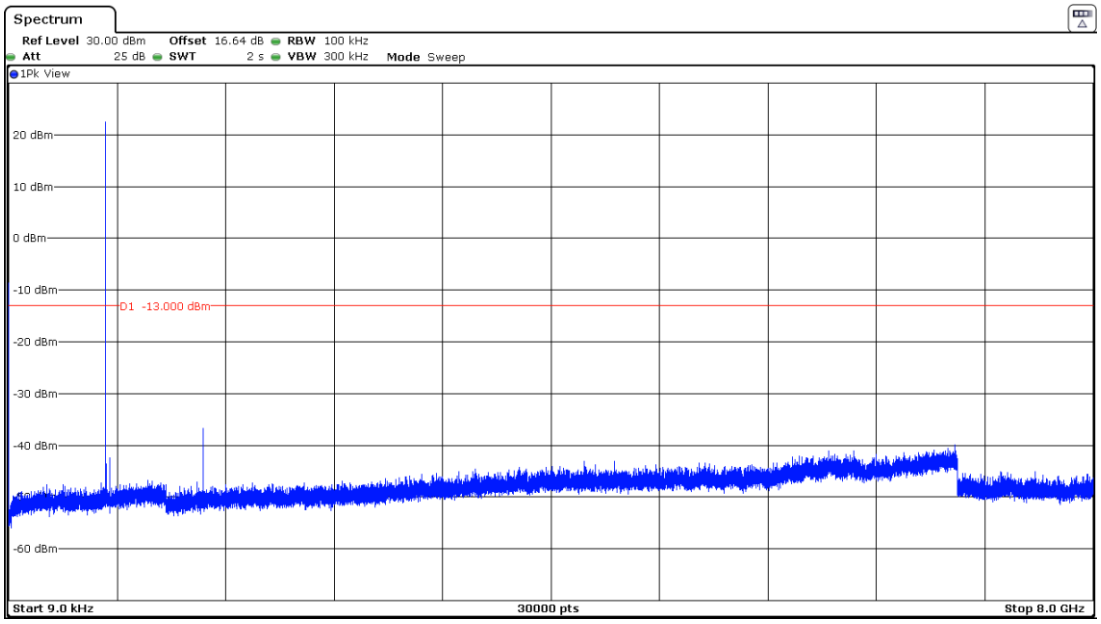
Frequency Range 9 kHz – 8 GHz



Note: The peak above the limit is the carrier frequency.

3. CHANNEL: HIGHEST

Frequency Range 9 kHz – 8 GHz

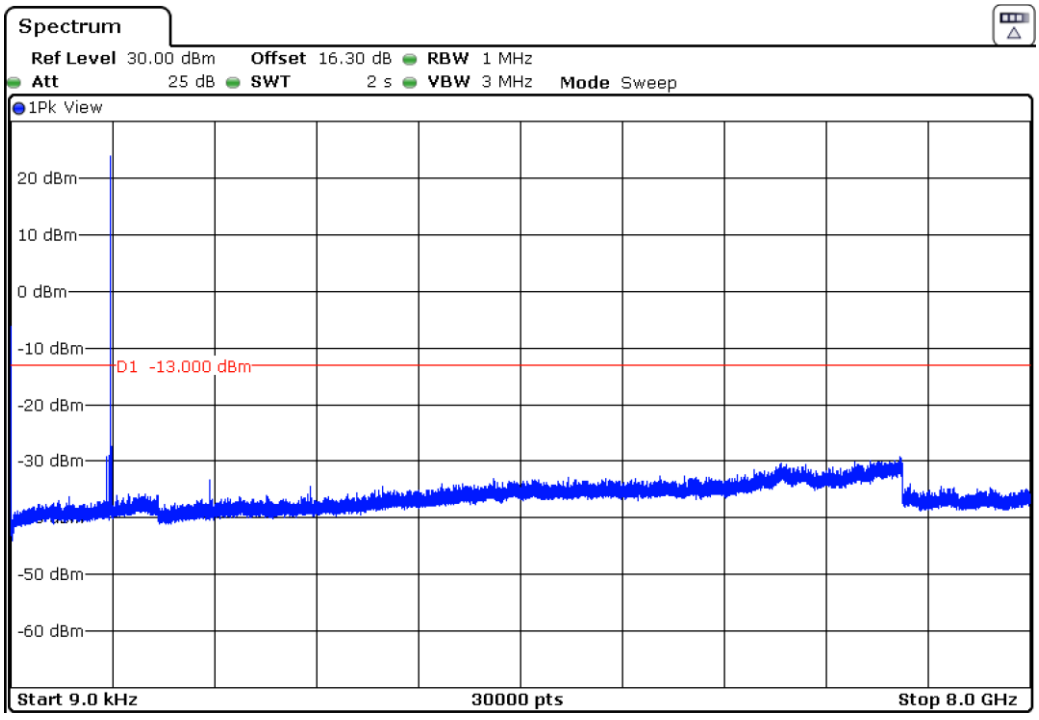


Note: The peak above the limit is the carrier frequency.

NBIoT Band 13

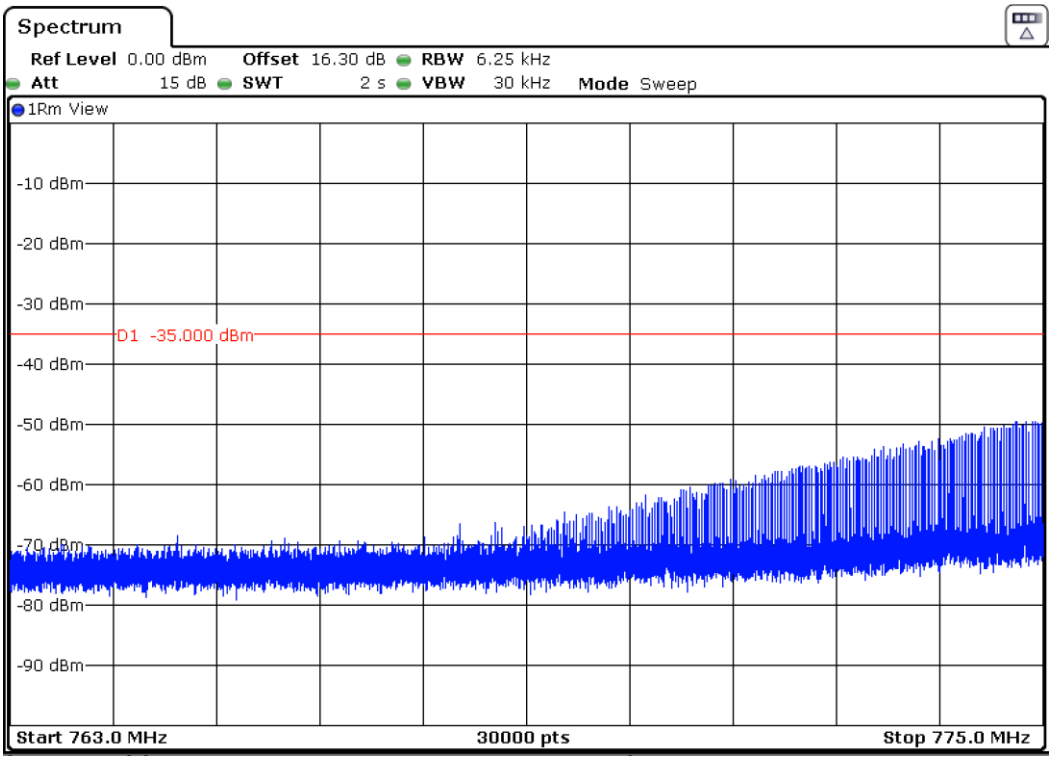
1. CHANNEL: LOWEST

Frequency Range 9 kHz – 8 GHz

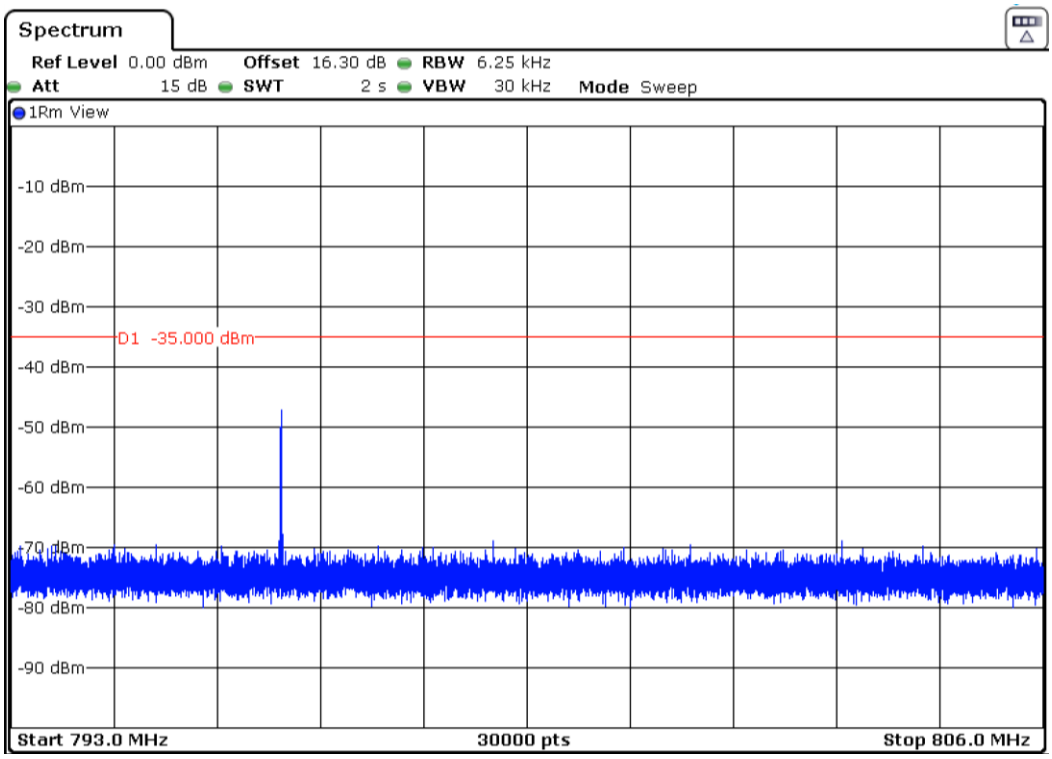


Note: The peak above the limit is the carrier frequency.

Frequency Range 763 MHz - 775 MHz

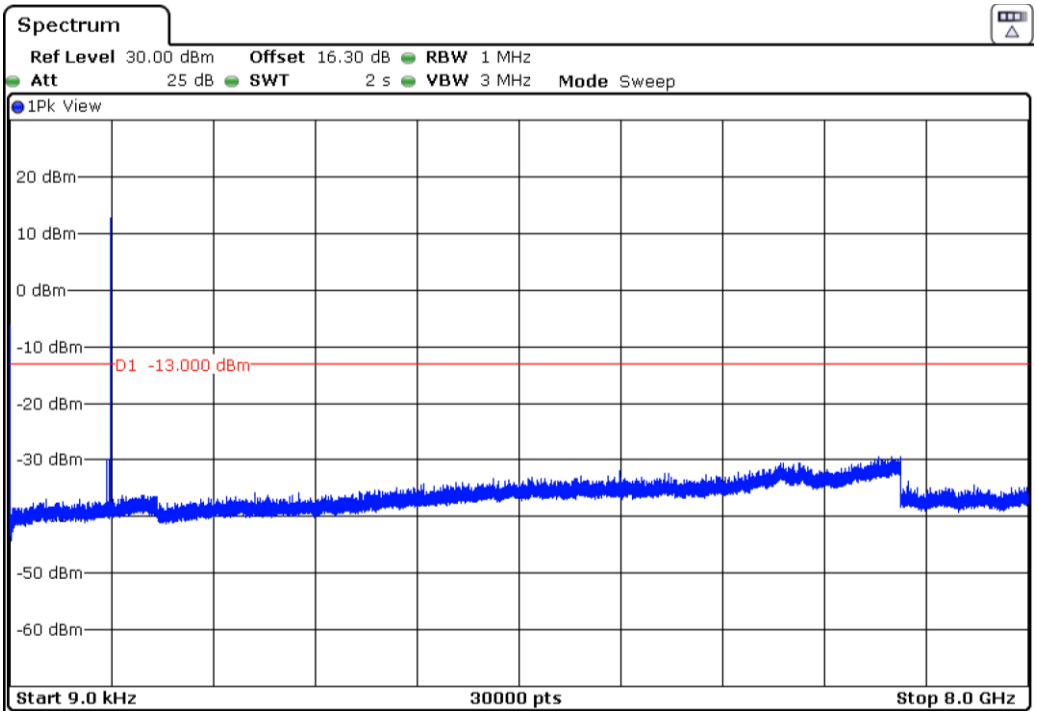


Frequency Range 793 MHz - 806 MHz



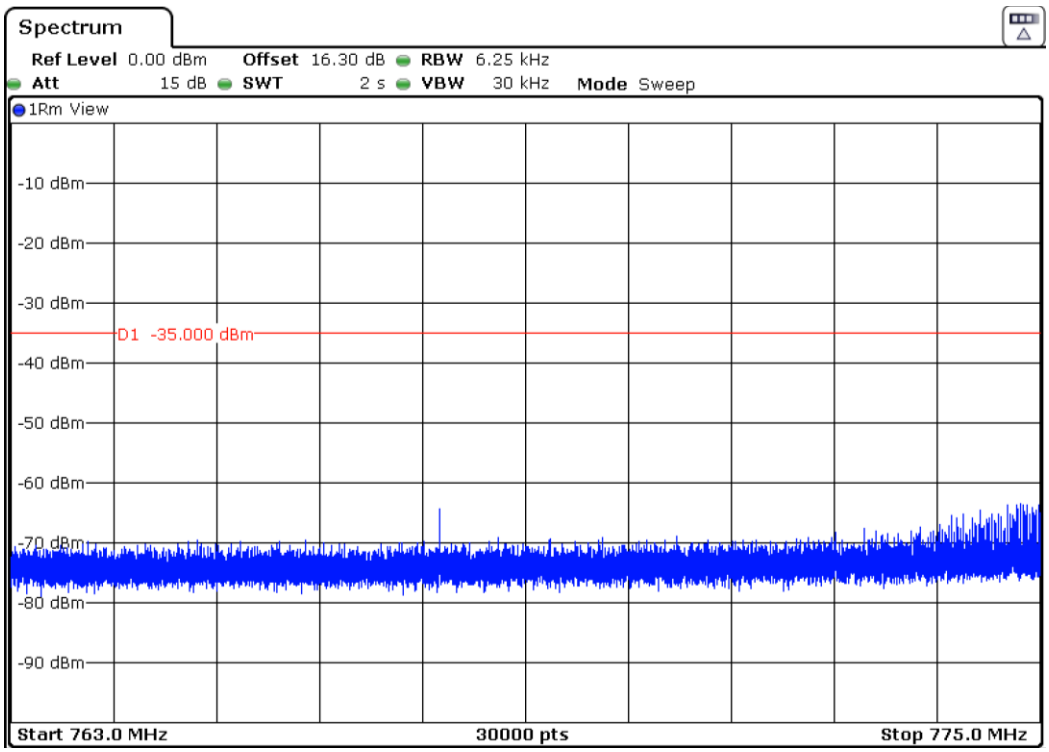
2. CHANNEL: MIDDLE

Frequency Range 9 kHz – 8 GHz

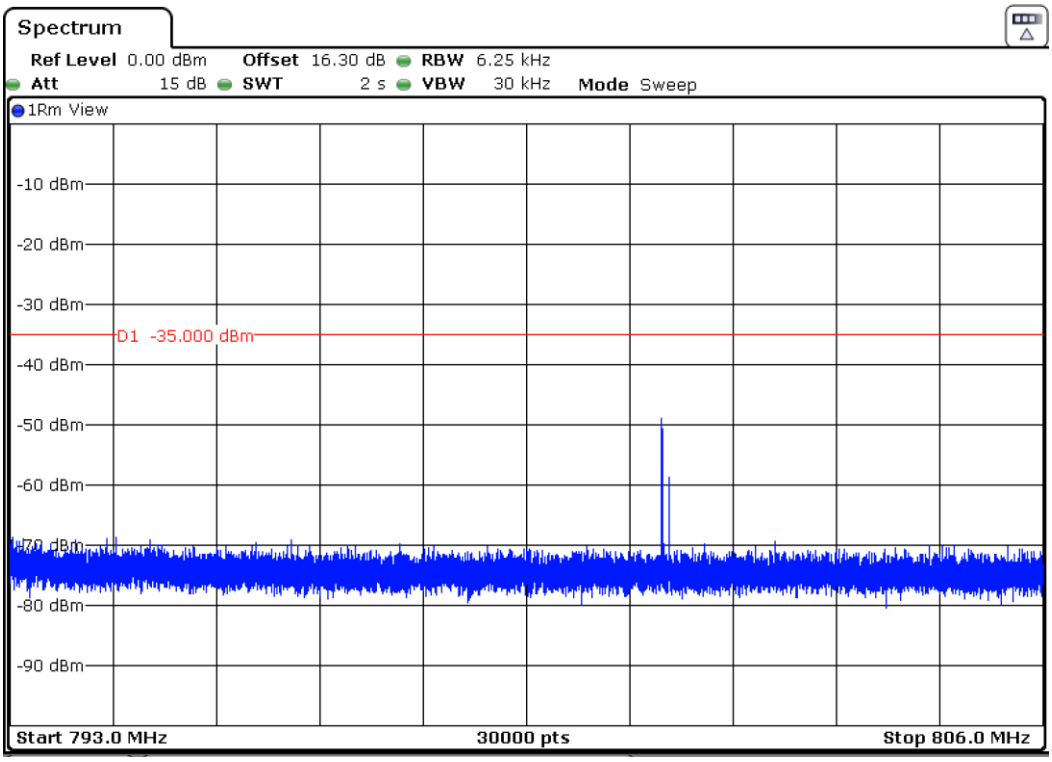


Note: The peak above the limit is the carrier frequency.

Frequency Range 763 MHz - 775 MHz

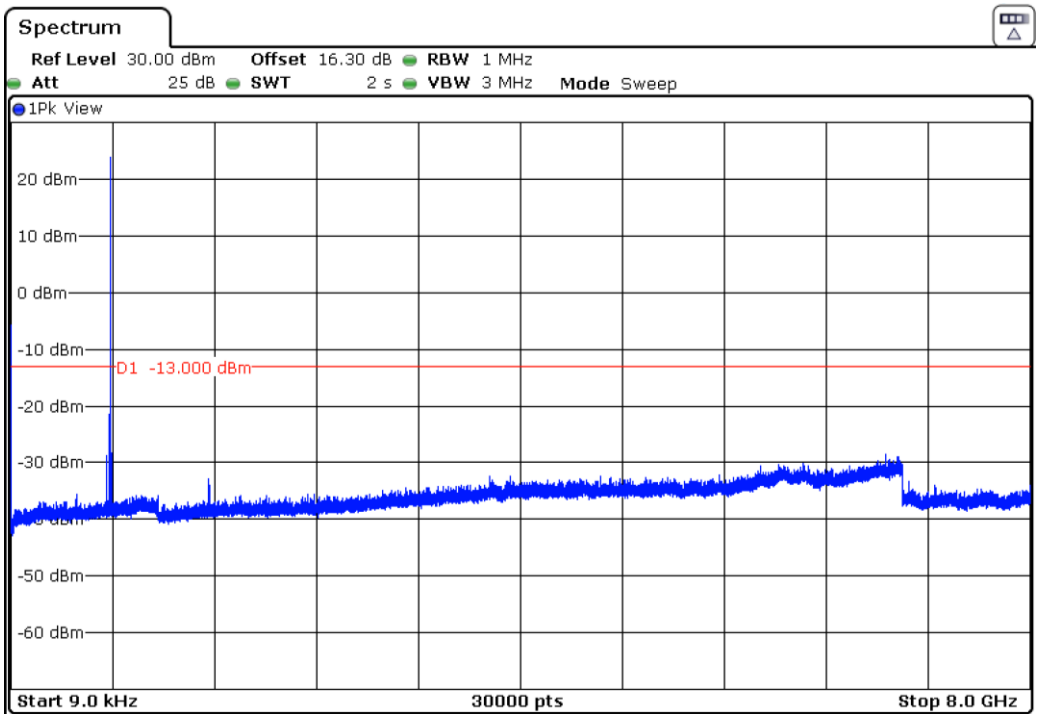


Frequency Range 793 MHz - 806 MHz



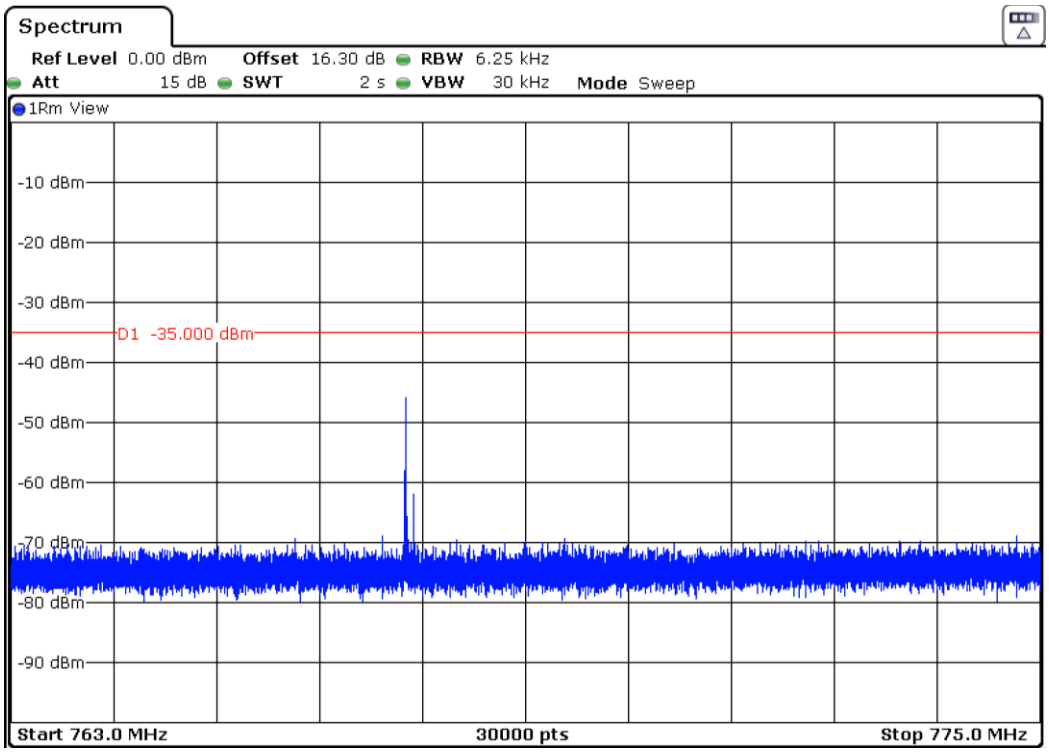
3. CHANNEL: HIGHEST

Frequency Range 9 kHz – 8 GHz

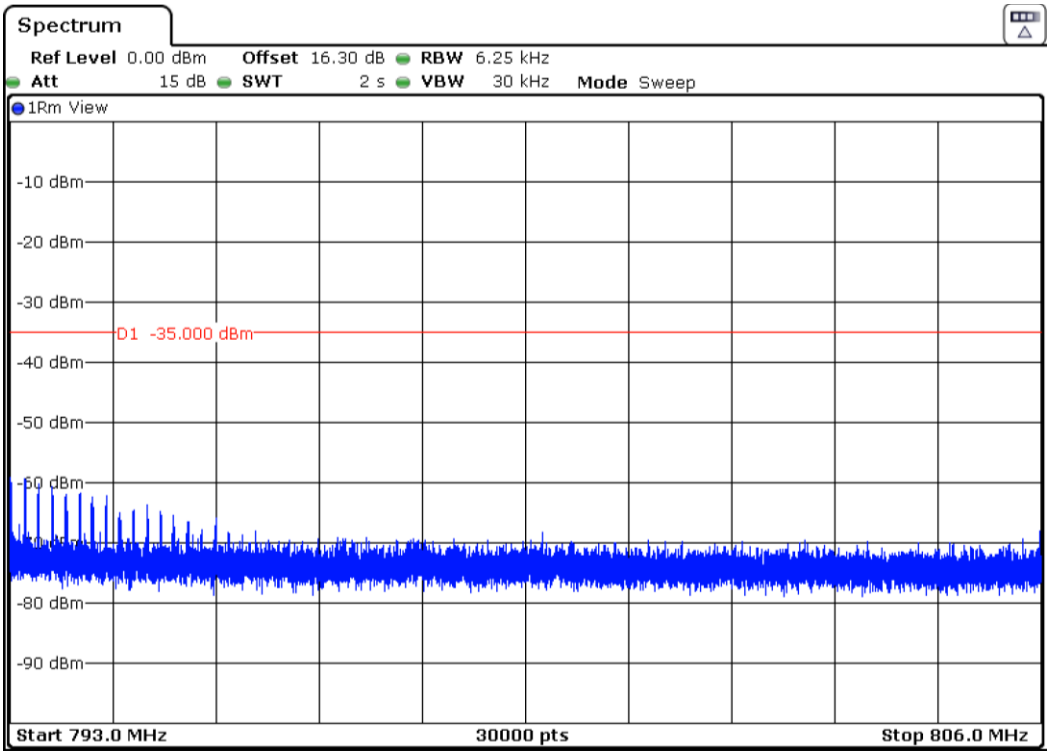


Note: The peak above the limit is the carrier frequency.

Frequency Range 763 MHz - 775 MHz



Frequency Range 793 MHz - 806 MHz



Spurious emissions at antenna terminals at Block Edges

SPECIFICATION

FCC §27.53 (c) & (g). RSS-130 Clause 4.6.

According to specification. the power of emissions shall be attenuated below the transmitter power (P) by a factor of at least 43 + 10 log (P) dB. P in watts.

At Po transmitting power. the specified minimum attenuation becomes 43+10log (Po). and the level in dBm relative Po becomes:
Po (dBm) – [43 + 10 log (Po in mwatts) - 30] = -13 dBm

METHOD

The EUT RF output connector was connected to a spectrum analyser and to the Universal Radio Communication tester R&S CMW500 (selecting maximum transmission power of the EUT and different modes of modulation) using a 50 ohm attenuator and a power splitter.

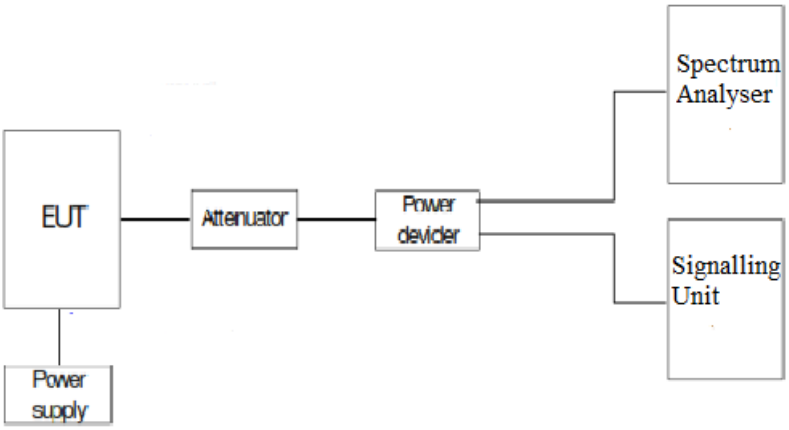
The reading of the spectrum analyser is corrected with the attenuation loss of connection between output terminal of EUT and input of the spectrum analyser.

The configuration of modulation which is the worst case for conducted power was used.

For NBIoT Band12. as indicated in FCC part 27.53 (g) /RSS-130 Clause 4.6., in the 100 kHz bands immediately outside and adjacent to the licensee's frequency block or band. a resolution bandwidth of 30 kHz may be employed.

For NBIoT Band 13. as indicated in FCC part 27.53 (c) (5) /RSS-130 Clause 4.6., in the 100 kHz bands immediately outside and adjacent to the licensee's frequency block or band. a resolution bandwidth of 30 kHz may be employed.

TEST SETUP



RESULTS (see plots in next pages)

NBIoT BAND 12.

The results in the next tables shows the results for the worst measured configuration:

(Channel 23011.Band 12):	3 Tones 15 kHz. Offset=9. π/4 - QPSK
Maximum measured level at lowest Block Edge at antenna port (dBm)	-32.86

(Channel 23179. Band 12):	1 Tone 3.75 kHz. Offset=0. π/2 - BPSK
Maximum measured level at highest Block Edge at antenna port (dBm)	-14.92

(Channel 23012. Band 12):	Tone= 15 kHz. Offset=0. π/2 - BPSK
Maximum measured level at lowest Block Edge at antenna port (dBm)	-39.40

(Channel 23178. Band 12):	1 Tone 3.75 kHz. Offset=47. π/2 - BPSK
Maximum measured level at highest Block Edge at antenna port (dBm)	-21.56

NBIoT. BAND 13.

The results in the next tables shows the results for the worst measured configuration:

(Channel 23181.Band 13):	3 Tones 15 kHz. Offset=9. π/4 - QPSK
Maximum measured level at lowest Block Edge at antenna port (dBm)	-15.21

(Channel 23279. Band 13):	1 Tone 3.75 kHz. Offset=0. π/2 - BPSK
Maximum measured level at highest Block Edge at antenna port (dBm)	-16.15

(Channel 23182. Band 13):	1 Tone 3.75 kHz. Offset=0. π/2 - BPSK
Maximum measured level at lowest Block Edge at antenna port (dBm)	-21.71

(Channel 23278. Band 13):	1 Tone 3.75 kHz. Offset=47. π/2 - BPSK
Maximum measured level at highest Block Edge at antenna port (dBm)	-21.02

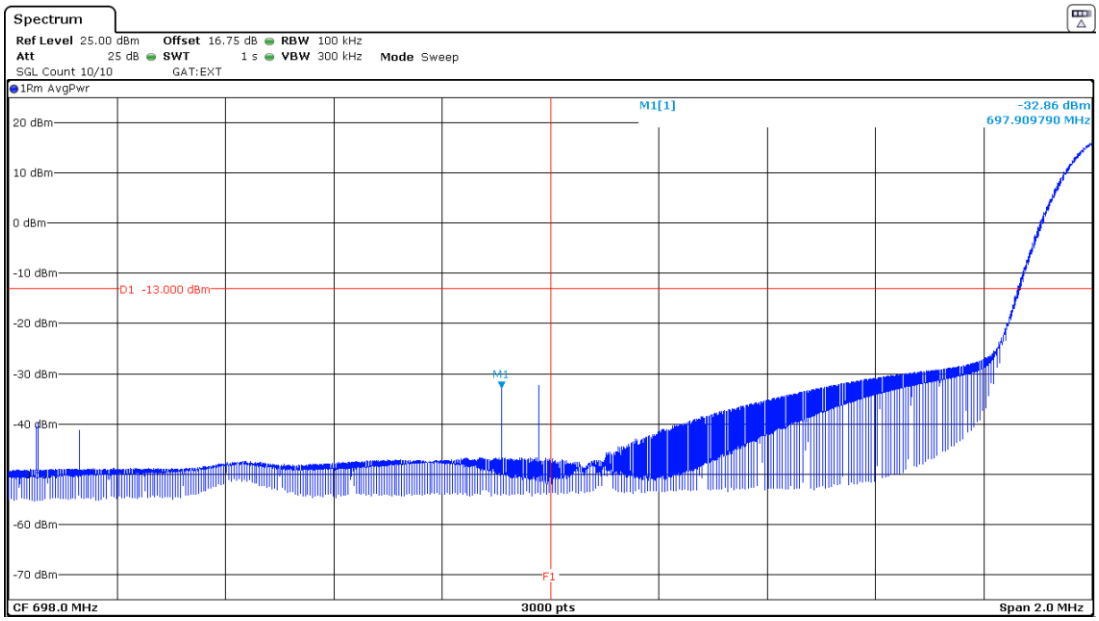
Measurement uncertainty = <±1.20 dB.

Verdict: PASS

NBIoT. BAND 12.

3 tones π/4 – QPSK. BW=15 kHz Offset = 9

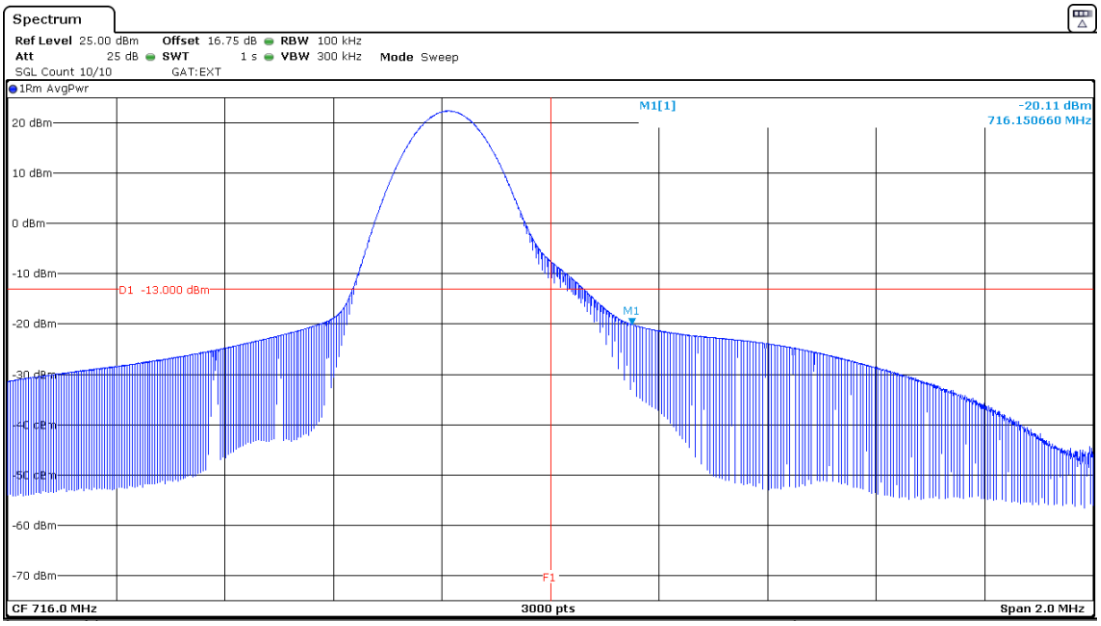
CHANNEL 23011



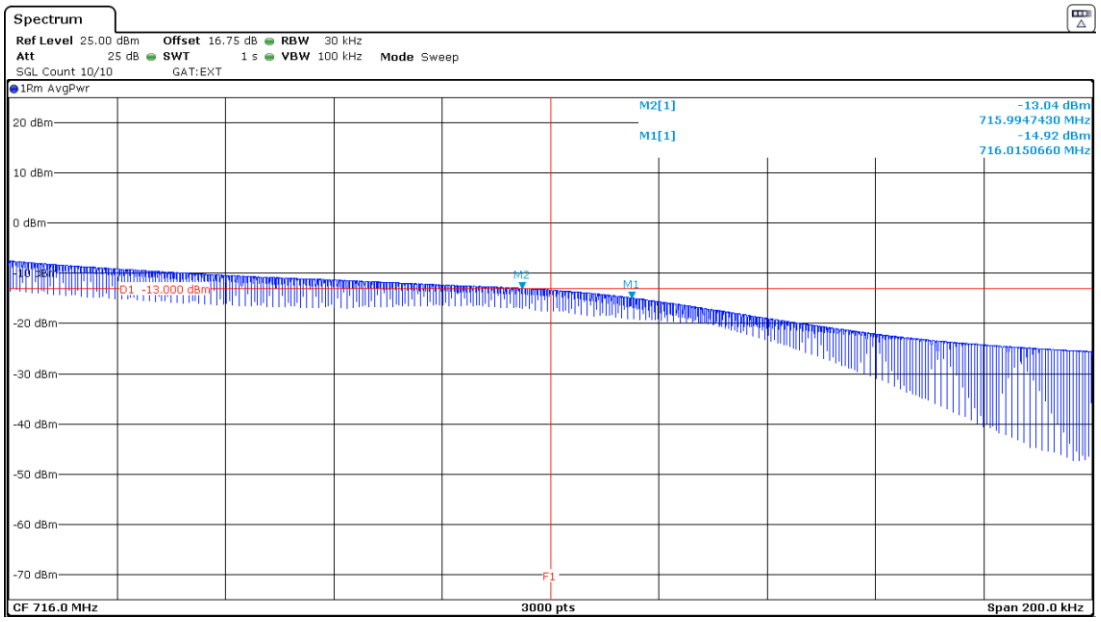
NOTE: The equipment transmits at the maximum output power

1 tone π/2 – BPSK. BW=3.75 kHz Offset = 0

CHANNEL 23179



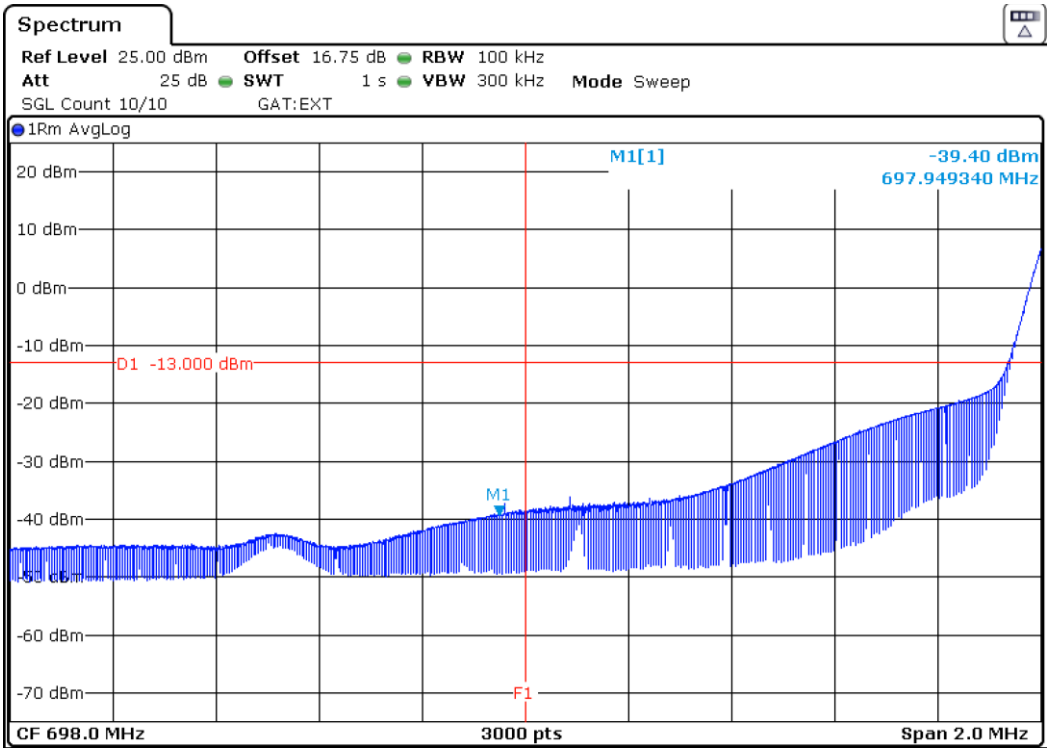
NOTE: The equipment transmits at the maximum output power



NOTE: Zoom (100KHz) with RBW=30KHz.

1 tone π/2 – BPSK. BW=15 kHz Offset = 0

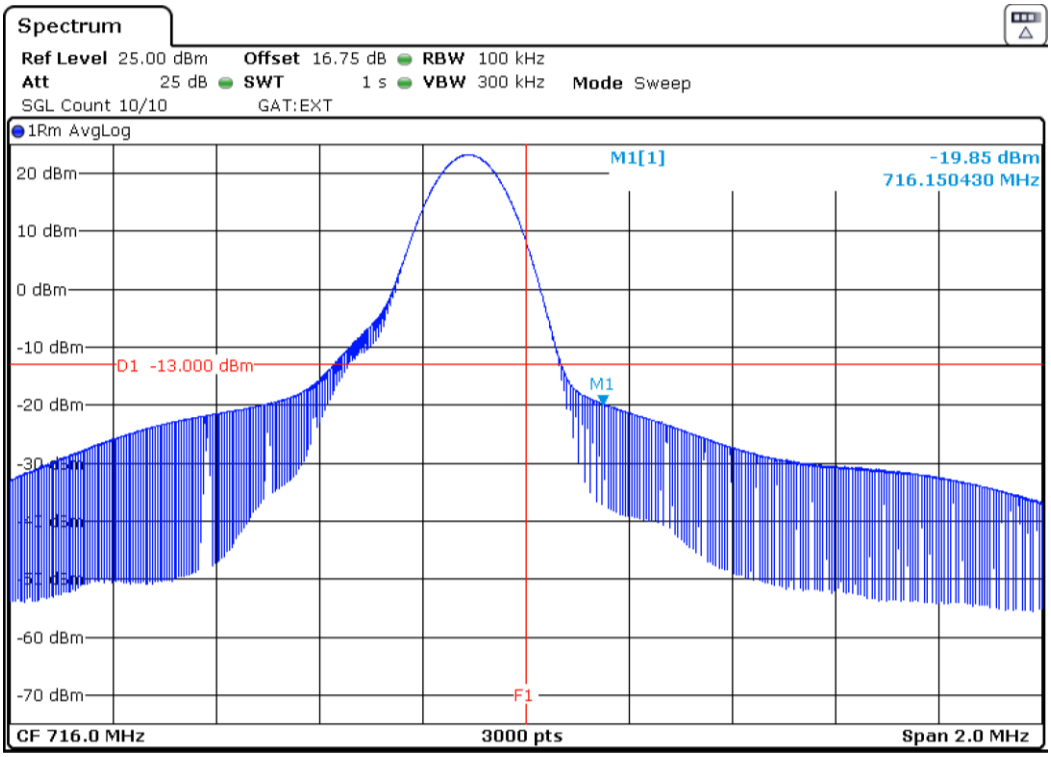
CHANNEL 23012



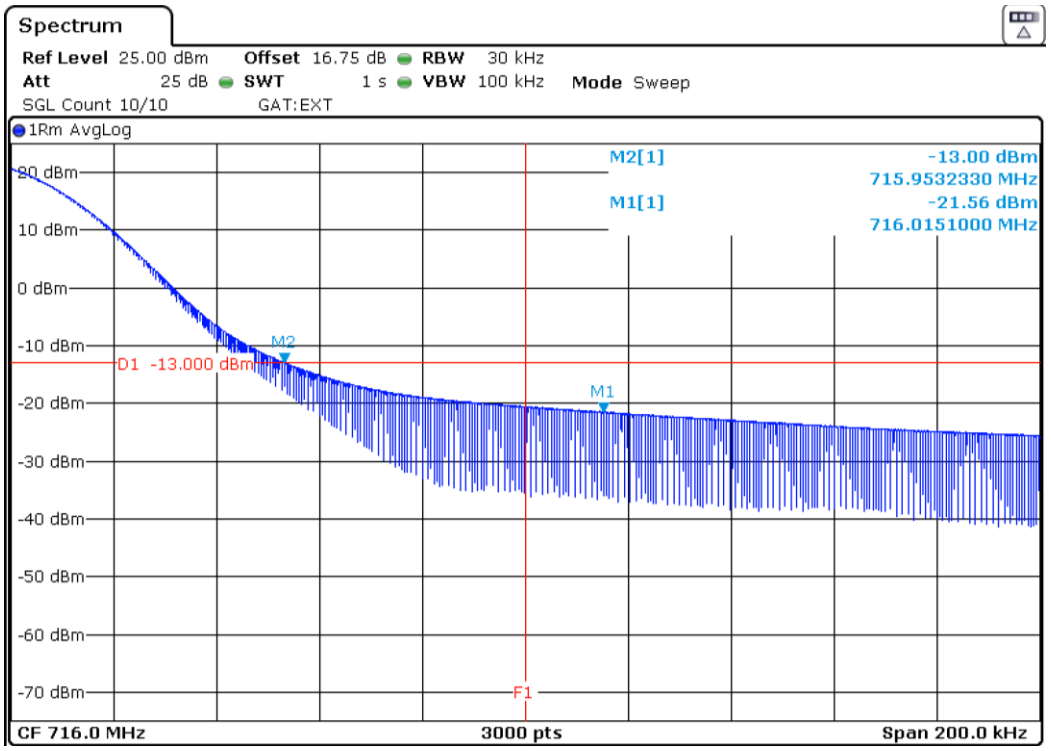
NOTE: The equipment transmits at the maximum output power

1 tone π/2 – BPSK. BW=3.75 kHz Offset = 47

CHANNEL HIGHEST



NOTE: The equipment transmits at the maximum output power

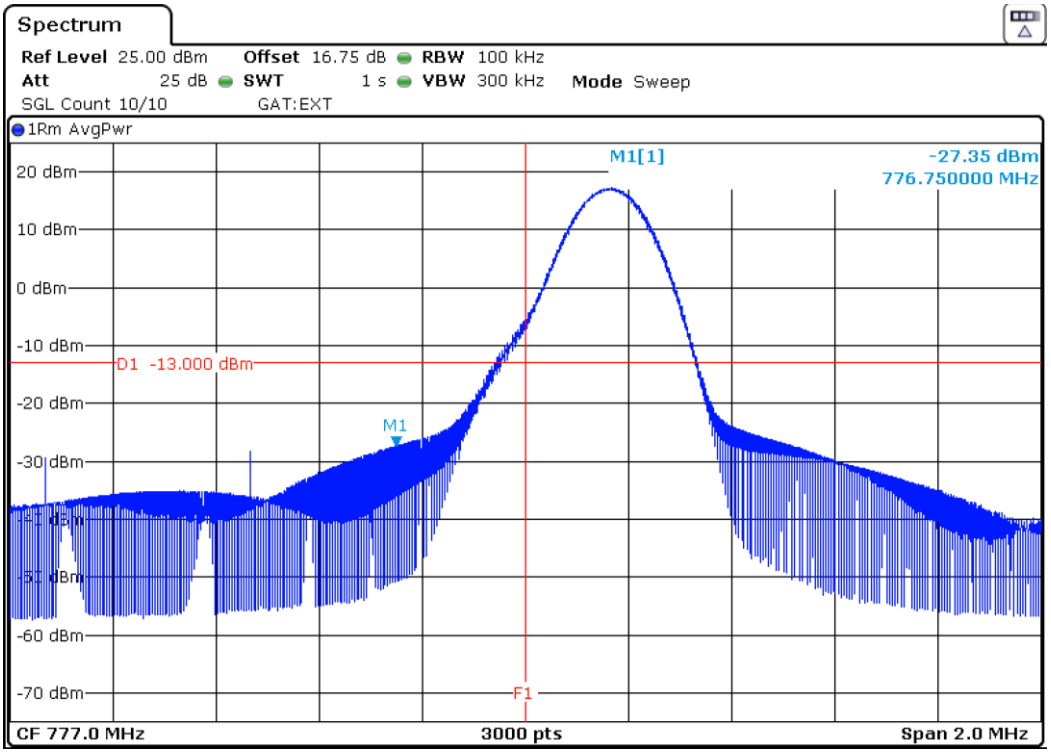


NOTE: Zoom (100KHz) with RBW=30KHz.

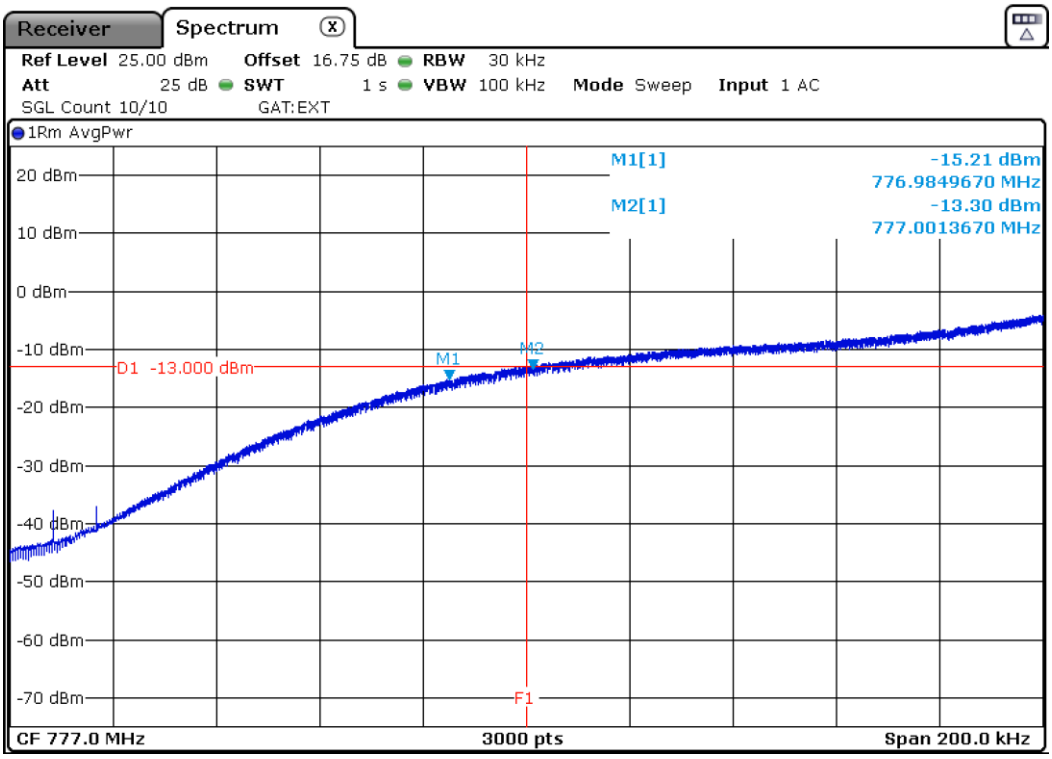
NBIoT. BAND 13.

3 tones π/4 – QPSK. BW=15 kHz Offset = 9

CHANNEL 23181



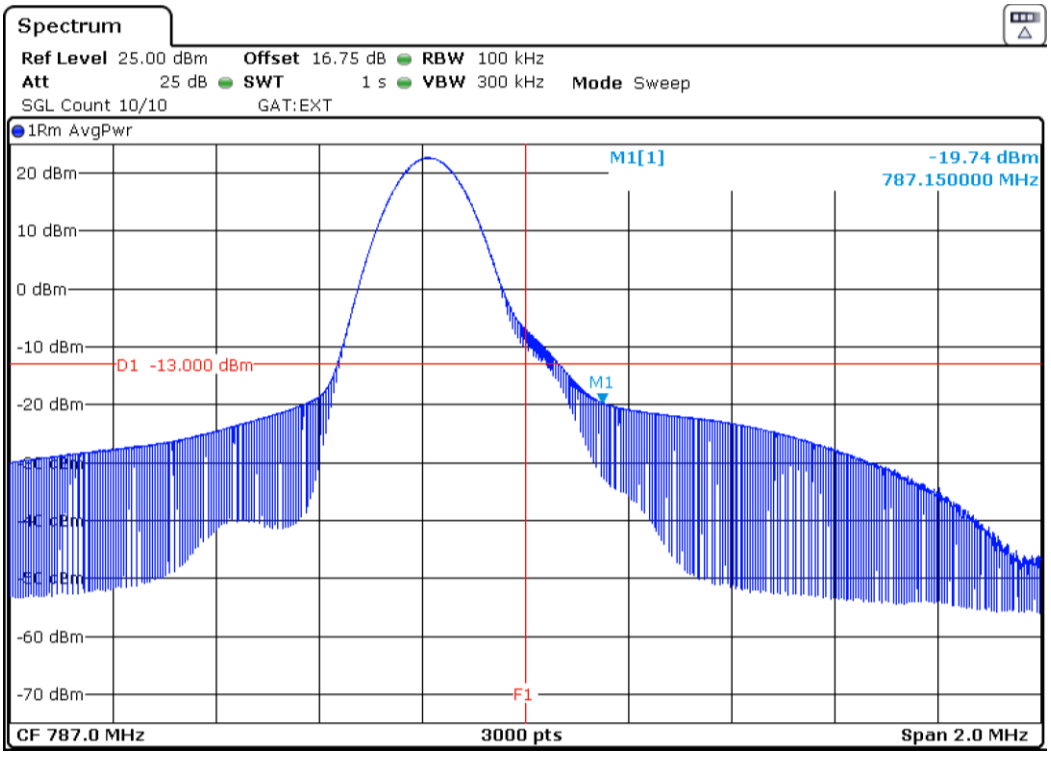
NOTE: The equipment transmits at the maximum output power



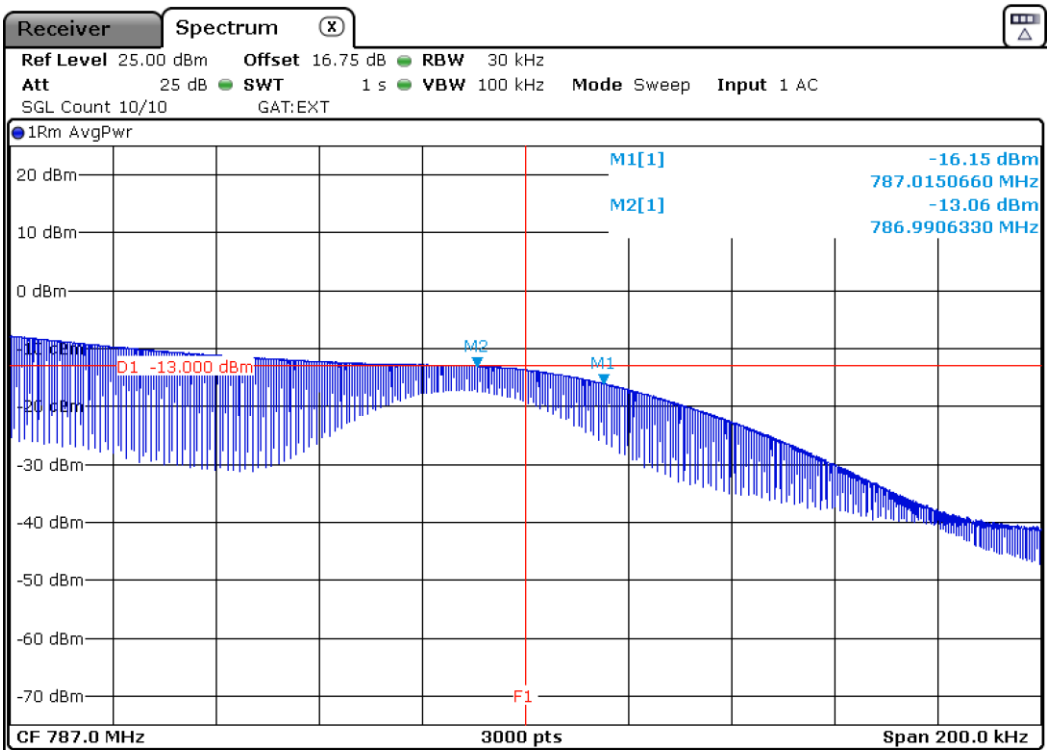
NOTE: Zoom (100KHz) with RBW=30KHz.

1 tone π/2 – BPSK. BW=3.75 kHz Offset = 0

CHANNEL 23279



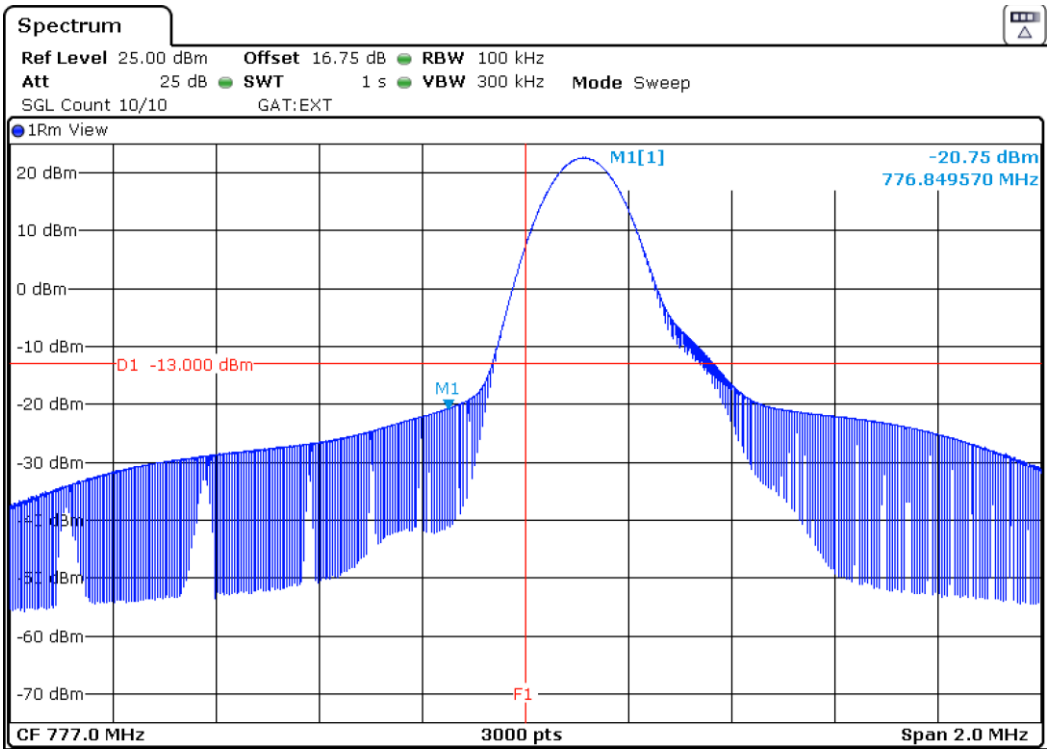
NOTE: The equipment transmits at the maximum output power



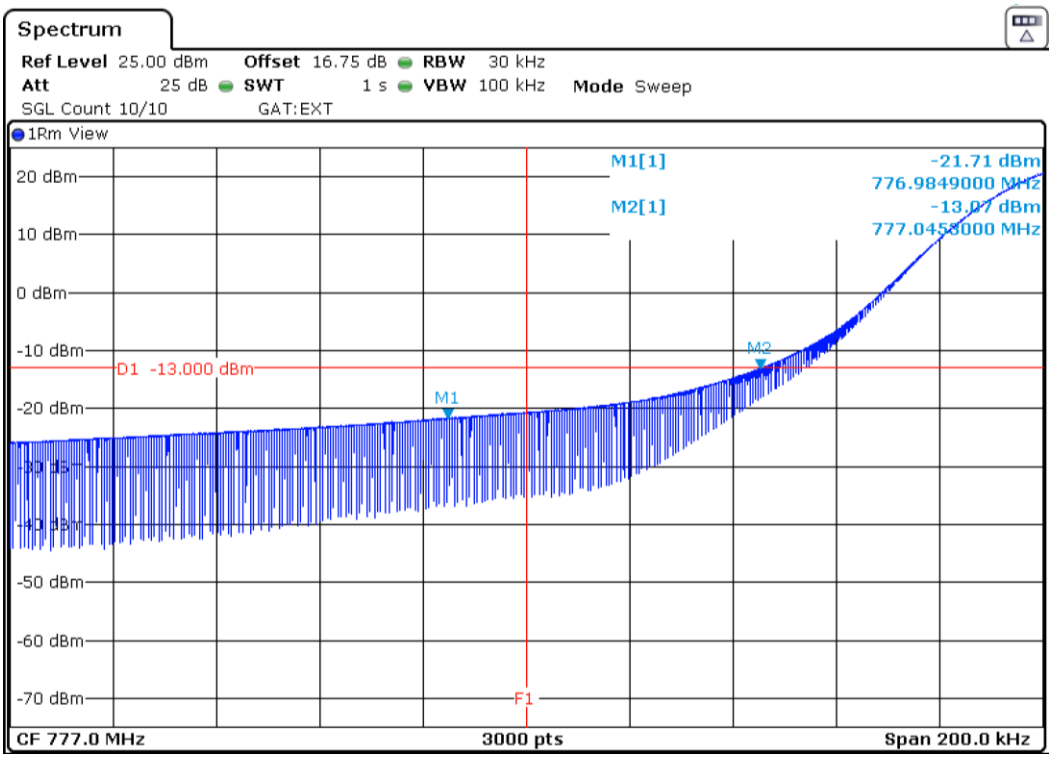
NOTE: Zoom (100KHz) with RBW=30KHz.

1 tone π/2 – BPSK. BW=3.75 kHz Offset = 0

CHANNEL 23182



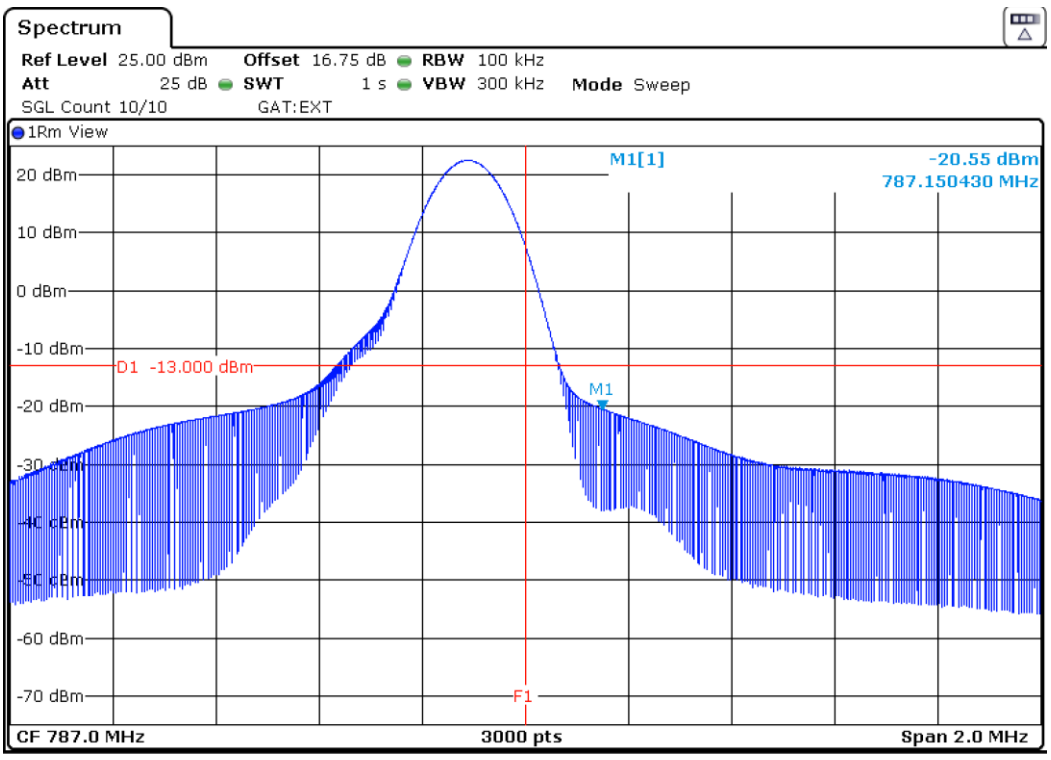
NOTE: The equipment transmits at the maximum output power



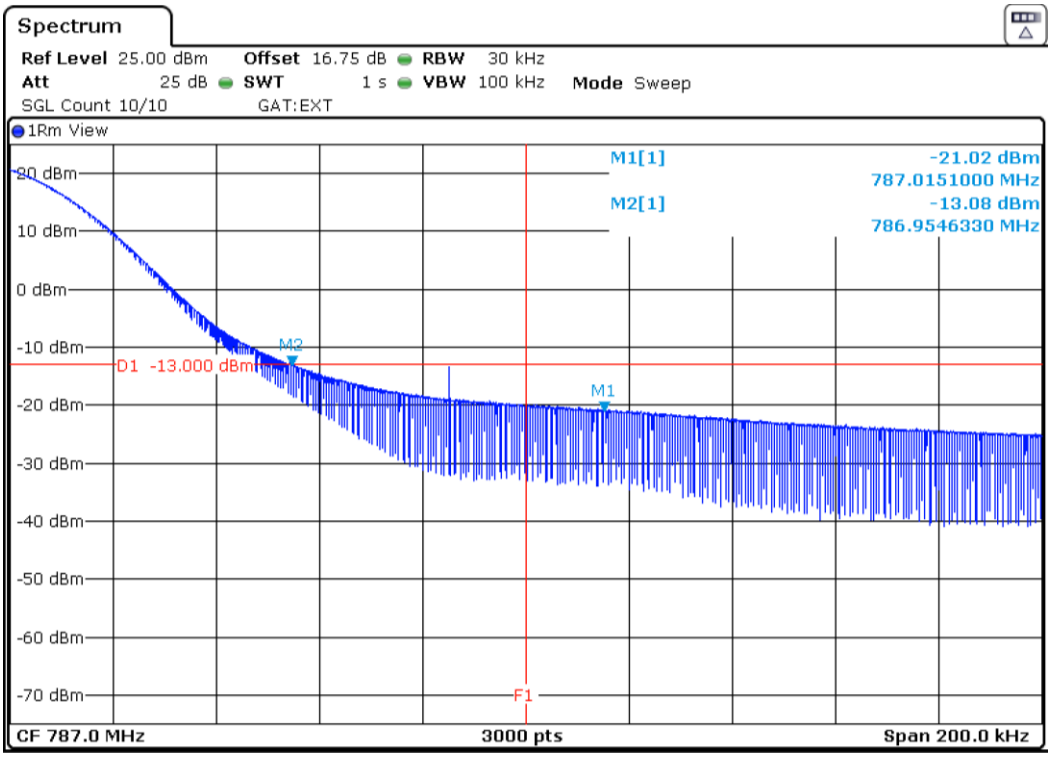
NOTE: Zoom (100KHz) with RBW=30KHz.

1 tone π/2 – BPSK. BW=3.75 kHz Offset = 47

CHANNEL 23278



NOTE: The equipment transmits at the maximum output power



NOTE: Zoom (100KHz) with RBW=30KHz.

Radiated emissions

SPECIFICATION

FCC §27.53 (g).

For operations in the 600 MHz band and the 698-746 MHz band. the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation. measured in watts. by at least 43 + 10 log (P) dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However. in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block. a resolution bandwidth of at least 30 kHz may be employed

FCC §27.53 (c) & (f).
On any frequency outside the 776-788 MHz band. the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB.

On all frequencies between 763-775 MHz and 793-805 MHz. by a factor not less than 65 + 10 log (P) dB in a 6.25 kHz band segment. for mobile and portable stations.

For operations in the 746-758 MHz. 775-788 MHz. and 805-806 MHz bands. emissions in the band 1559-1610 MHz shall be limited to −70 dBW (-40 dBm)/MHz equivalent isotropically radiated power (EIRP) for wideband signals. and −80 dBW (-50 dBm) EIRP for discrete emissions of less than 700 Hz bandwidth.

RSS-130 Clause 4.6.
The power of any unwanted emissions in any 100 kHz bandwidth on any frequency outside the frequency range(s) within which the equipment is designed to operate shall be attenuated below the transmitter power. P (dBW). by at least 43 + 10 log10 p (watts). dB.

The power of any unwanted emissions in any 6.25 kHz bandwidth for all frequencies between 763-775 MHz and 793-806 MHz shall be attenuated below the transmitter power. P (dBW). by at least 65 + 10 log10 p(watts). dB. for mobile and portable equipment.

The e.i.r.p. in the band 1559-1610 MHz shall not exceed -70 dBW (-40 dBm) /MHz for wideband signal and -80 dBW (-50 dBm) for discrete emission with bandwidth less than 700 Hz.

At Po transmitting power. the specified minimum attenuation becomes 43+10 log (Po). and the level in dBm relative Po becomes:
Po (dBm) – [43 + 10 log (Po in mwatts) - 30] = -13 dBm.

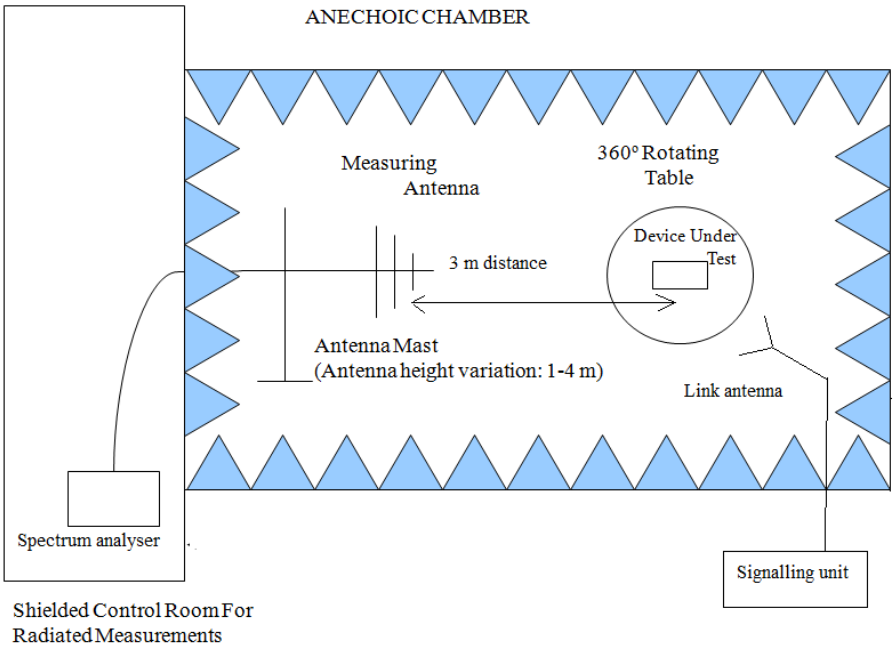
At Po transmitting power. the specified minimum attenuation becomes 65+10 log (Po). and the level in dBm relative Po becomes:
Po (dBm) – [65 + 10 log (Po in mwatts) - 30] = -35 dBm.

METHOD

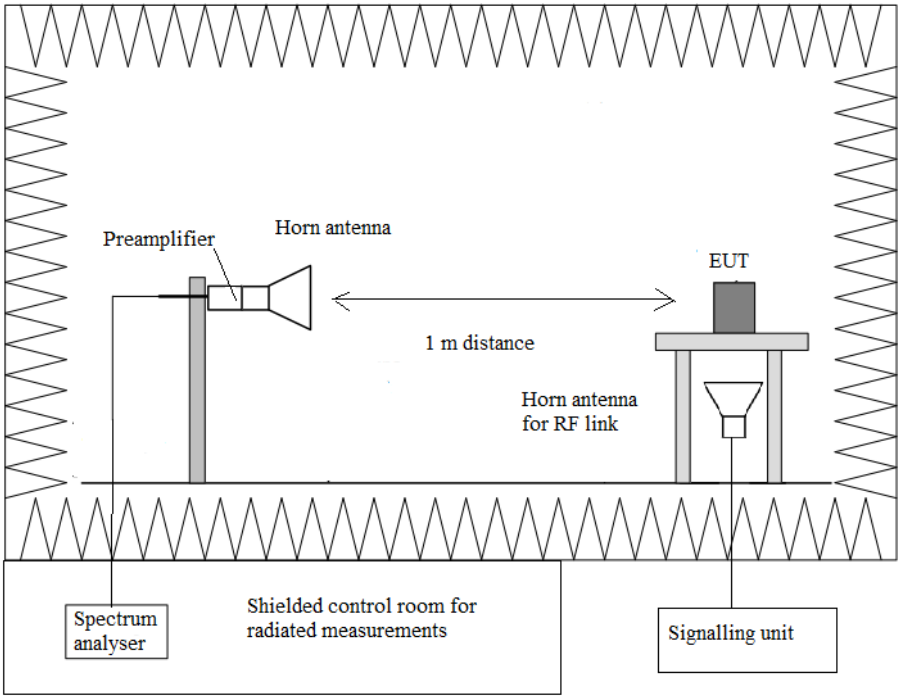
The measurement was performed with the EUT inside an anechoic chamber. The spectrum was scanned from 30 MHz to at least the 10th harmonic of the highest frequency generated within the equipment.
The EUT was placed on a non-conductive stand at a 3 meter distance from the measuring antenna for measurements below 1 GHz and at 1 m distance for measurements above 1 GHz.
Detected emissions were maximized at each frequency by rotating the EUT and adjusting the measuring antenna height and polarization. The maximum meter reading was recorded.
Each detected emission at less than 20 dB respect to the limit is substituted by the Substitution method in accordance with the ANSI/TIA-603-E: 2016.

TEST SETUP

Radiated measurements below 1 GHz.



Radiated measurements above 1 GHz.



RESULTS

NBIoT. BAND 12.

Preliminary measurements determined the configuration 1 tone of 3.75kHz as the worst case. The results in the next tables shows the results for this configuration.

1. CHANNEL: LOWEST

Frequency range 30 MHz-1000 MHz.

No radiated spurious signals were detected at less than 20 dB respect to the limit.

Frequency range 1 GHz-8 GHz.

No radiated spurious signals were detected at less than 20 dB respect to the limit.

2. CHANNEL: MIDDLE

Frequency range 30 MHz-1000 MHz.

No radiated spurious signals were detected at less than 20 dB respect to the limit.

Frequency range 1 GHz-8 GHz.

No radiated spurious signals were detected at less than 20 dB respect to the limit.

3. CHANNEL: HIGHEST

Frequency range 30 MHz-1000 MHz.

No radiated spurious signals were detected at less than 20 dB respect to the limit.

Frequency range 1 GHz-8 GHz.

No radiated spurious signals were detected at less than 20 dB respect to the limit.

NBIoT. BAND 13.

Preliminary measurements determined the configuration 1 tone of 3.75kHz as the worst case. The results in the next tables shows the results for this configuration.

1. CHANNEL: LOWEST

Frequency range 30 MHz-1000 MHz.

No radiated spurious signals were detected at less than 20 dB respect to the limit.

Frequency range 1 GHz-8 GHz.

No radiated spurious signals were detected at less than 20 dB respect to the limit.

Frequency range 1559 MHz-1610 MHz.

No radiated spurious signals were detected at less than 20 dB respect to the limit.

2. CHANNEL: MIDDLE

Frequency range 30 MHz-1000 MHz.

No radiated spurious signals were detected.

Frequency range 1 GHz-8 GHz.
No radiated spurious signals were detected at less than 20 dB respect to the limit.

Frequency range 1559 MHz-1610 MHz.

Substitution method data

Frequency (MHz)	Instrument reading (dBm)	Polarization	RBW	(1) Generator output (dBm)	(2) Cable loss (dB)	(3) Substitution antenna gain Gi (respect to isotropic radiator) (dB)	E.I.R.P. (dBm) = (1) – (2) + (3)
1564.04	-36.97	Horizontal	1 MHz	-50.05	0.79	8.27	-42.57

No discrete signals were detected. Only wideband signals were detected.

3. CHANNEL: HIGHEST

Frequency range 30 MHz-1000 MHz.

No radiated spurious signals were detected.

Frequency range 1 GHz-8 GHz.

No radiated spurious signals were detected at less than 20 dB respect to the limit.

Frequency range 1559 MHz-1610 MHz.

Substitution method data

Frequency (MHz)	Instrument reading (dBm)	Polarization	RBW	(1) Generator output (dBm)	(2) Cable loss (dB)	(3) Substitution antenna gain Gi (respect to isotropic radiator) (dB)	E.I.R.P. (dBm) = (1) – (2) + (3)
1573.77	-39.31	Horizontal	1 MHz	-52.42	0.79	8.31	-44.90

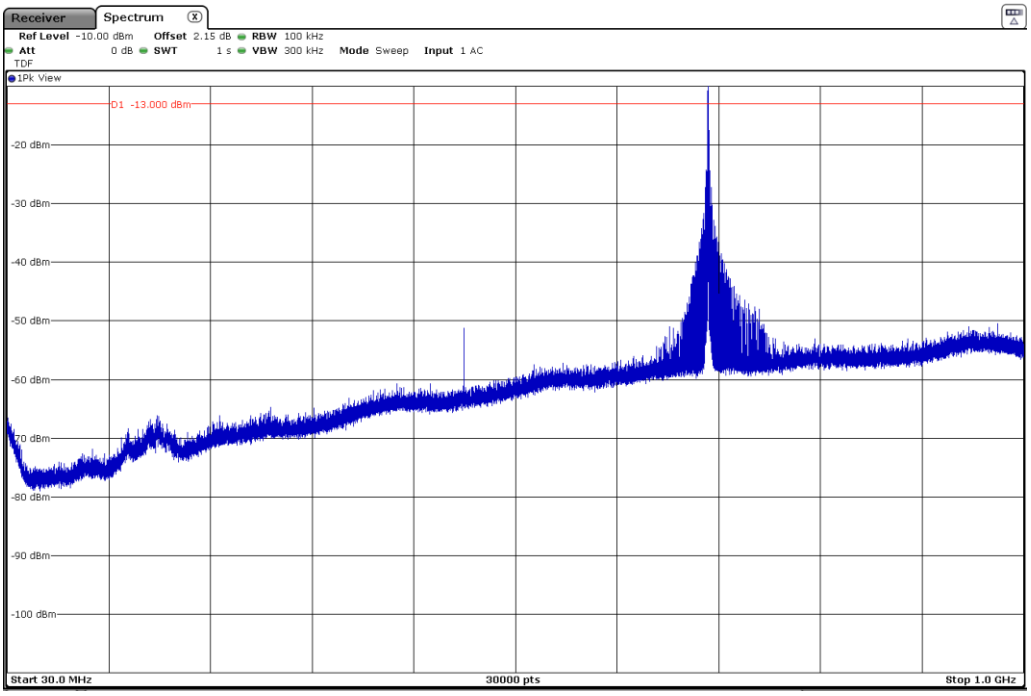
No discrete signals were detected. Only wideband signals were detected.

Verdict: PASS

FREQUENCY RANGE 30 MHz-1000 MHz.

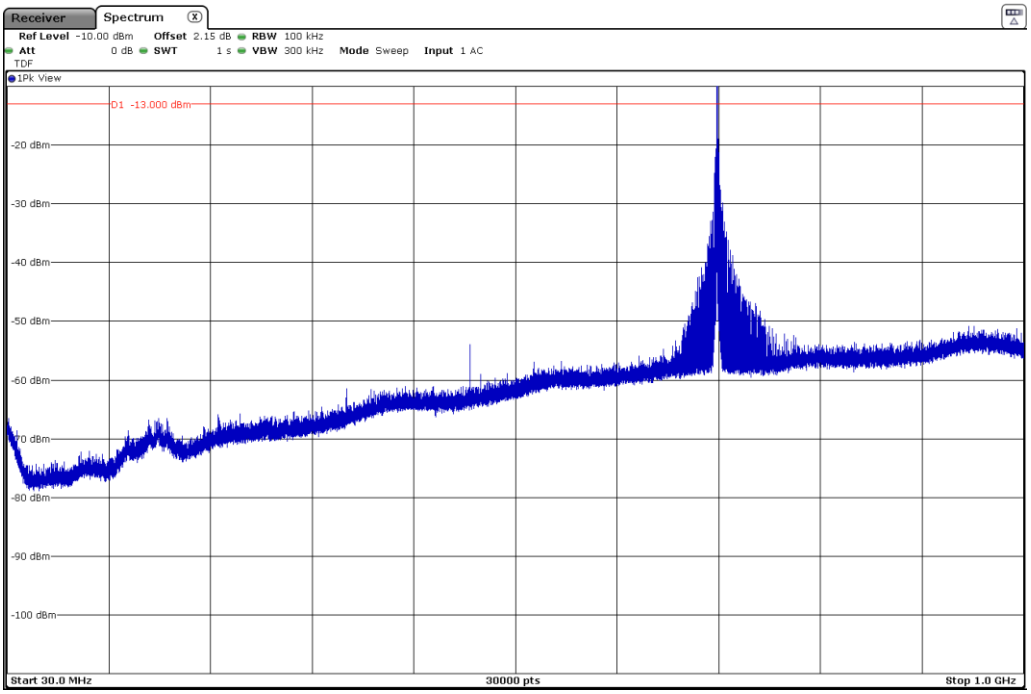
NBIoT Band 12

CHANNEL: LOWEST



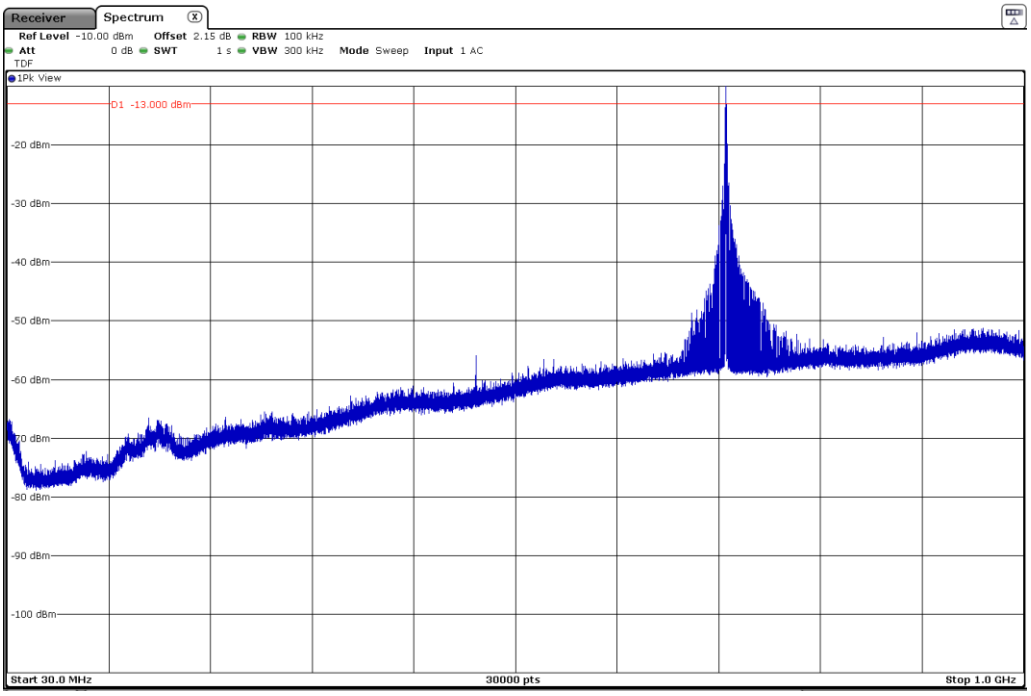
Note: The peak above the limit is the carrier frequency.

CHANNEL: MIDDLE



Note: The peak above the limit is the carrier frequency.

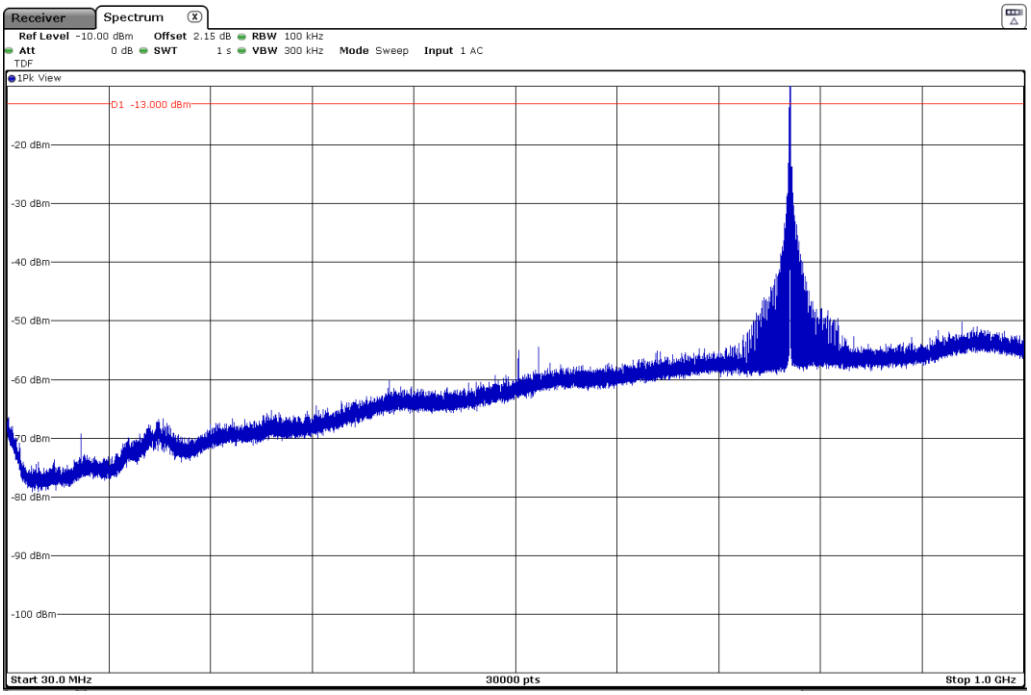
CHANNEL: HIGHEST



Note: The peak above the limit is the carrier frequency.

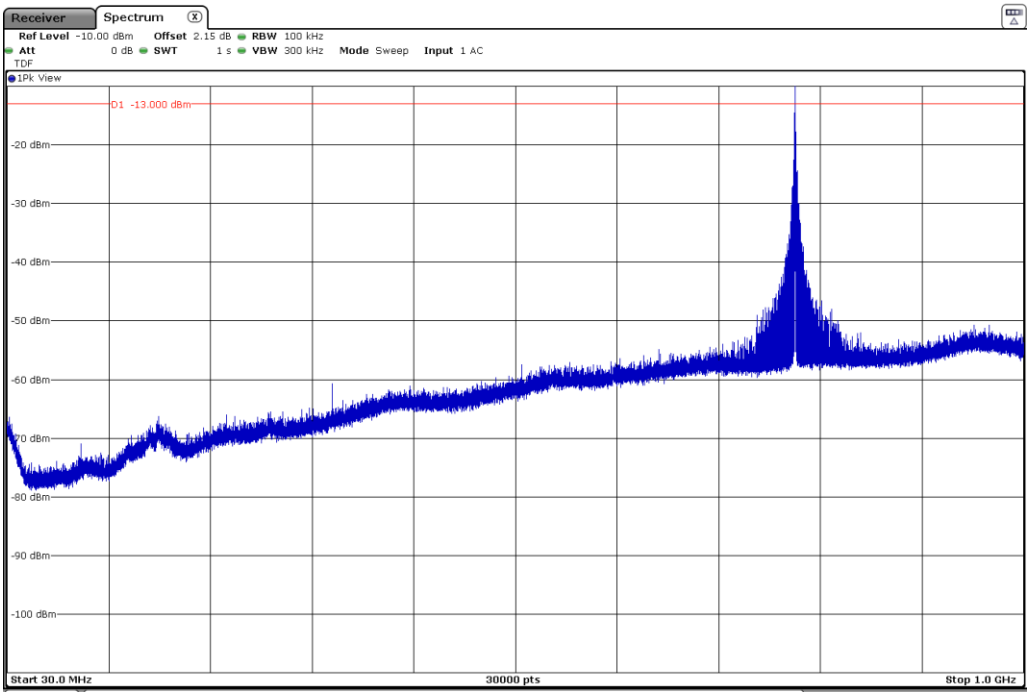
NBIoT Band 13

CHANNEL: LOWEST



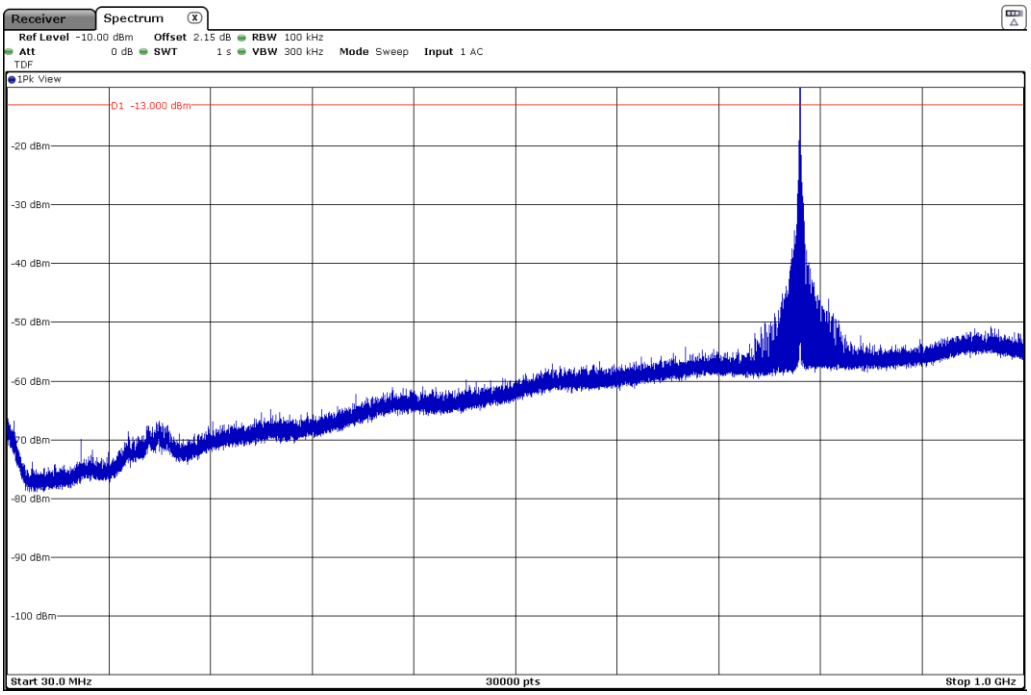
Note: The peak above the limit is the carrier frequency.

CHANNEL: MIDDLE



Note: The peak above the limit is the carrier frequency.

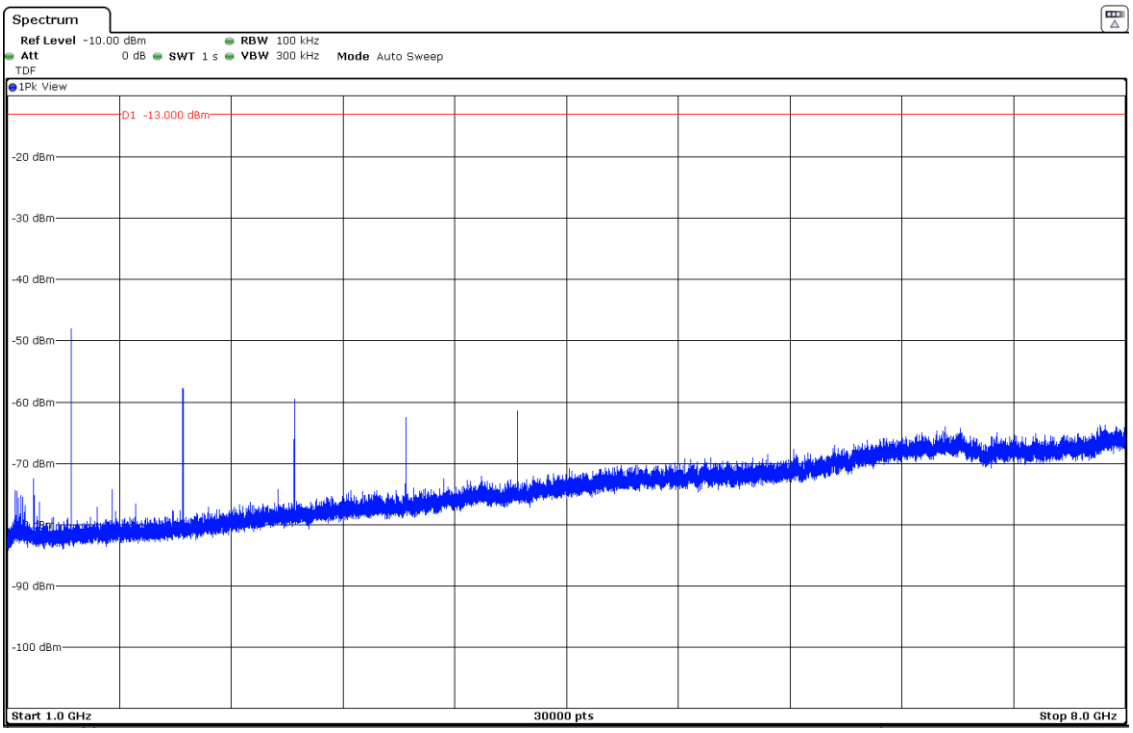
CHANNEL: HIGHEST



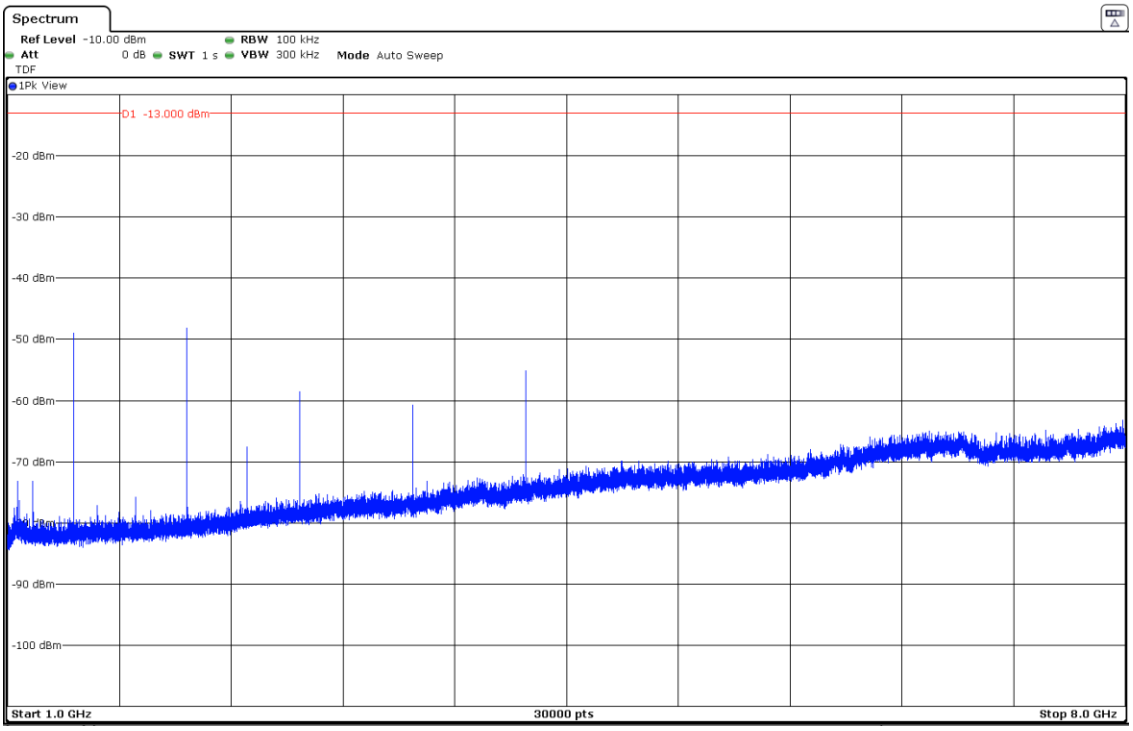
Note: The peak above the limit is the carrier frequency.

NBIoT Band 12. Frequency range 1 GHz to 8 GHz.

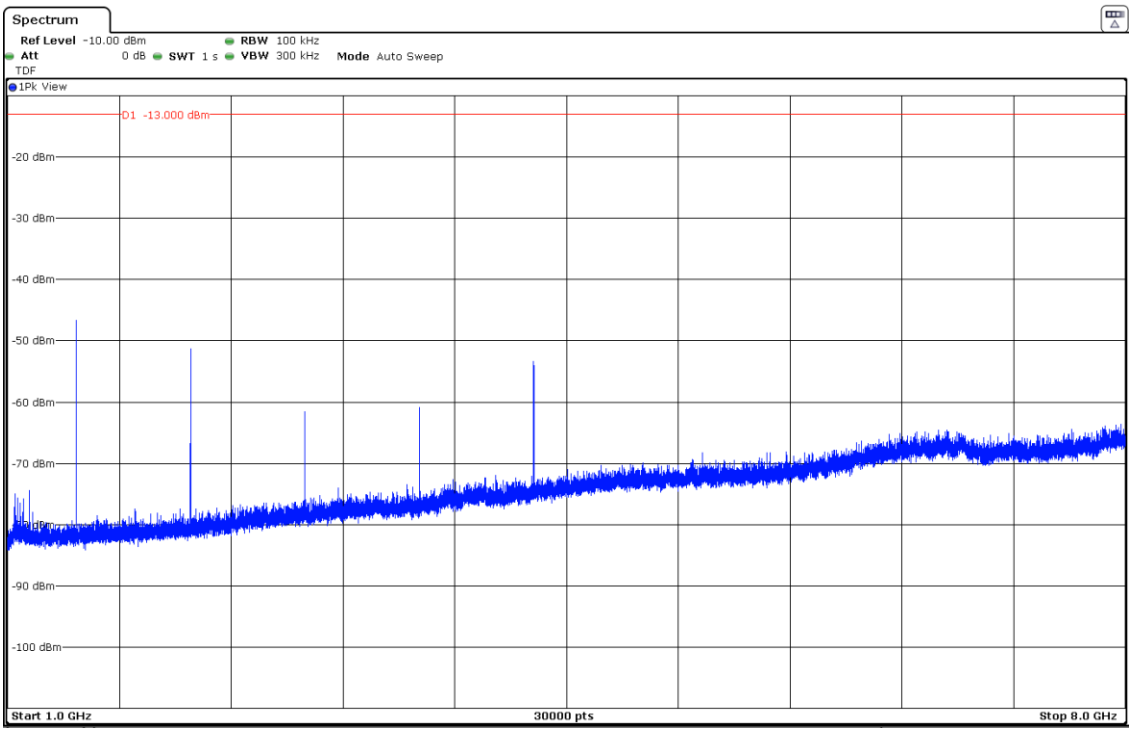
CHANNEL: LOWEST



CHANNEL: MIDDLE

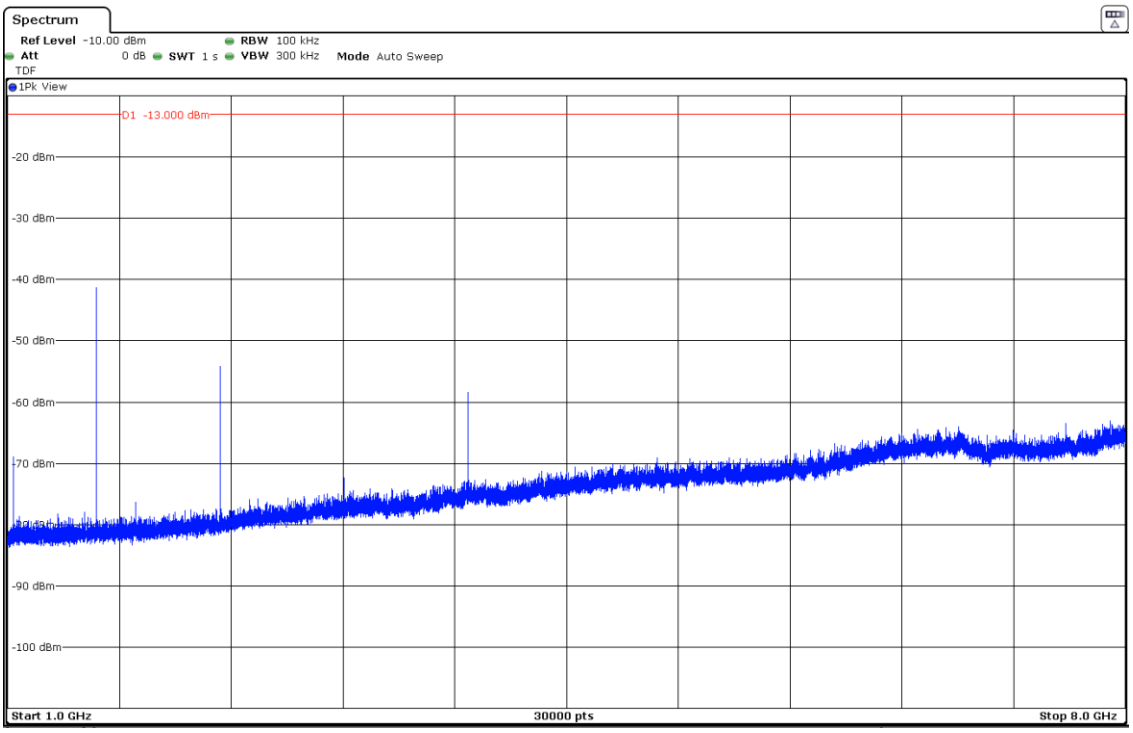


CHANNEL: HIGHEST

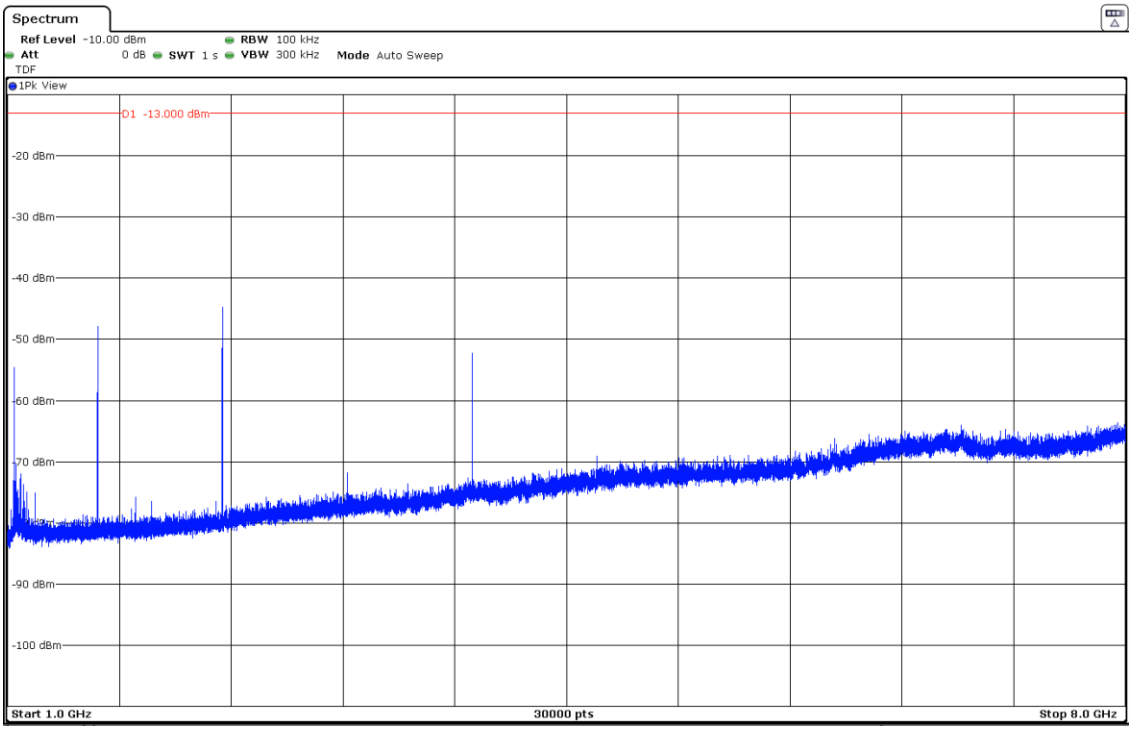


NBIoT Band 13. Frequency range 1 GHz to 8 GHz.

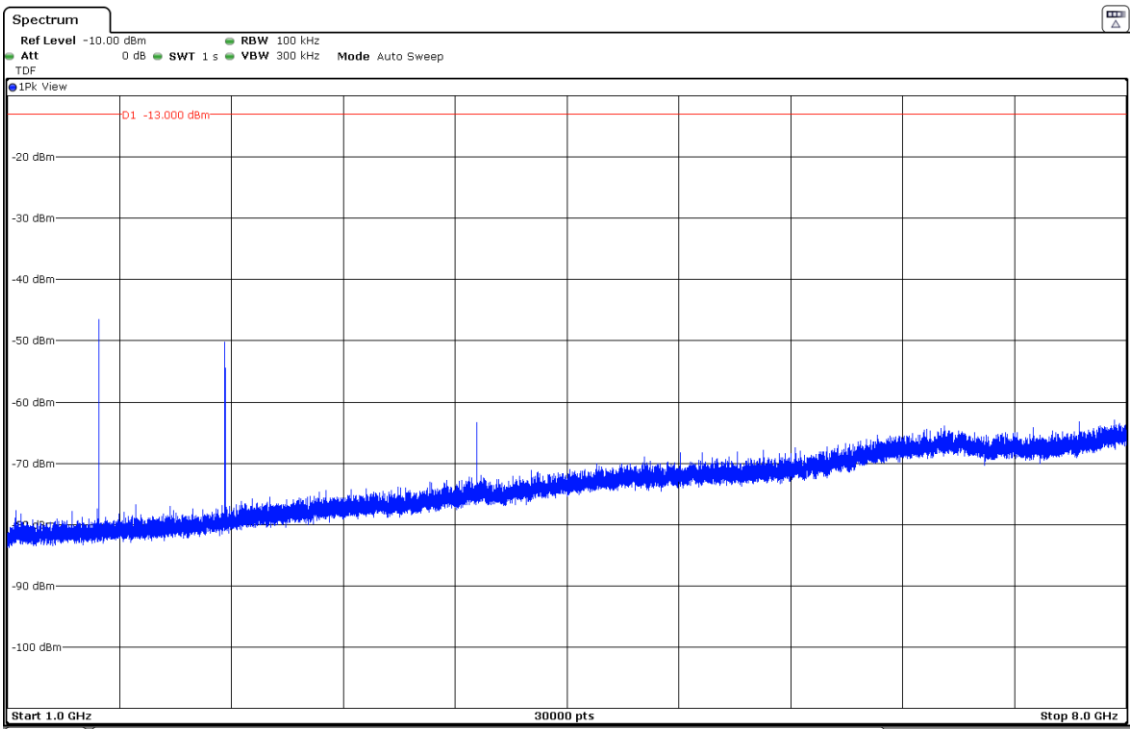
CHANNEL: LOWEST



CHANNEL: MIDDLE

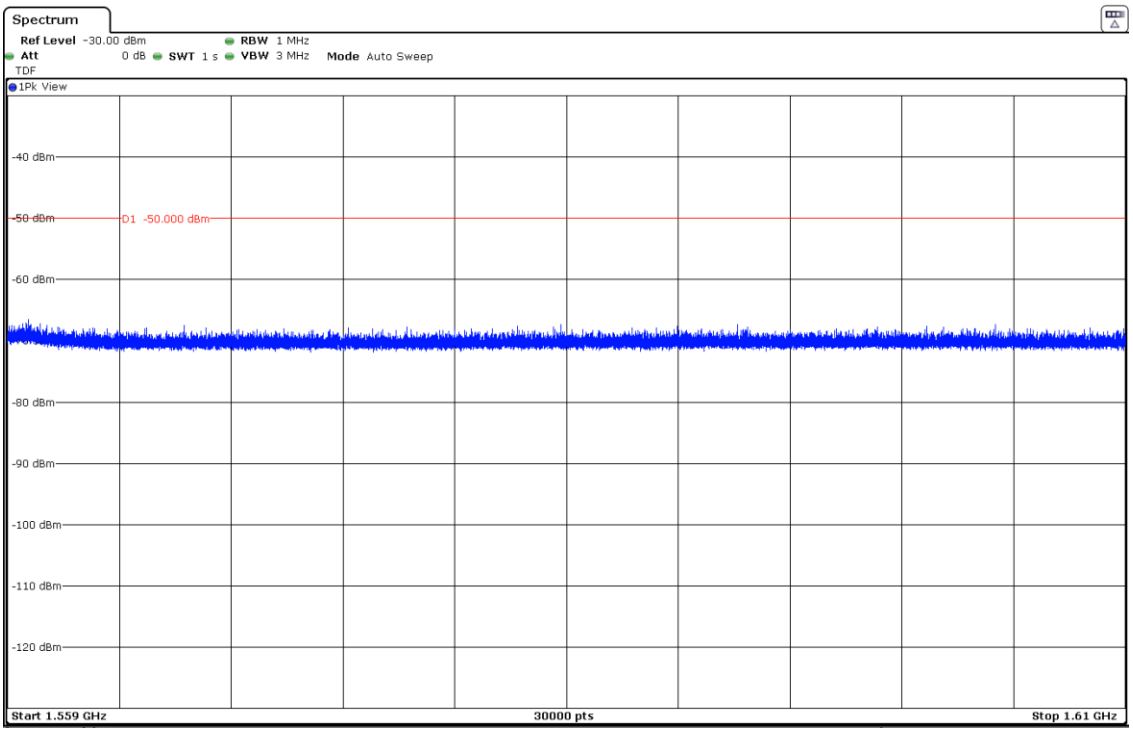


CHANNEL: HIGHEST

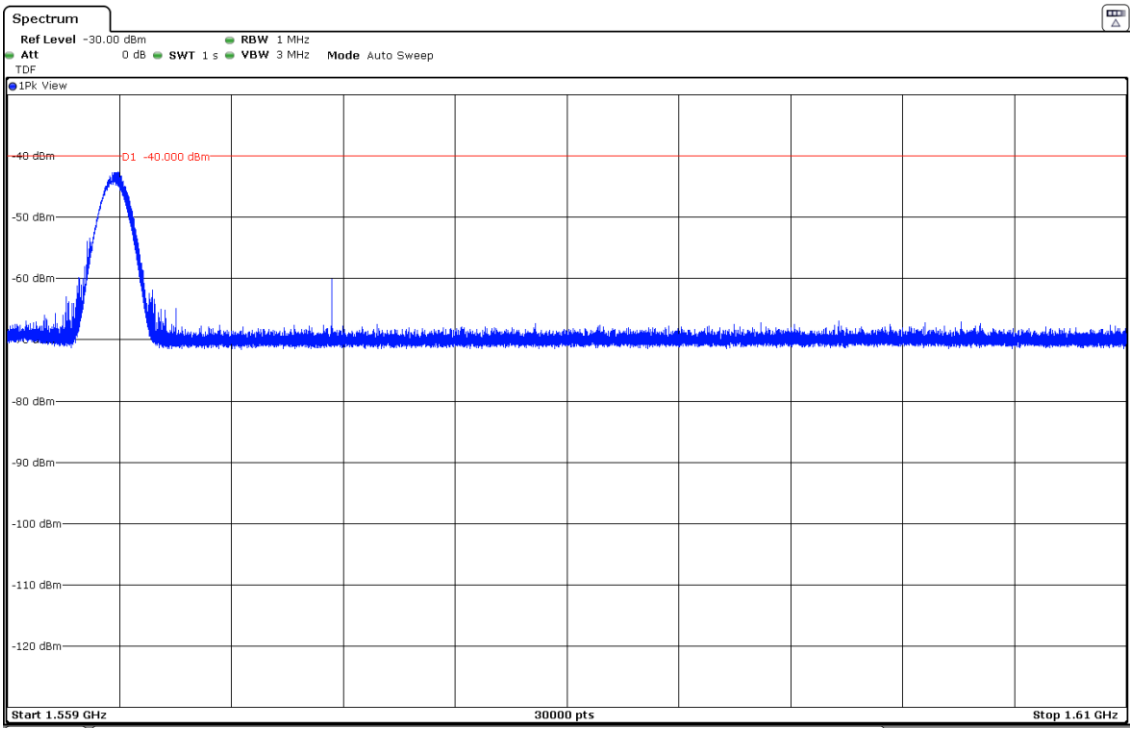


NBIoT Band 13. Frequency range 1559 MHz to 1610 MHz.

CHANNEL: LOWEST



CHANNEL: MIDDLE



CHANNEL: HIGHEST