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Report On

FCC and IC Testing of the
Ericsson KRC 161 326/4 mRRUS12 B4 LTE (2100 MHz) Base Station
in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 27, Industry Canada RSS-GEN and Industry Canada RSS-139

COMMERCIAL-IN-CONFIDENCE

FCC ID: TA8AKRC161326
IC: 287AB-AS161326

PREPARED BY	APPROVED BY	DATED
Natalie Bennett Project Manager (RF and Telecom)	Steve Scarfe Authorised Signatory	16 November 2018

Document 75943170 Report 09 Issue 1 **November 2018**

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SECTION 1

REPORT INFORMATION

1.1 REPORT DETAILS

Manufacturer	Ericsson
Address	Torshamnsgatan 23 Kista SE-16480 Stockholm Sweden
Product Name & Product Number	mRRUS12 B4 - KRC 161 326/4
Declared Variant(s)	KRC 161 326/1 KRC 161 326/2 KRC 161 326/3
IC Model Name	AS1613261 AS1613262 AS1613263 AS1613264
Serial Number(s)	C827530909
Software Version	NB-IoT GB CXP9013268_9 R73AM, NB-IoT SA base CXP9013268_259 R72CL01
Hardware Version	R1E
Test Specification/Issue/Date	FCC CFR 47 Part 2: 2017 FCC CFR 47 Part 27: 2017 Industry Canada RSS-GEN: Issue 5: 2018 Industry Canada RSS-139: Issue 3: 2015
Start of Test	04 October 2018
Finish of Test	22 October 2018
Name of Engineer(s)	Neil Rousell Graeme Lawler
Related Document(s)	KDB 971168 D01 v02r02 KDB 662911 D01 v02r01

ENGINEERING STATEMENT

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate compliance with FCC CFR 47 Part 2, FCC CFR 47 Part 27, Industry Canada RSS-GEN and Industry Canada RSS-139. The sample tested was found to comply with the requirements defined in the applied rules.

Test Engineer(s);

Neil Rousell Graeme Lawler

1.2 BRIEF SUMMARY OF RESULTS

A brief summary of results for each configuration, in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 27, Industry Canada RSS-GEN and Industry Canada RSS-139 is shown below.

Section	Specification Clause				Test Description	Result
	FCC CFR 47 Part 2	FCC CFR 47 Part 27	RSS-GEN	RSS-139		
2.1	2.1046	27.50	-	6.4	Maximum Peak Output Power and Peak to Average Ratio - Conducted	Pass
2.2	2.1049	27.53	6.6	-	Occupied Bandwidth	Pass
2.3	2.1051	27.53 (h)	-	6.5	Band Edge	Pass
2.4	2.1051	27.53 (h)	-	6.5	Transmitter Spurious Emissions	Pass
2.5	2.1051	27.53 (g)	-	6.5	Radiated Emissions	Pass

Measurement Uncertainty Decision Statement

Determination of conformity with the specification limits is based on the results of the compliance measurement and does not take into account measurement instrumentation uncertainty as defined in ANSI C63.26:2015 Clause 1.3.

1.3 CONFIGURATION DESCRIPTION

Configuration	RAT	No. Of carriers	Carrier Bandwidth	Carrier Frequency Configuration (MHz)		
				Bottom	Middle	Top
A	LTE+NB IoT GB	1	10MHz	2115.0	-	2150.0
A	LTE+NB IoT GB	1	15MHz	2117.5	-	2147.5
A	LTE+NB IoT GB	1	20MHz	2120.0	-	2145.0
B	NB IoT SA	1	0.18 MHz	2110.2	2132.5	2154.8

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1.4 DECLARATION OF BUILD STATUS

MAIN EUT		
MANUFACTURING DESCRIPTION	Radio Unit	
MANUFACTURER	Ericsson AB	
PRODUCT NAME	mRRUS12 B4	
PART NUMBER	KRC 161 326/1 KRC 161 326/2 KRC 161 326/3 KRC 161 326/4[1]	110-240VAC internal antenna, -48VDC internal antenna, 110-240VAC external antenna, -48VDC external antenna
IC Model Names	AS1613261 AS1613262 AS1613263 AS1613264	
SERIAL NUMBER	C827530909	
HARDWARE VERSION	R1E	
SOFTWARE VERSION	NB-IoT GB CXP9013268_9 R73AM, NB-IoT SA base CXP9013268_259 R72CL01	
TRANSMITTER OPERATING RANGE	2110 to 2155 MHz	
MODULATIONS	QPSK, 16QAM, 64QAM, 256QAM[2]	
INTERMEDIATE FREQUENCIES	-	
ITU DESIGNATION OF EMISSION	WCDMA: 3M90F9W, 4M18F9W	
	1,4 MHz BW channel: 1M40F9W	
	3 MHz BW channel: 3M00F9W	
	5 MHz BW channel: 5M00F9W	
	10 MHz BW channel[3]: 9M40F9W	
	15 MHz BW channel[3]: 14M0F9W	
	20 MHz BW channel[3]: 18M5F9W	
	NB-IoT SA 200 kHz BW channel: 230KW7D	
OUTPUT POWER (RMS) (W or dBm)	2 ports, 5W[3] per port	
	NB-IoT SA 1x5W (per port)	
FCC ID	TA8AKRC161326	
IC ID	287AB-AS161326	
TECHNICAL DESCRIPTION (a brief description of the intended use and operation)	Micro base station radio	

[1] KRC 161 326/1 to KRC 161 326/4 have the same radio design with different PSU and antenna configuration, whereas KRC 161 326/4 is best suited and chosen to be the test unit.
[2] Used for LTE.
[3] Including 2 NB-IoT GB carriers.

Signature Linda Grell

Linda Grell

Date 2018-11-08

No responsibility will be accepted by TÜV SÜD Product Service as to the accuracy of the information declared in this document by the manufacturer.

1.5 PRODUCT INFORMATION

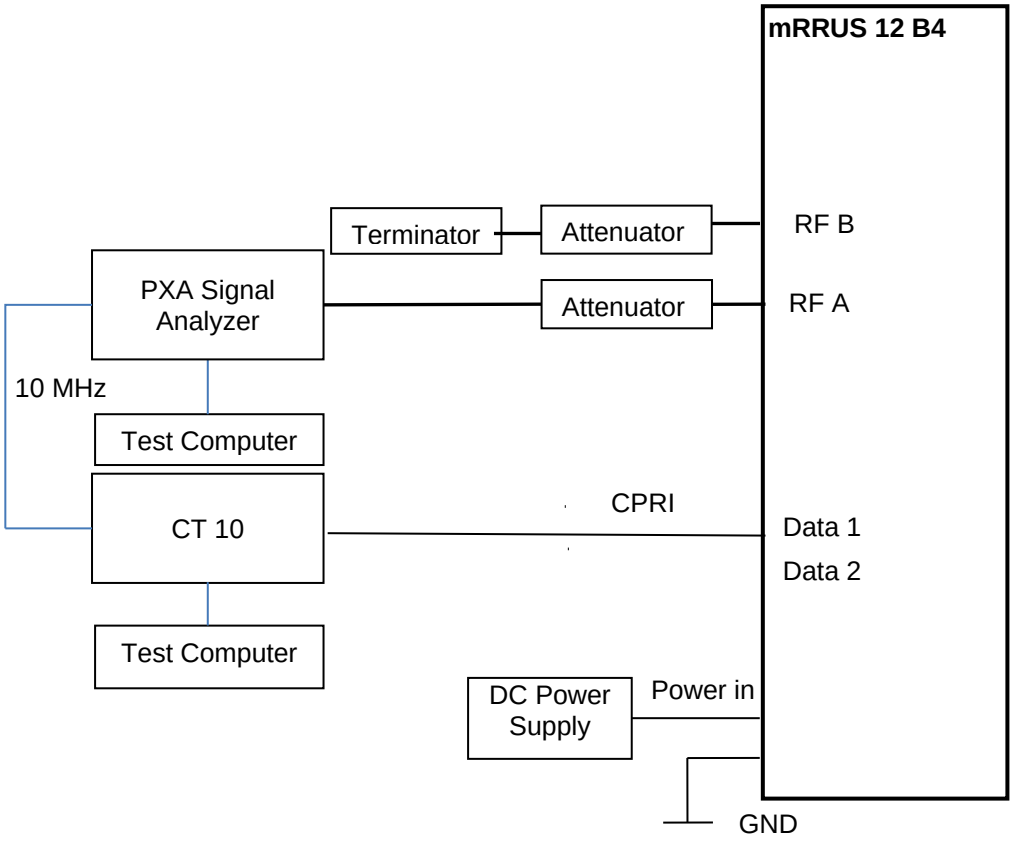
1.5.1 Technical Description

The Equipment Under Test (EUT) mRRUS12 B4 - KRC 161 326/4 mRRUS12 B4 is an Ericsson AB Radio Unit working in the public mobile service (Band) band which provides communication connections to (Band) network. The mRRUS12 B4 - KRC 161 326/4 mRRUS12 B4 operates from a -48V DC supply.

The Equipment Under Test (EUT) is shown in the photograph below. A full technical description can be found in the Manufacturer's documentation.

Equipment Under Test

1.6 TEST SETUP



1.7 TEST CONDITIONS

For all tests the EUT was set up in accordance with the relevant test standard and to represent typical operating conditions. Tests were applied with the EUT situated in a shielded enclosure, test laboratories or a chamber as appropriate.

The EUT was powered from a -48V DC supply.

FCC Measurement Facility Registration Number
90987 Octagon House, Fareham Test Laboratory

Industry Canada Accreditation
IC2932B-1 Octagon House, Fareham Test Laboratory

1.8 DEVIATION FROM THE STANDARD

No deviations from the applicable test standards or test plan were made during testing.

1.9 MODIFICATION RECORD

No modifications were made to the EUT during testing.

1.10 TEST LOCATION

TÜV SÜD Product Service conducted the following tests at our Fareham Test Laboratory.

Test Name	Name of Engineer(s)
Maximum Peak Output Power and Peak to Average Ratio - Conducted	Neil Rousell
Occupied Bandwidth	Neil Rousell
Band Edge	Neil Rousell
Transmitter Spurious Emissions	Neil Rousell
Radiated Emissions	Graeme Lawler

Office Address:

Octagon House
Concorde Way
Segensworth North
Fareham
Hampshire
PO15 5RL
United Kingdom

SECTION 2

TEST DETAILS

2.1 MAXIMUM PEAK OUTPUT POWER AND PEAK TO AVERAGE RATIO - CONDUCTED

2.1.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1046
FCC CFR 47 Part 27, Clause 27.50
Industry Canada RSS-139, Clause 6.4

2.1.2 Date of Test and Modification State

10 May and 04 October 2018 - Modification State 0

2.1.3 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.1.4 Environmental Conditions

Ambient Temperature	23.8 - 25.2°C
Relative Humidity	41.3 - 52.1%

2.1.5 Test Method

All measurements were made in accordance with FCC KDB 971168 D01, clause 5.2.1 and summed in accordance with FCC KDB 662911 D01.

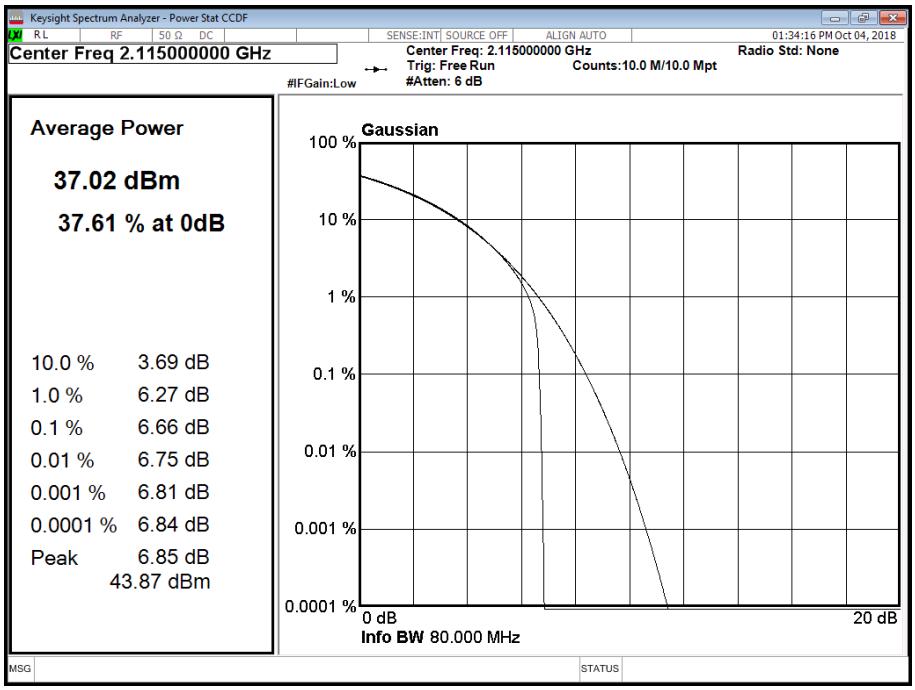
2.1.6 Test Results

Configuration A

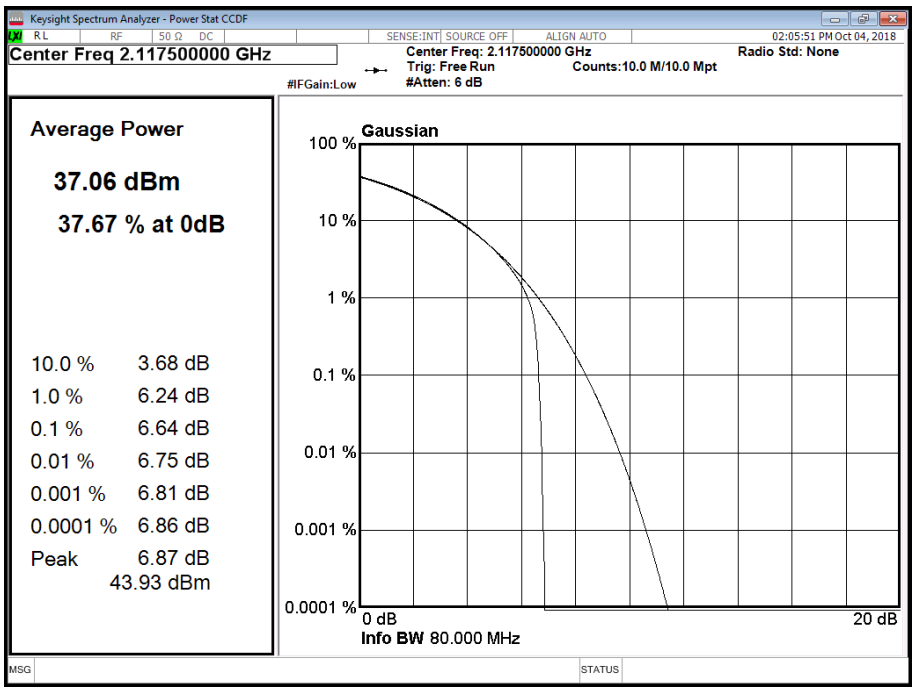
Maximum Output Power 37 dBm

Antenna	E-UTRA / NB-IoT GB Modulation	E-UTRA / NB-IoT GB Carrier Bandwidth	Peak to Average Ratio (PAR) / Output Power		
			Channel Position B		
			PAR (dB)	Average Power	
				dBm	dBm/MHz
A	64QAM	10.0 MHz	6.66	37.13	-
A	64QAM	15.0 MHz	6.64	37.19	-
A	64QAM	20.0 MHz	6.66	37.17	-

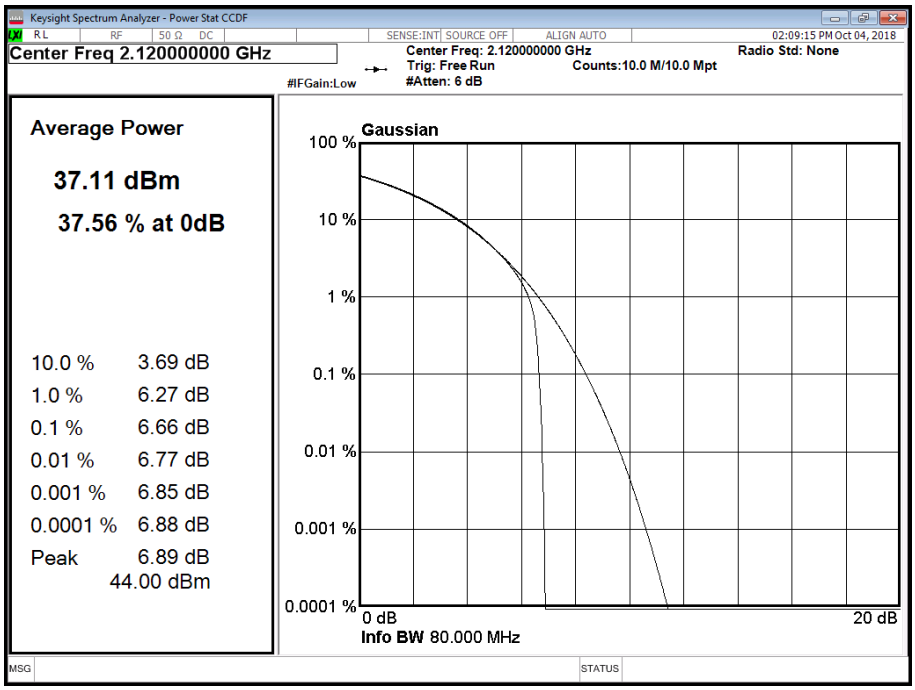
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 10.0 MHz - Channel Position B



Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 15.0 MHz - Channel Position B



Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 20.0 MHz - Channel Position B

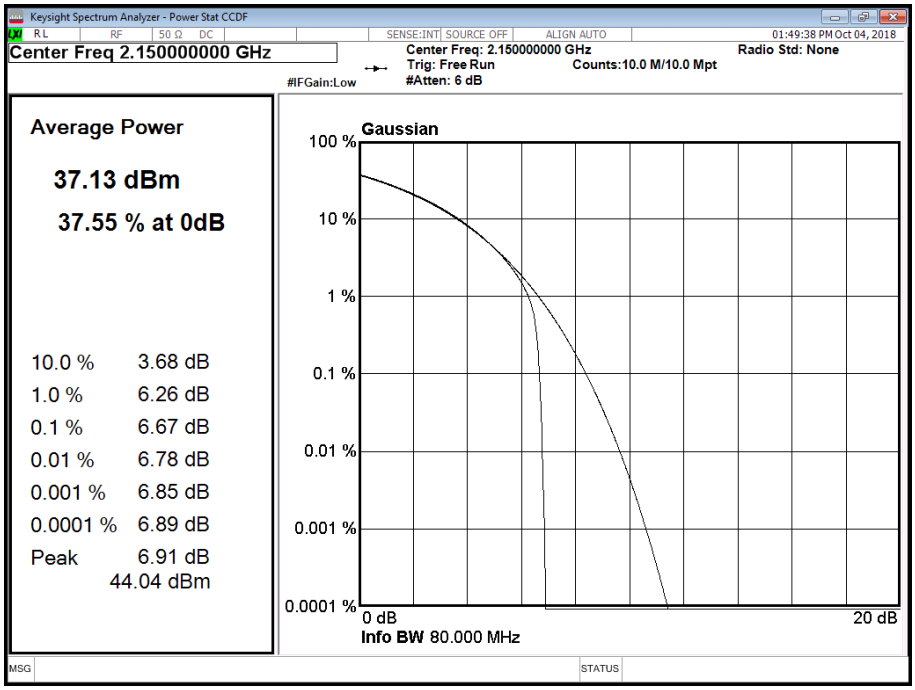


Configuration A

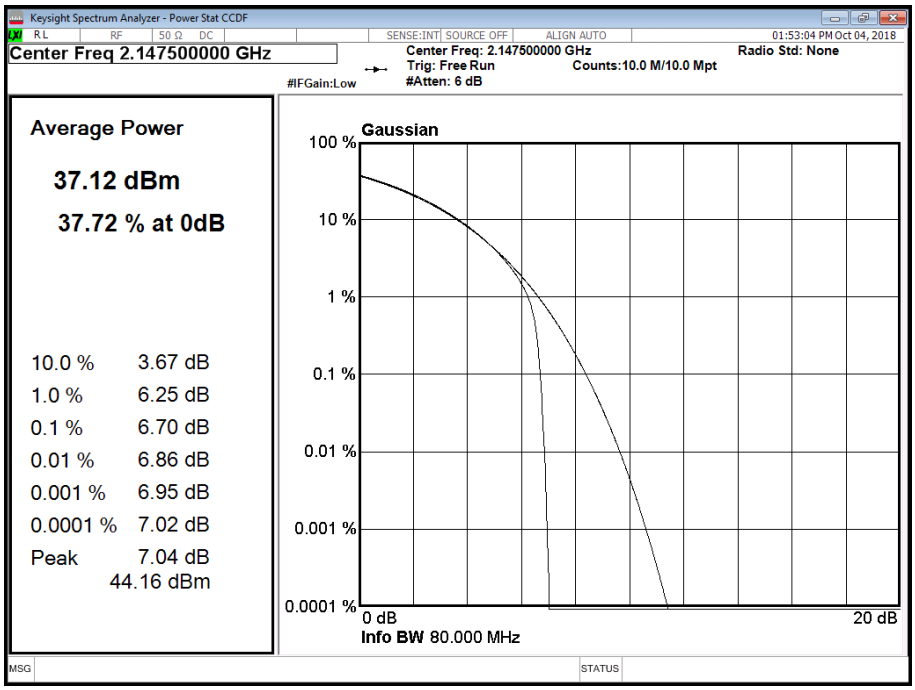
Maximum Output Power 37 dBm

Antenna	E-UTRA / NB-IoT GB Modulation	E-UTRA / NB-IoT GB Carrier Bandwidth	Peak to Average Ratio (PAR) / Output Power		
			Channel Position T		
			PAR (dB)	Average Power	
				dBm	dBm/MHz
A	64QAM	10.0 MHz	6.67	37.20	-
A	64QAM	15.0 MHz	6.70	37.27	-
A	64QAM	20.0 MHz	6.73	37.23	-

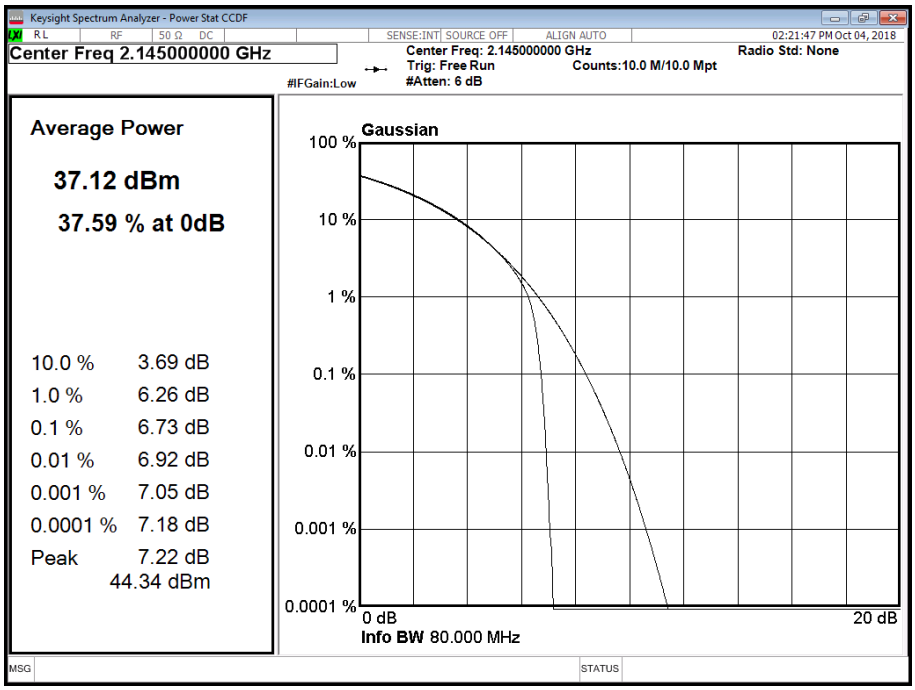
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 10.0 MHz - Channel Position T



Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 15.0 MHz - Channel Position T



Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 20.0 MHz - Channel Position T

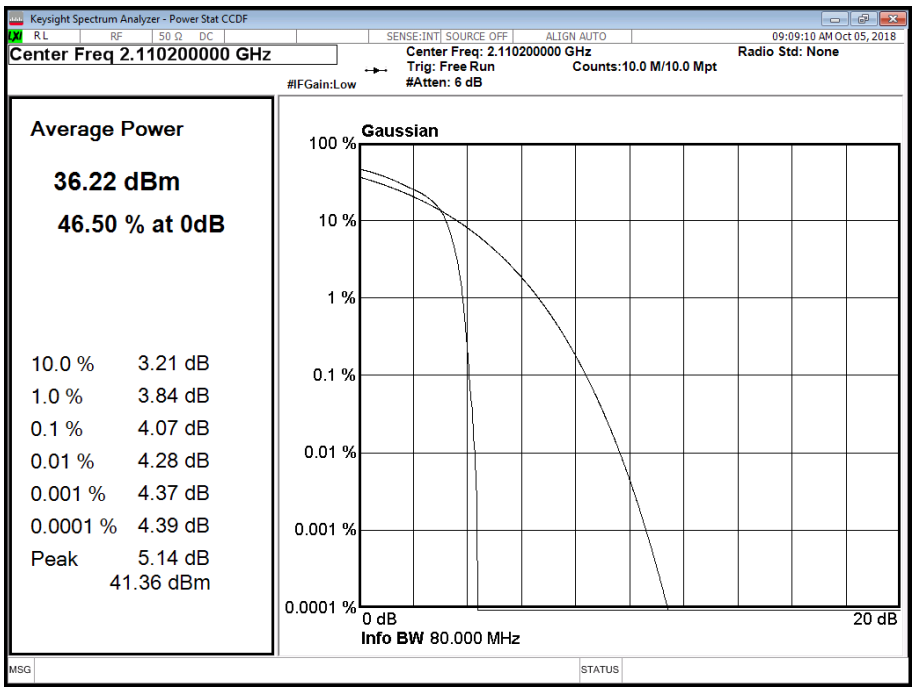


Configuration B

Maximum Output Power 37 dBm

Antenna	NB-IoT SA Modulation	NB-IoT SA Carrier Bandwidth	Peak to Average Ratio (PAR) / Output Power		
			Channel Position B		
			PAR (dB)	Average Power	
				dBm	dBm/MHz
A	N:QPSK	N:180 kHz	4.07	36.32	-

Antenna A - NB-IoT SA Modulation N:QPSK - NB-IoT SA Carrier Bandwidth N:180 kHz - Channel Position B

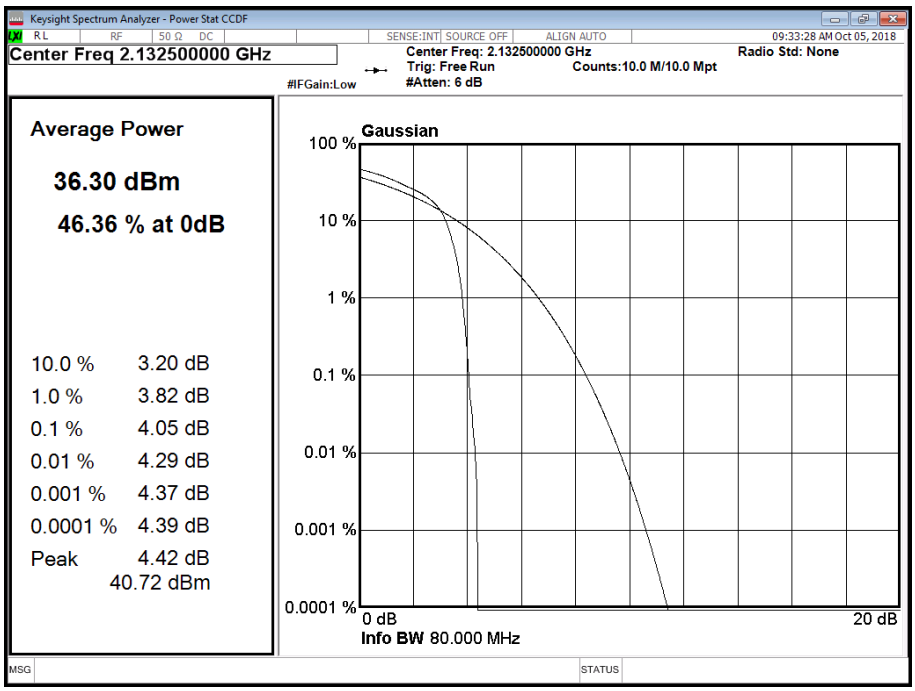


Configuration B

Maximum Output Power 37 dBm

Antenna	NB-IoT SA Modulation	NB-IoT SA Carrier Bandwidth	Peak to Average Ratio (PAR) / Output Power		
			Channel Position M		
			PAR (dB)	Average Power	
				dBm	dBm/MHz
A	N:QPSK	N:180 kHz	4.05	36.35	-

Antenna A - NB-IoT SA Modulation N:QPSK - NB-IoT SA Carrier Bandwidth N:180 kHz - Channel Position M

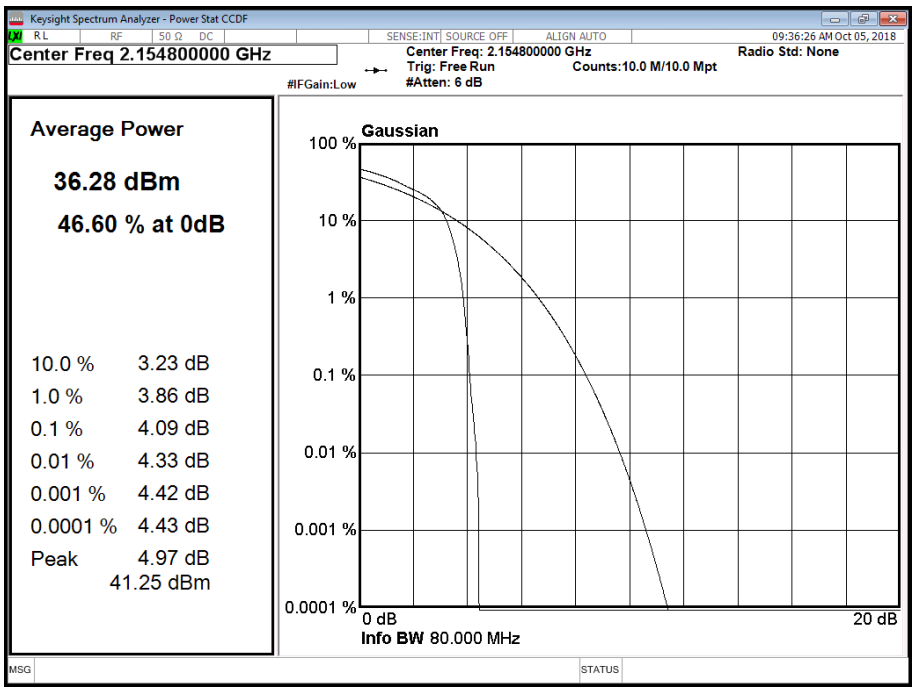


Configuration B

Maximum Output Power 37 dBm

Antenna	NB-IoT SA Modulation	NB-IoT SA Carrier Bandwidth	Peak to Average Ratio (PAR) / Output Power		
			Channel Position T		
			PAR (dB)	Average Power	
				dBm	dBm/MHz
A	N:QPSK	N:180 kHz	4.09	36.40	-

Antenna A - NB-IoT SA Modulation N:QPSK - NB-IoT SA Carrier Bandwidth N:180 kHz - Channel Position T



Limit	
Peak Power	≤500 W or ≤+57 dBm
Peak to Average Ratio	13 dB

2.2 OCCUPIED BANDWIDTH

2.2.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1049
FCC CFR 47 Part 27, Clause 27.53
Industry Canada RSS-GEN, Clause 6.6

2.2.2 Date of Test and Modification State

10 April and 10 May 2018 - Modification State 0

2.2.3 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.2.4 Environmental Conditions

Ambient Temperature	23.8 - 25.2°C
Relative Humidity	41.3 - 52.1%

2.2.5 Test Method

All measurements were made in accordance with FCC KDB 971168 D01.

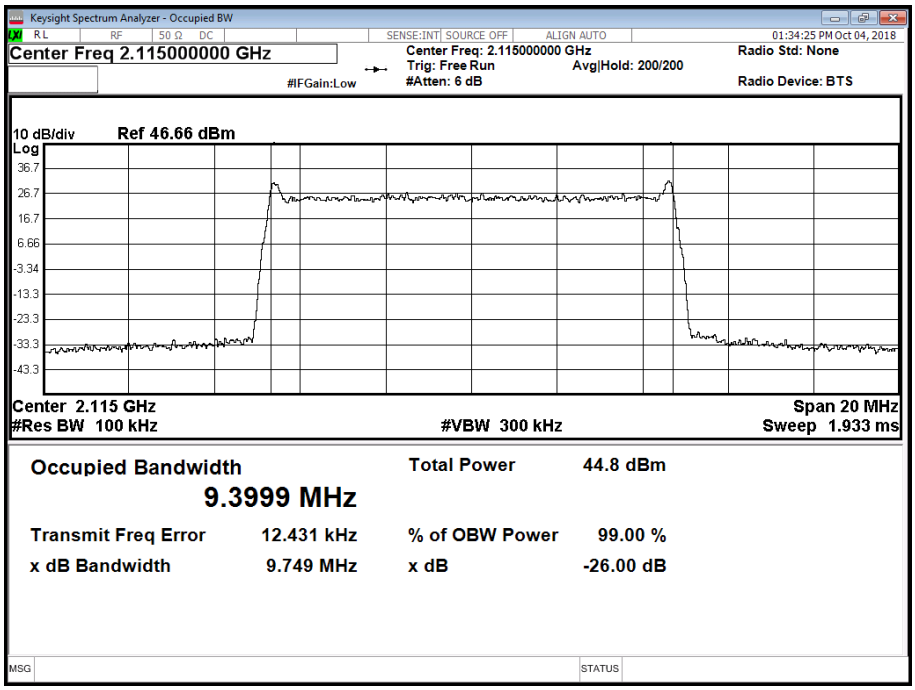
2.2.6 Test Results

Configuration A

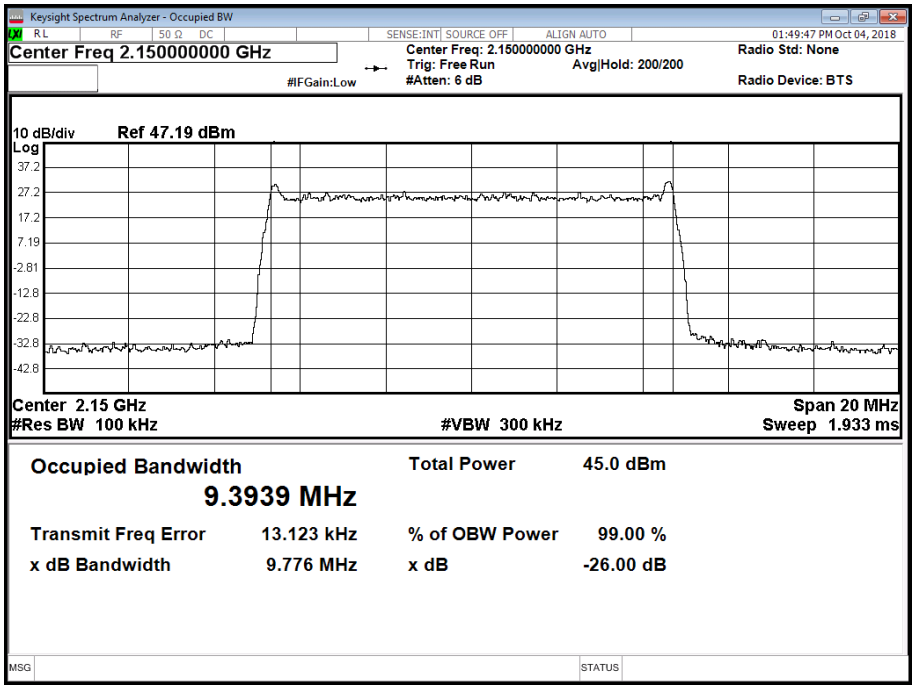
Maximum Output Power 37 dBm

Antenna	E-UTRA / NB-IoT GB Modulation	E-UTRA / NB-IoT GB Carrier Bandwidth	Result (KHz)					
			Channel Position B		Channel Position M		Channel Position T	
			Occupied Bandwidth	-26 dB Bandwidth	Occupied Bandwidth	-26 dB Bandwidth	Occupied Bandwidth	-26 dB Bandwidth
A	64QAM	10.0 MHz	9,399.88	9,749.37	-	-	9,393.91	9,776.48
A	64QAM	15.0 MHz	14,016.27	14,580.25	-	-	13,998.85	14,585.80
A	64QAM	20.0 MHz	18,462.45	19,380.39	-	-	18,445.00	19,260.31

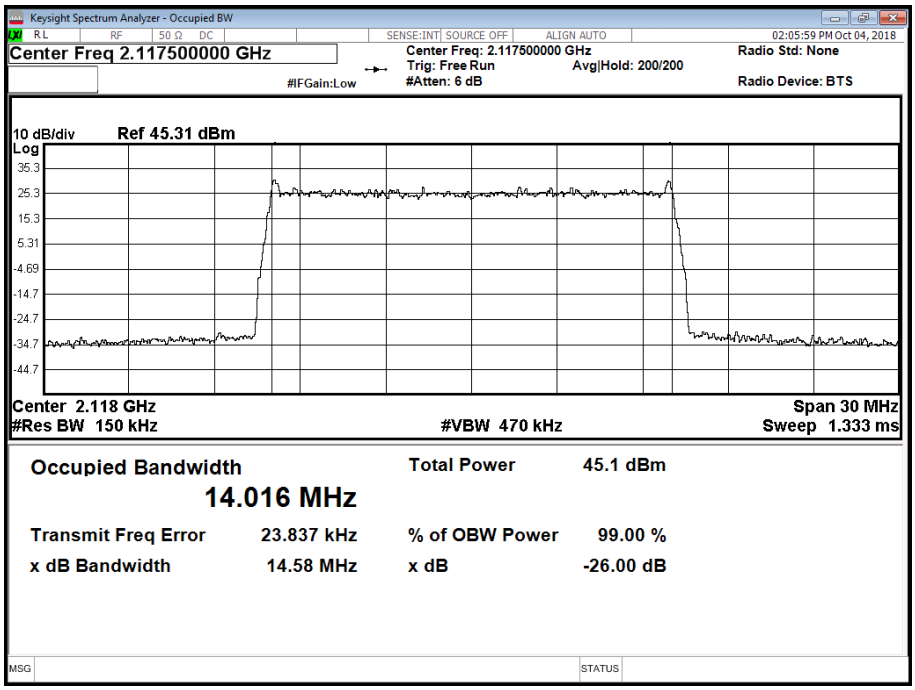
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 10.0 MHz - Channel Position B



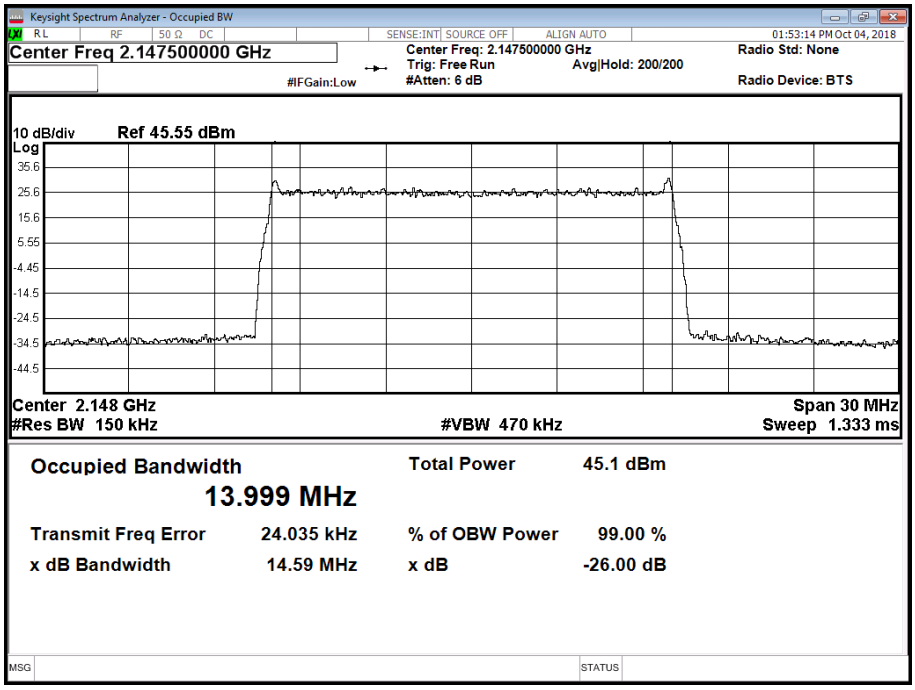
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 10.0 MHz - Channel Position T



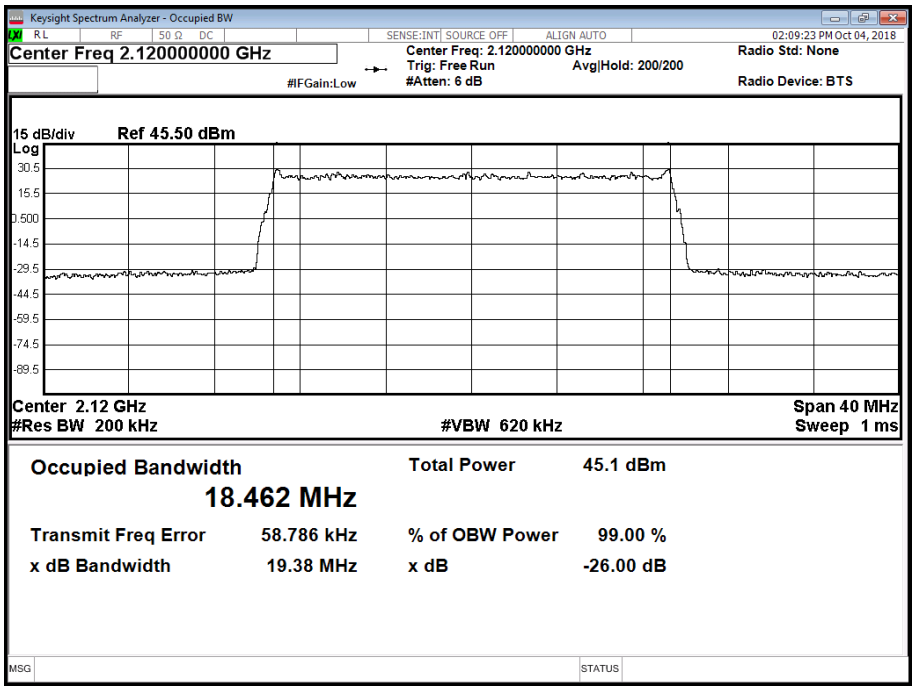
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 15.0 MHz - Channel Position B



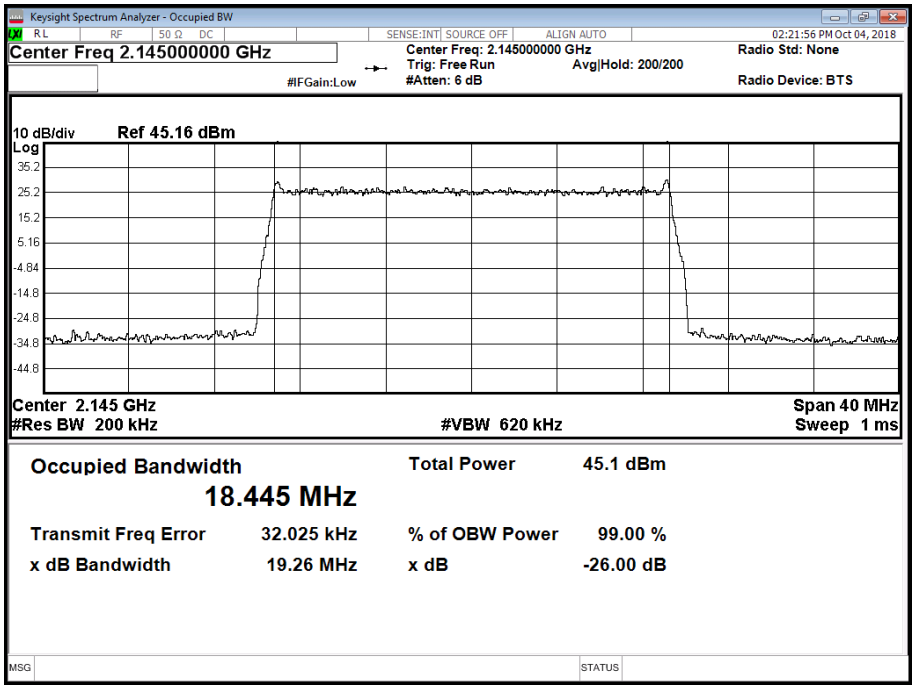
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 15.0 MHz - Channel Position T



Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 20.0 MHz - Channel Position B



Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 20.0 MHz - Channel Position T

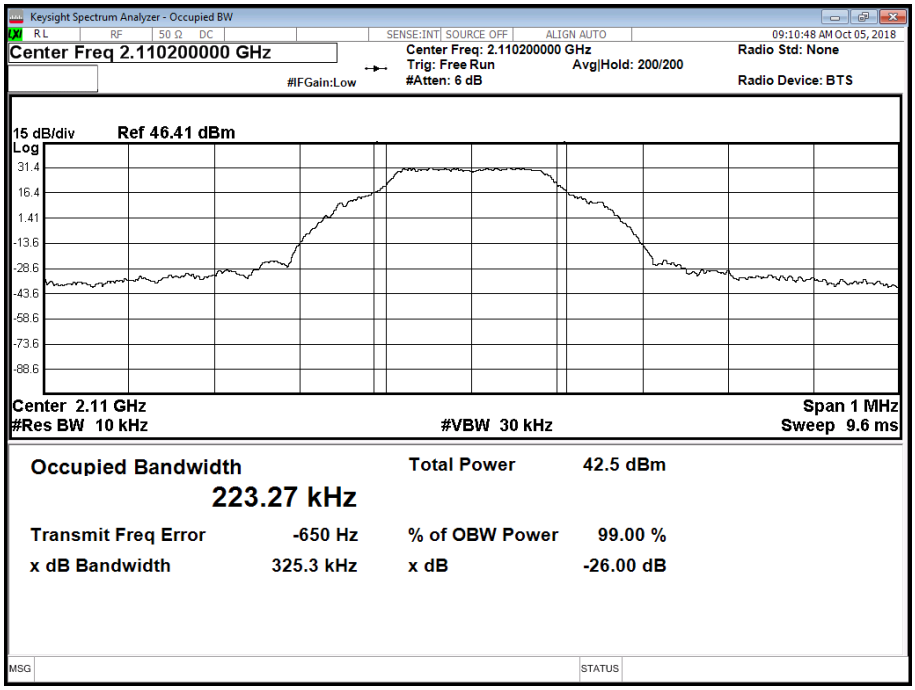


Configuration B

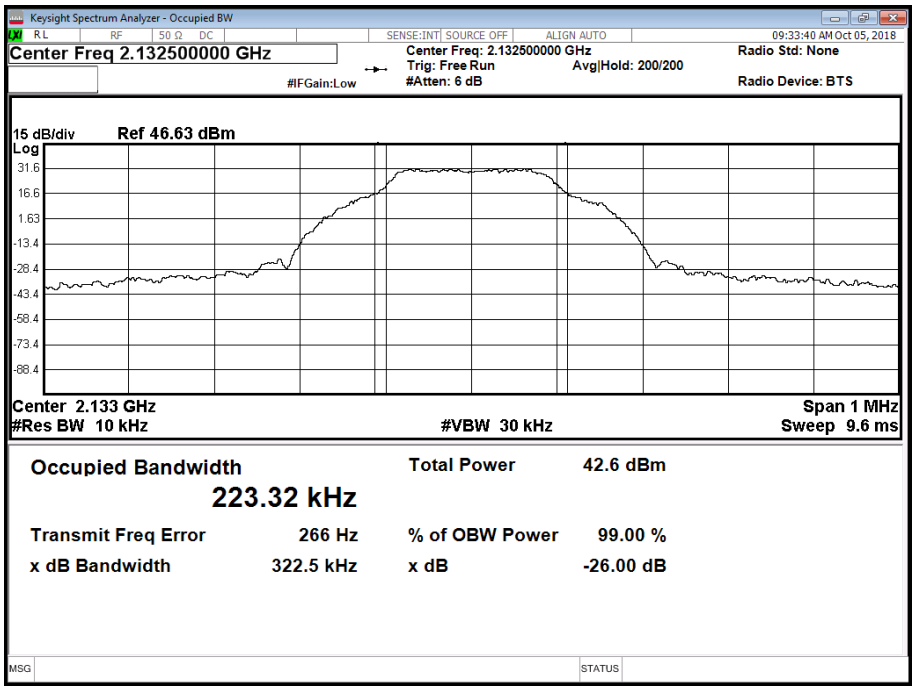
Maximum Output Power 37 dBm

Antenna	NB-IoT SA Modulation	NB-IoT SA Carrier Bandwidth	Result (KHz)					
			Channel Position B		Channel Position M		Channel Position T	
			Occupied Bandwidth	-26 dB Bandwidth	Occupied Bandwidth	-26 dB Bandwidth	Occupied Bandwidth	-26 dB Bandwidth
A	N:QPSK	N:180 kHz	223.27	325.34	223.32	322.54	222.36	324.14

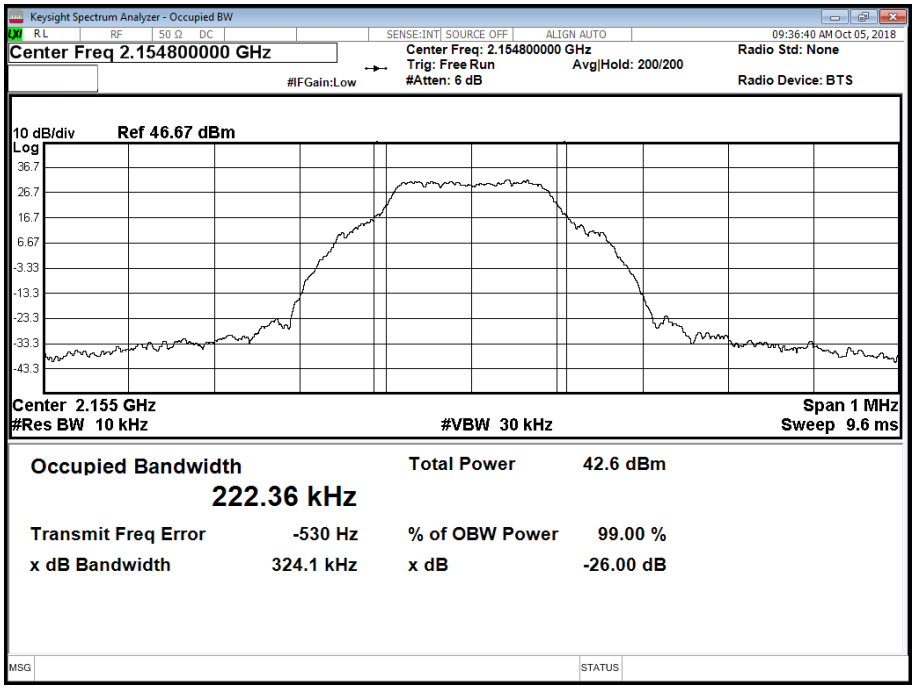
Antenna A - NB-IoT SA Modulation N:QPSK - NB-IoT SA Carrier Bandwidth N:180 kHz - Channel Position B



Antenna A - NB-IoT SA Modulation N:QPSK - NB-IoT SA Carrier Bandwidth N:180 kHz - Channel Position M



Antenna A - NB-IoT SA Modulation N:QPSK - NB-IoT SA Carrier Bandwidth N:180 kHz - Channel Position T



2.3 BAND EDGE

2.3.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1051
FCC CFR 47 Part 27, Clause 27.53 (h)
Industry Canada RSS-139, Clause 6.5

2.3.2 Date of Test and Modification State

10 April and 10 May 2018 - Modification State 0

2.3.3 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.3.4 Environmental Conditions

Ambient Temperature	23.8 - 25.2°C
Relative Humidity	41.3 - 52.1%

2.3.5 Test Method

All measurements were made in accordance with FCC KDB 971168 D01.

Each antenna port has been declared as being equivalent, therefore measurements were made on one antenna port only. To account for this, the limit was tightened by 10 * Log(N), where N is equal to the number of MIMO antenna ports.

For single carrier, the limit was calculated as being -13 dBm - 10 * Log (4) = -19 dBm.

For dual carrier, the limit was calculated as being -13 dBm - 10 * Log (2) = -16 dBm.

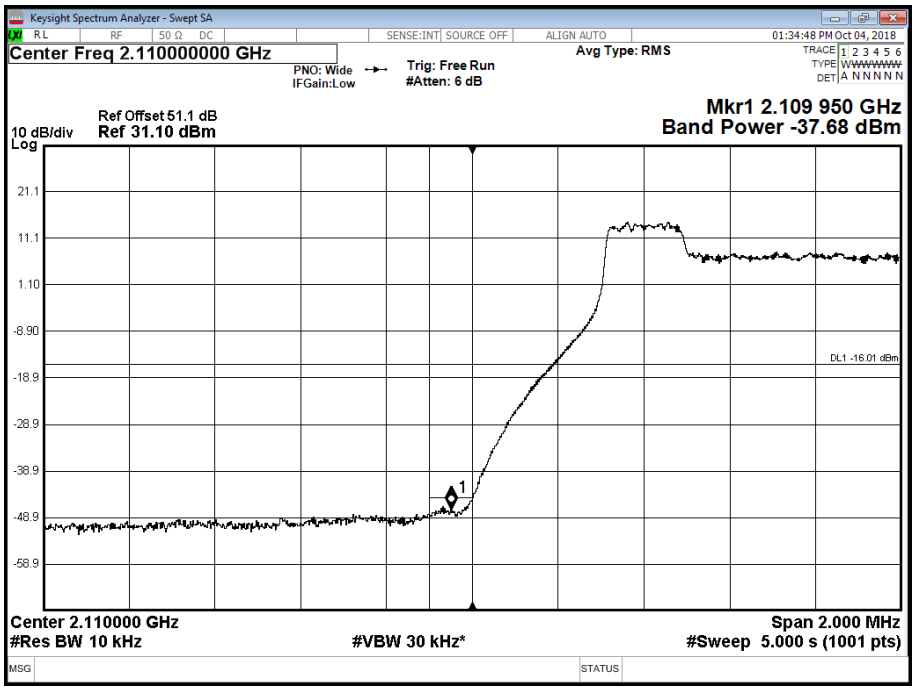
2.3.6 Test Results

Configuration A

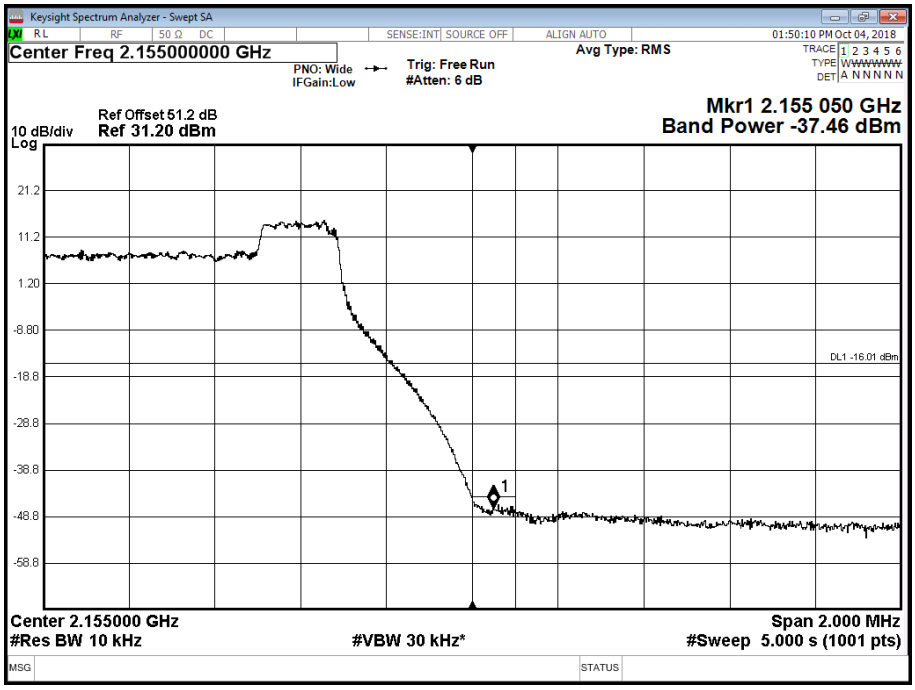
Maximum Output Power 37 dBm

Antenna	E-UTRA / NB-IoT GB Modulation	E-UTRA / NB-IoT GB Carrier Bandwidth	Band Edge (MHz)	
			Channel Position B	Channel Position T
A	64QAM	10.0 MHz	2,115.0	2,150.0
A	64QAM	15.0 MHz	2,117.5	2,147.5
A	64QAM	20.0 MHz	2,120.0	2,145.0

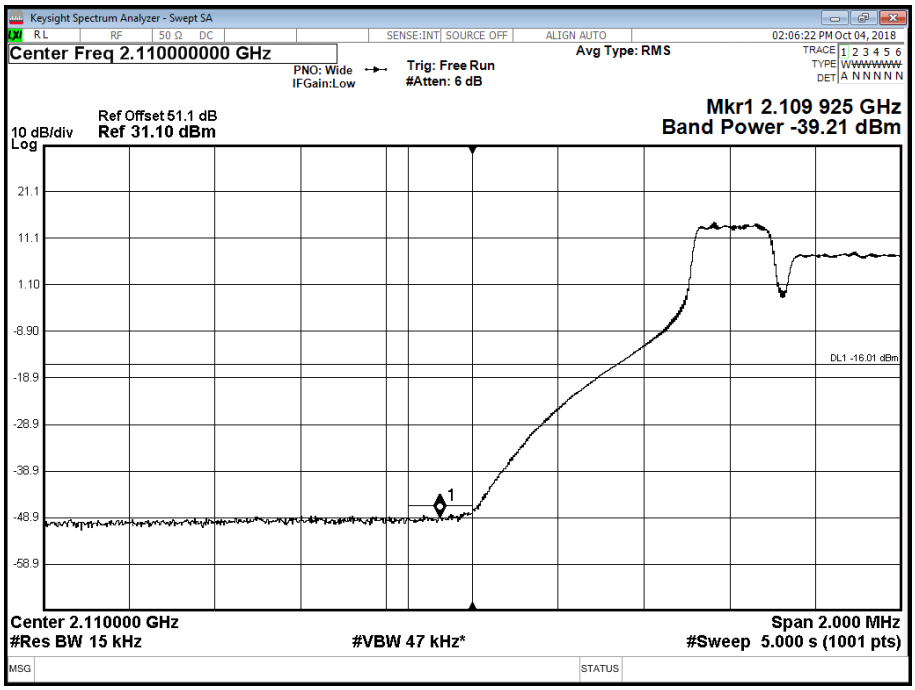
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 10.0 MHz - Channel Position B



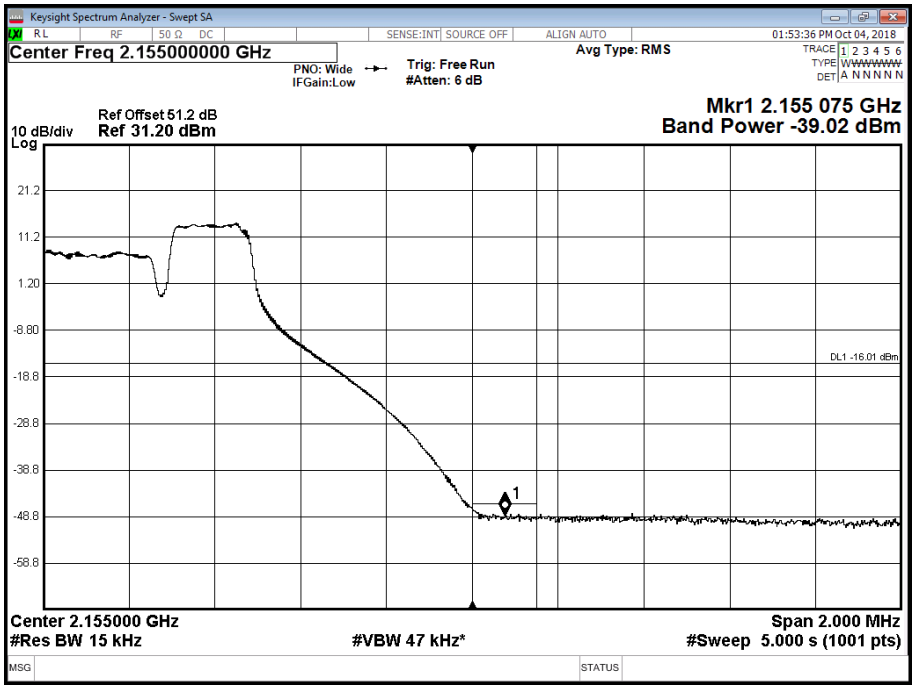
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 10.0 MHz - Channel Position T



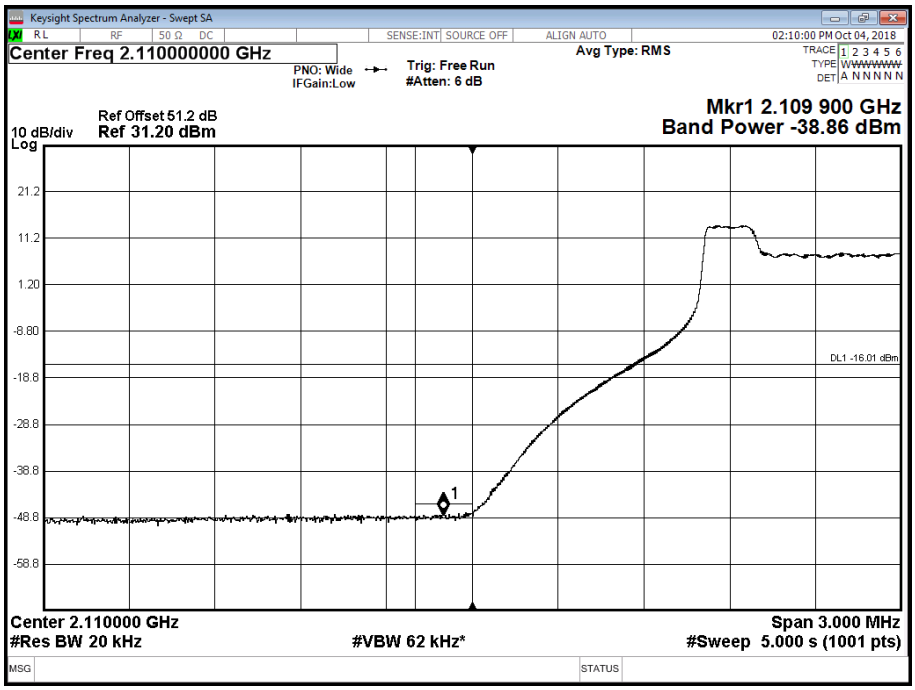
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 15.0 MHz - Channel Position B



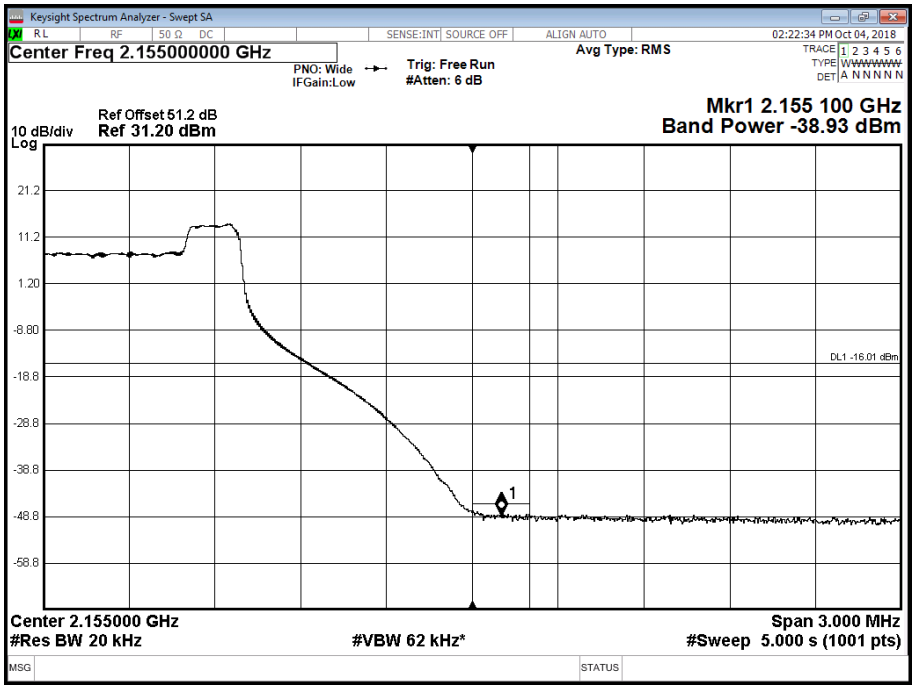
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 15.0 MHz - Channel Position T



Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 20.0 MHz - Channel Position B



Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 20.0 MHz - Channel Position T

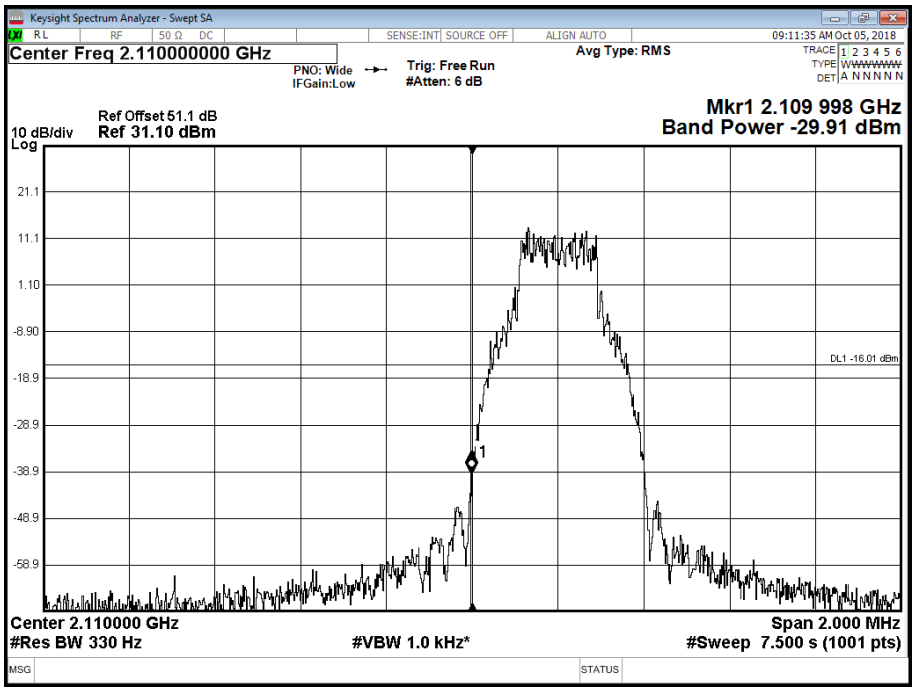


Configuration B

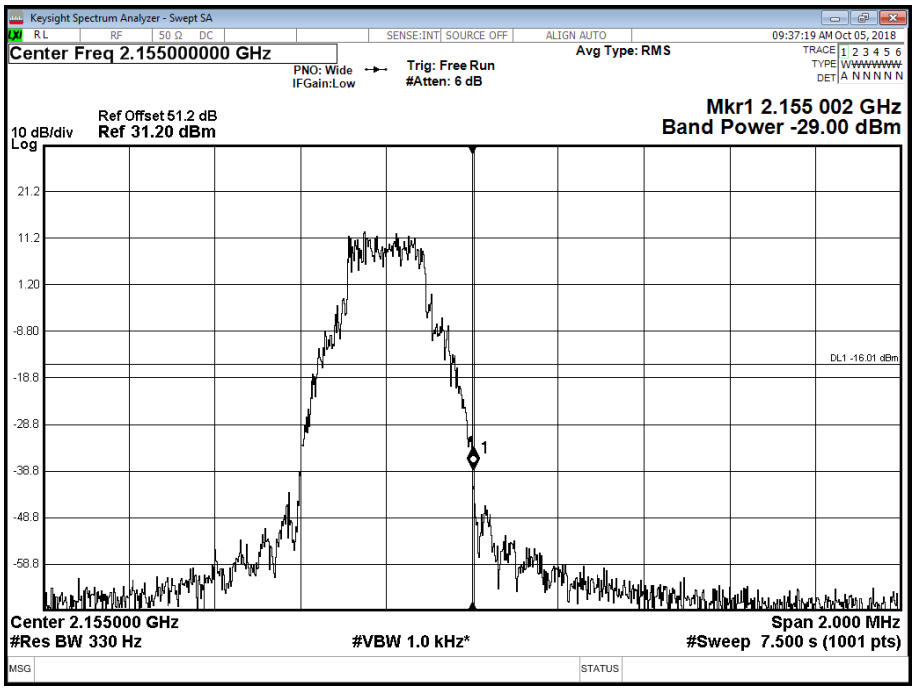
Maximum Output Power 37 dBm

Antenna	NB-IoT SA Modulation	NB-IoT SA Carrier Bandwidth	Band Edge (MHz)	
			Channel Position B	Channel Position T
A	N:QPSK	N:180 kHz	2,110.2	2,154.8

Antenna A - NB-IoT SA Modulation N:QPSK - NB-IoT SA Carrier Bandwidth N:180 kHz - Channel Position B



Antenna A - NB-IoT SA Modulation N:QPSK - NB-IoT SA Carrier Bandwidth N:180 kHz - Channel Position T



Limit	-16 dBm

2.4 TRANSMITTER SPURIOUS EMISSIONS

2.4.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1051
FCC CFR 47 Part 27, Clause 27.53 (h)
Industry Canada RSS-139, Clause 6.5

2.4.2 Date of Test and Modification State

10 April and 10 May 2018 - Modification State 0

2.4.3 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.4.4 Environmental Conditions

Ambient Temperature	23.8 - 25.2°C
Relative Humidity	41.3 - 52.1%

2.4.5 Test Method

All measurements were made in accordance with FCC KDB 971168 D01.

Each antenna port has been declared as being equivalent, therefore measurements were made on one antenna port only. To account for this, the limit was tightened by 10 * Log(N), where N is equal to the number of MIMO antenna ports.

For single carrier, the limit was calculated as being -13 dBm - 10 * Log (4) = -19 dBm.

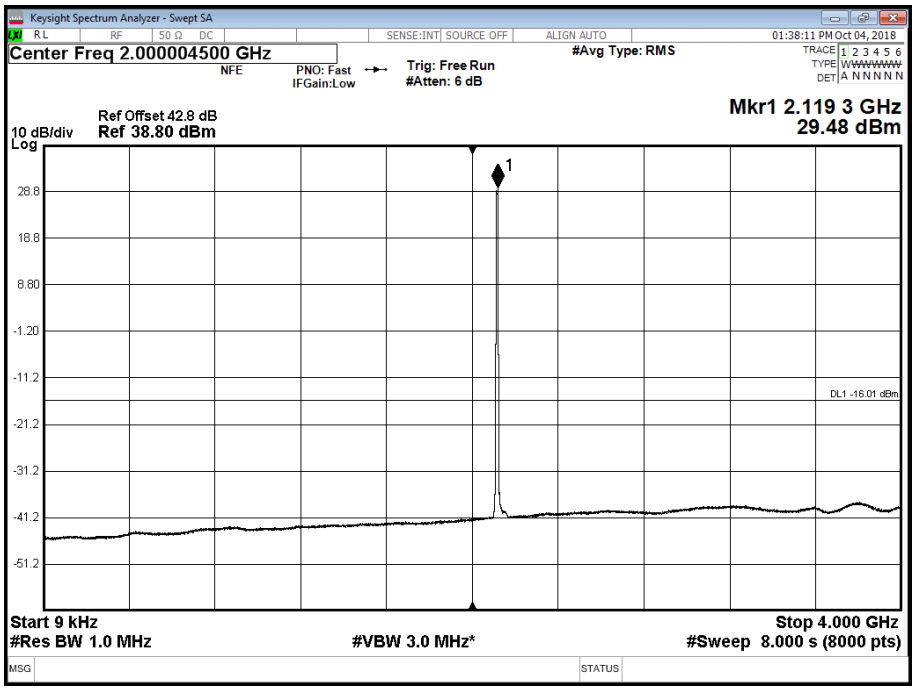
For dual carrier, the limit was calculated as being -13 dBm - 10 * Log (2) = -16 dBm.

2.4.6 Test Results

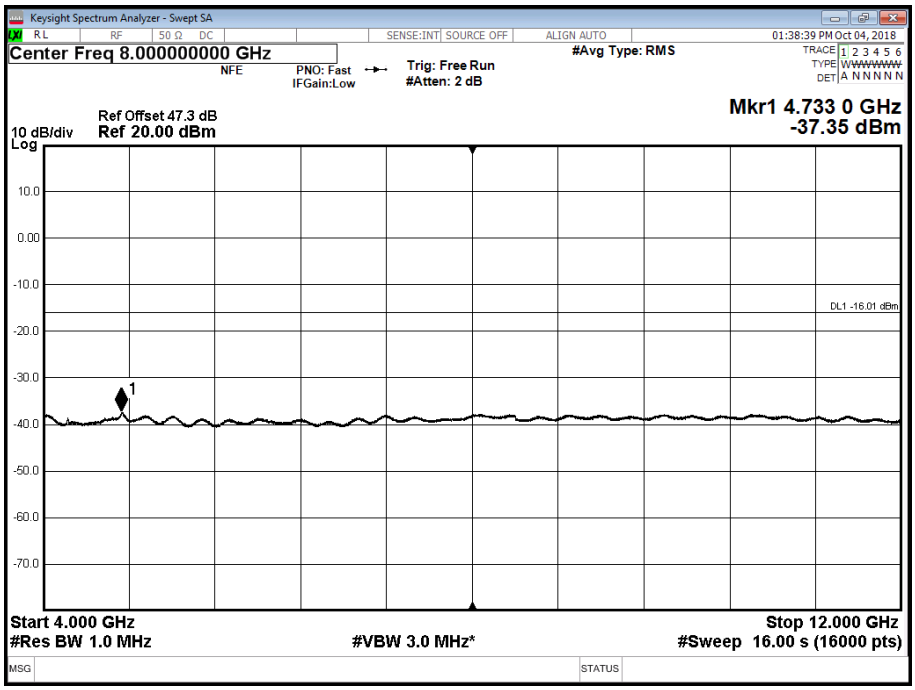
Configuration A

Maximum Output Power 37 dBm

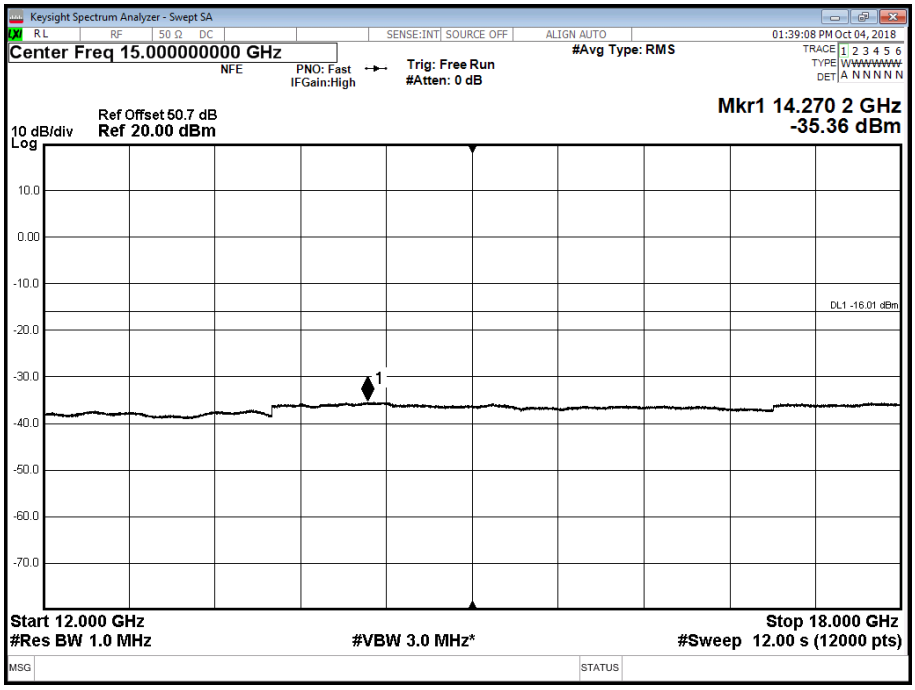
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 10.0 MHz - Channel Position B - Band 1 - Range 0.009 to 4000 MHz



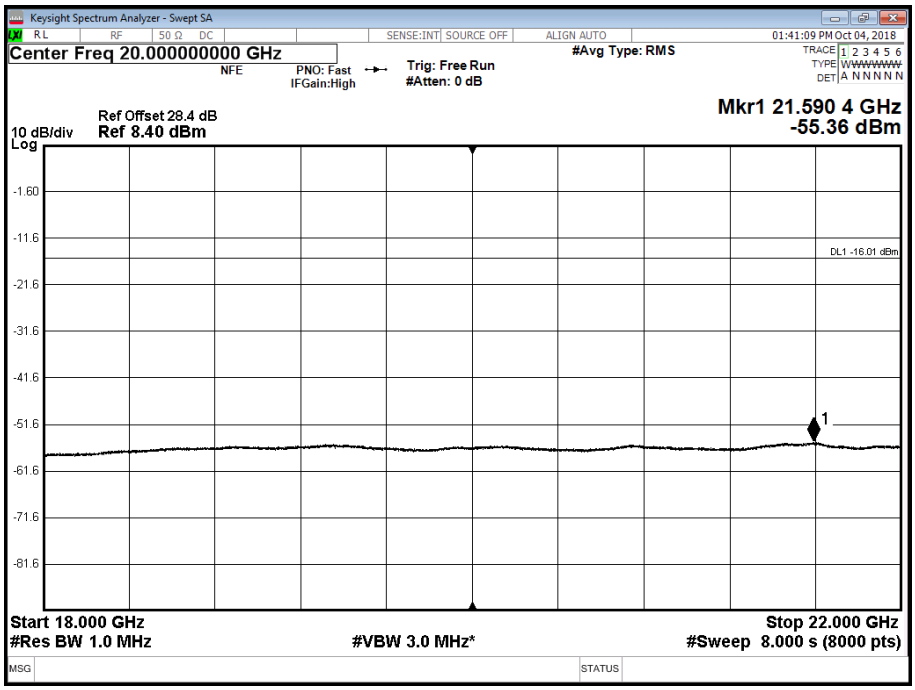
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 10.0 MHz - Channel Position B - Band 2 - Range 4000 to 12000 MHz



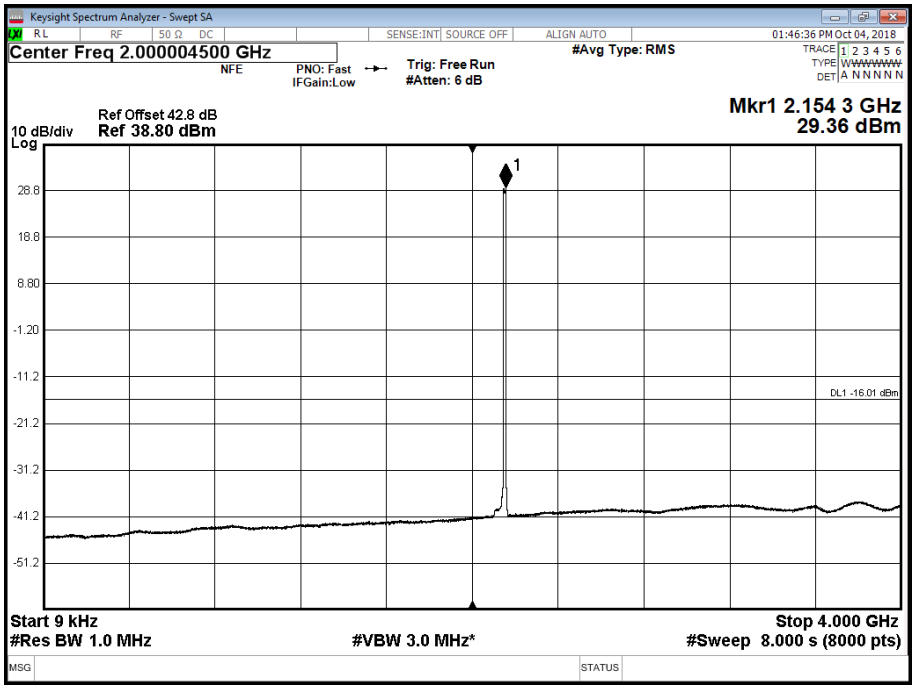
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 10.0 MHz - Channel Position B - Band 3 - Range 12000 to 18000 MHz



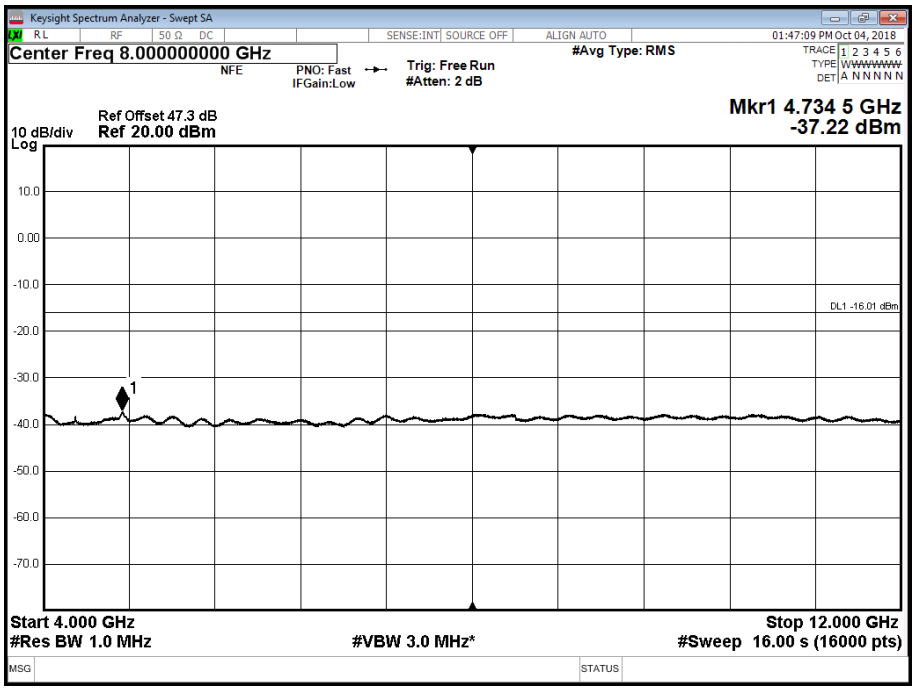
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 10.0 MHz - Channel Position B - Band 4 - Range 18000 to 22000 MHz



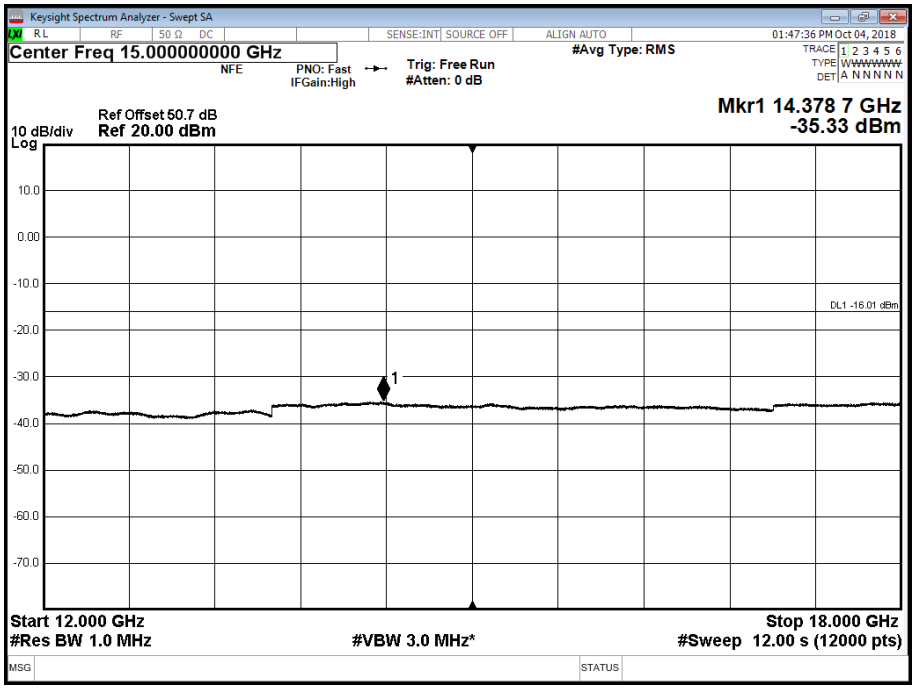
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 10.0 MHz - Channel Position T - Band 1 - Range 0.009 to 4000 MHz



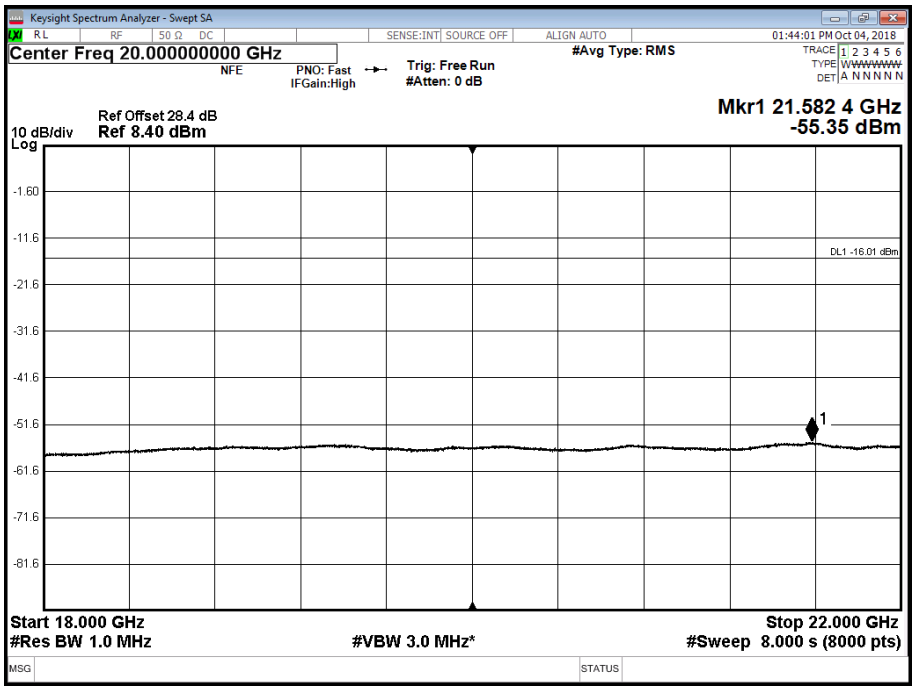
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 10.0 MHz - Channel Position T - Band 2 - Range 4000 to 12000 MHz



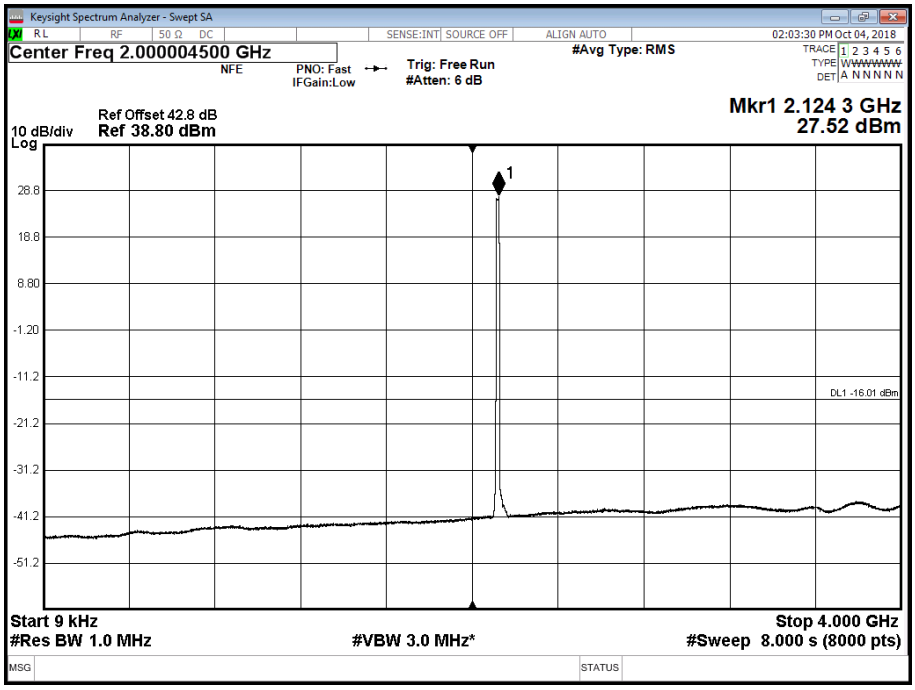
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 10.0 MHz - Channel Position T - Band 3 - Range 12000 to 18000 MHz



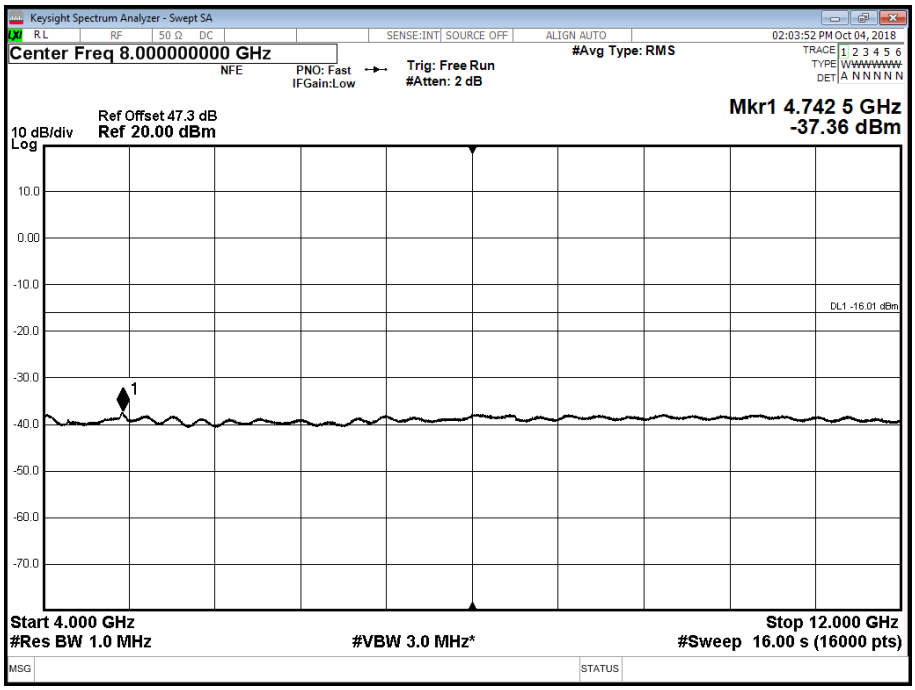
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 10.0 MHz - Channel Position T - Band 4 - Range 18000 to 22000 MHz



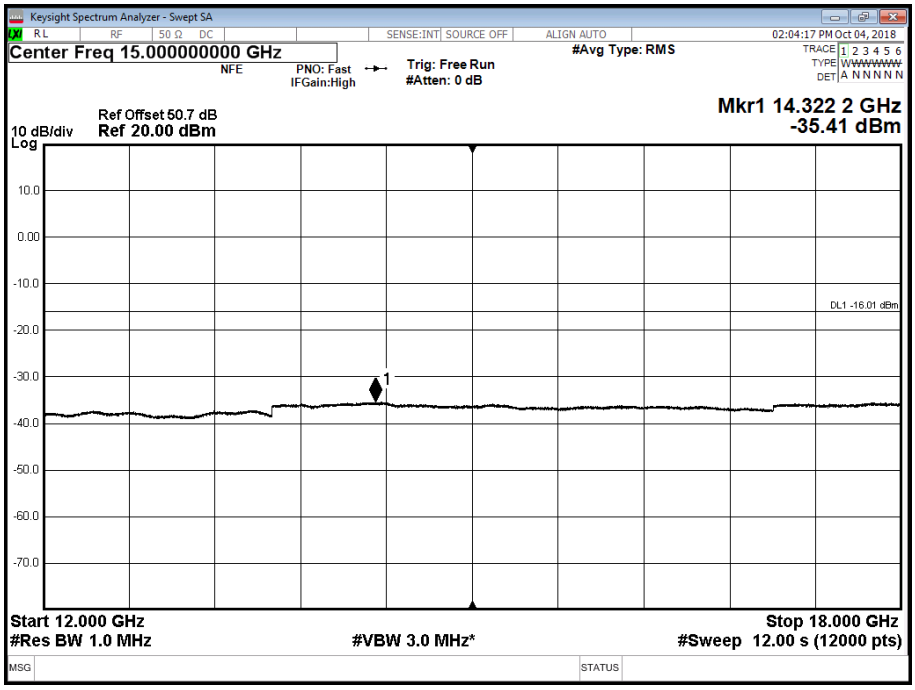
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 15.0 MHz - Channel Position B - Band 1 - Range 0.009 to 4000 MHz



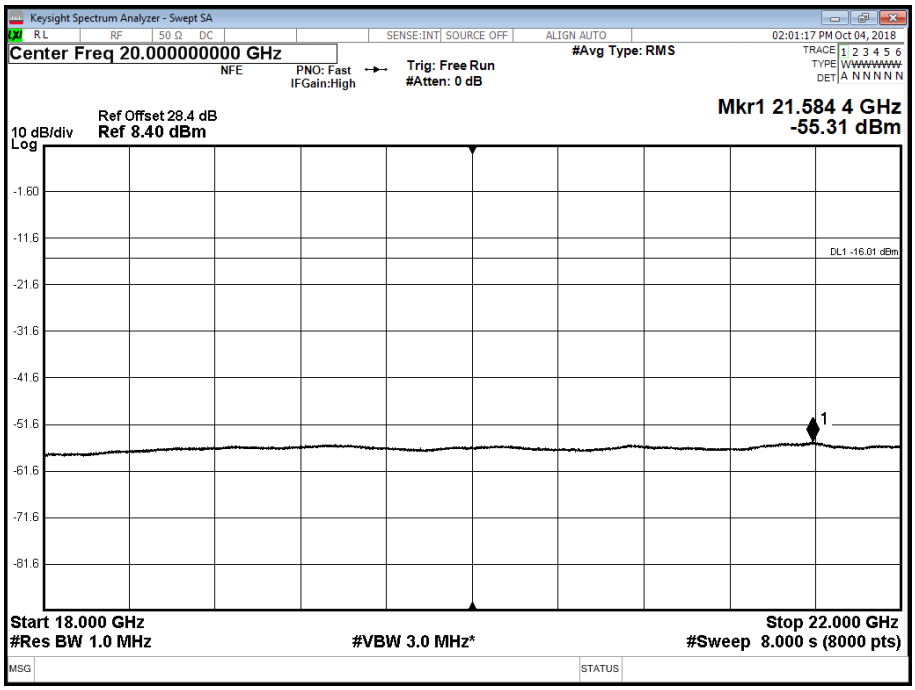
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 15.0 MHz - Channel Position B - Band 2 - Range 4000 to 12000 MHz



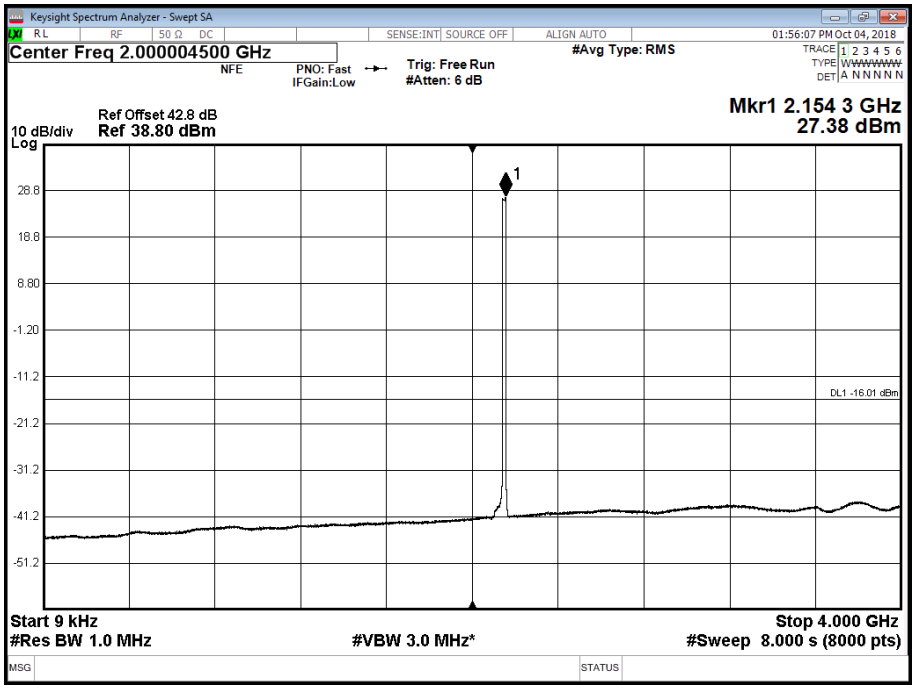
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 15.0 MHz - Channel Position B - Band 3 - Range 12000 to 18000 MHz



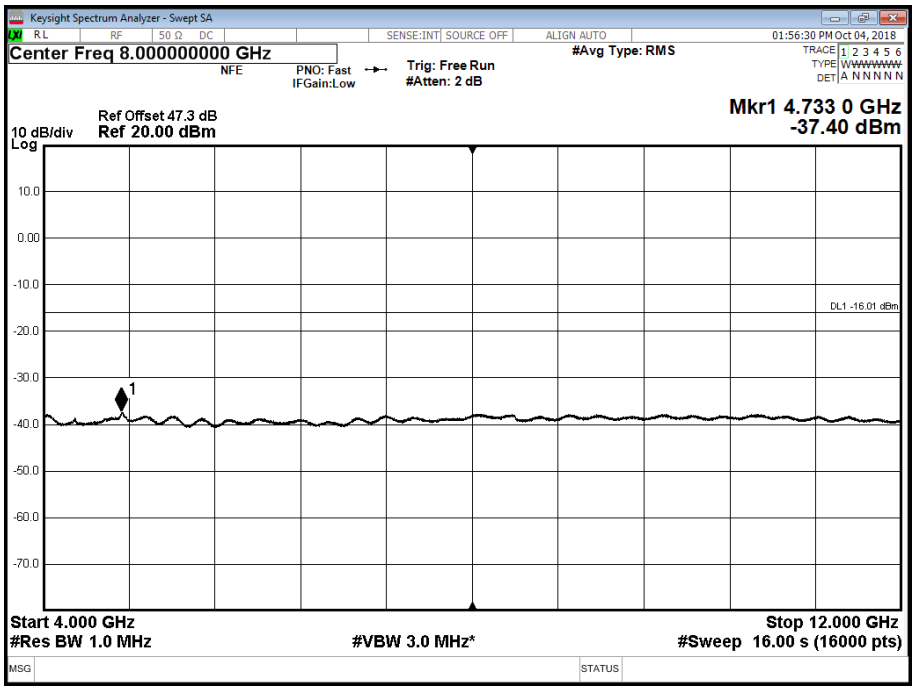
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 15.0 MHz - Channel Position B - Band 4 - Range 18000 to 22000 MHz



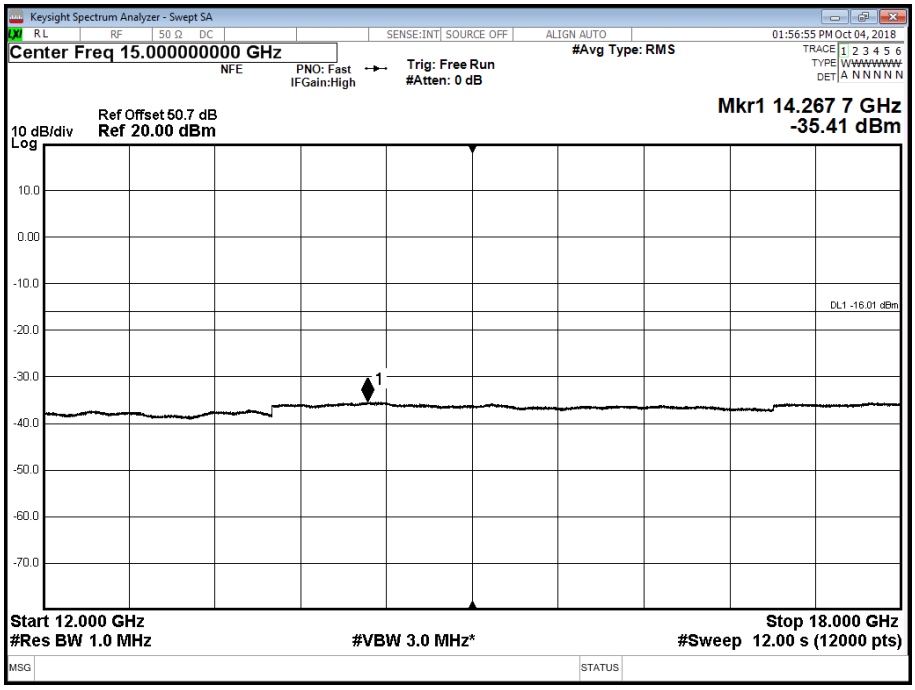
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 15.0 MHz - Channel Position T - Band 1 - Range 0.009 to 4000 MHz



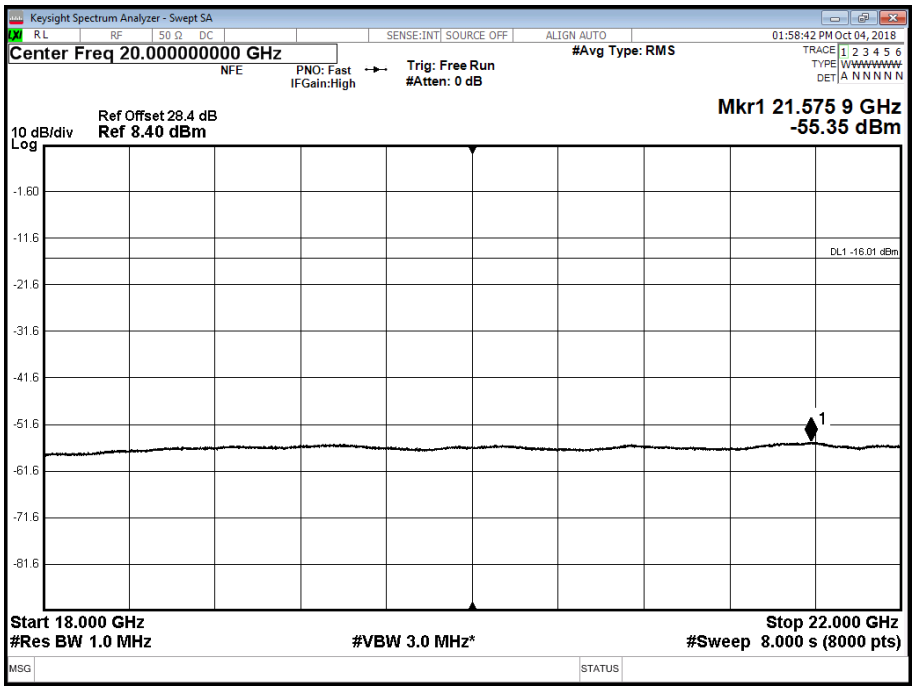
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 15.0 MHz - Channel Position T - Band 2 - Range 4000 to 12000 MHz



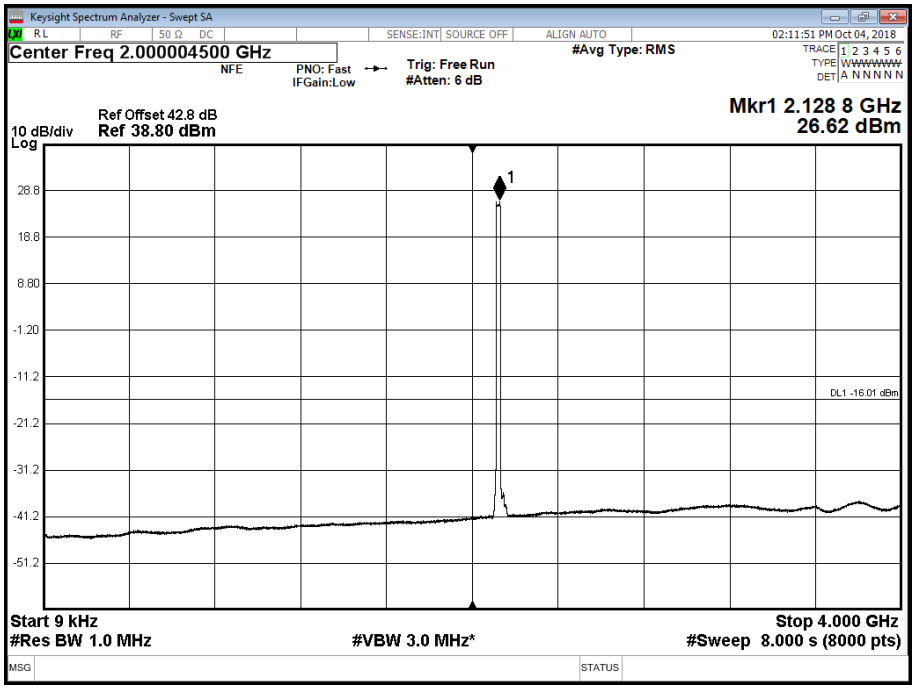
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 15.0 MHz - Channel Position T - Band 3 - Range 12000 to 18000 MHz



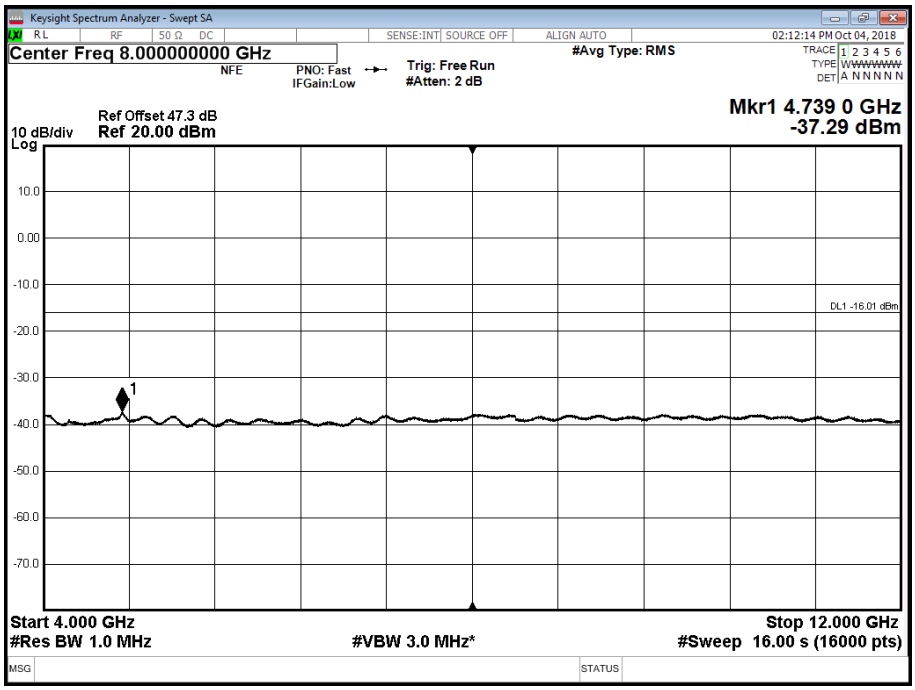
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 15.0 MHz - Channel Position T - Band 4 - Range 18000 to 22000 MHz



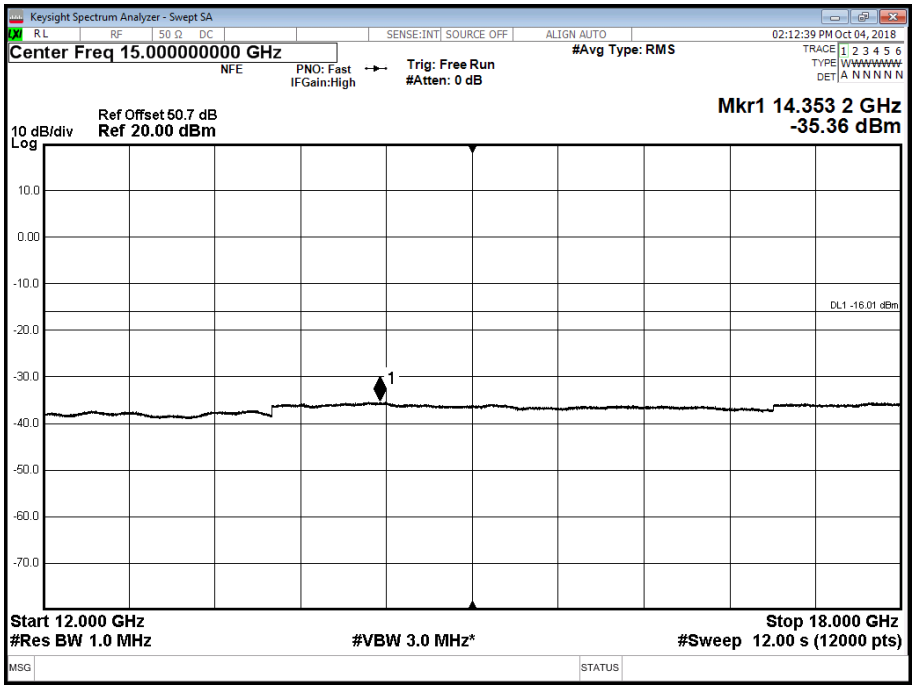
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 20.0 MHz - Channel Position B - Band 1 - Range 0.009 to 4000 MHz



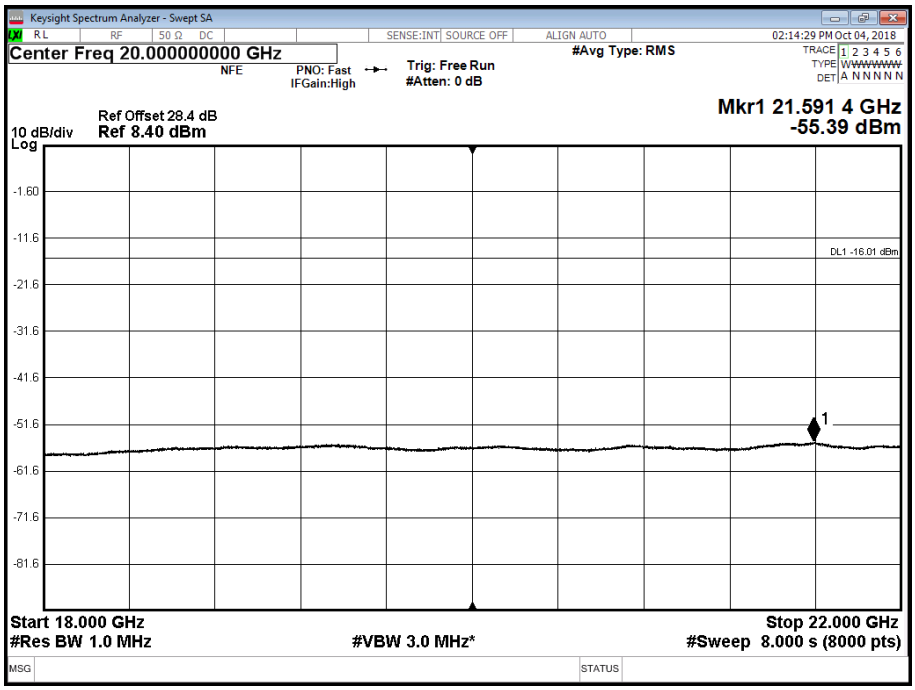
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 20.0 MHz - Channel Position B - Band 2 - Range 4000 to 12000 MHz



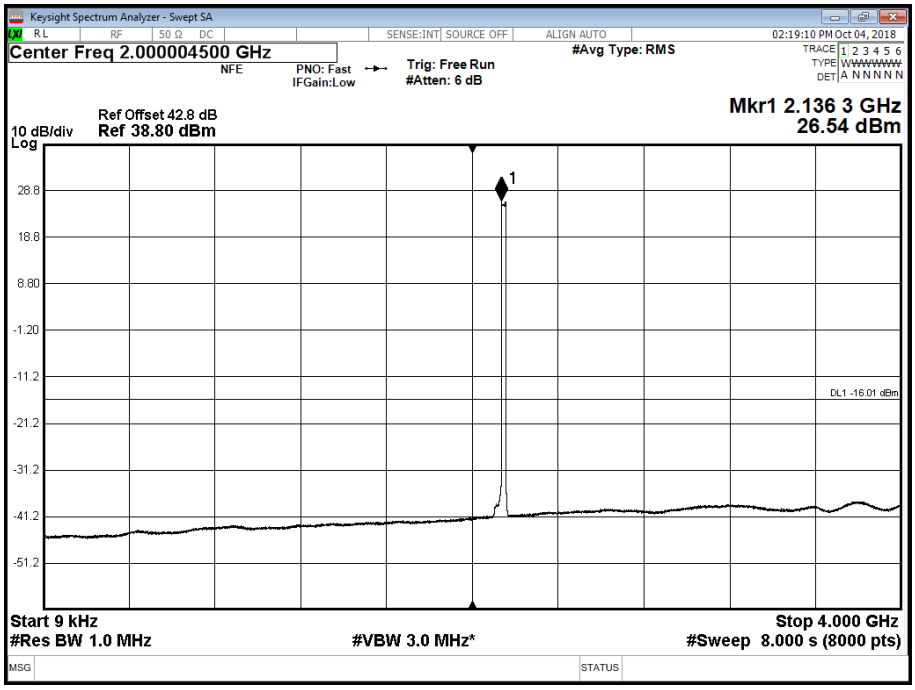
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 20.0 MHz - Channel Position B - Band 3 - Range 12000 to 18000 MHz



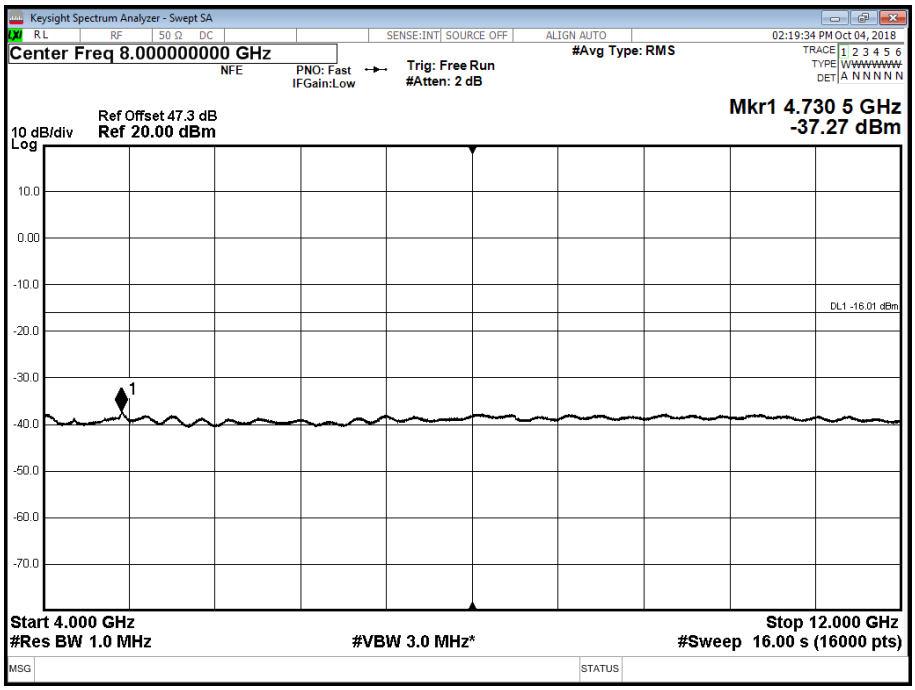
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 20.0 MHz - Channel Position B - Band 4 - Range 18000 to 22000 MHz



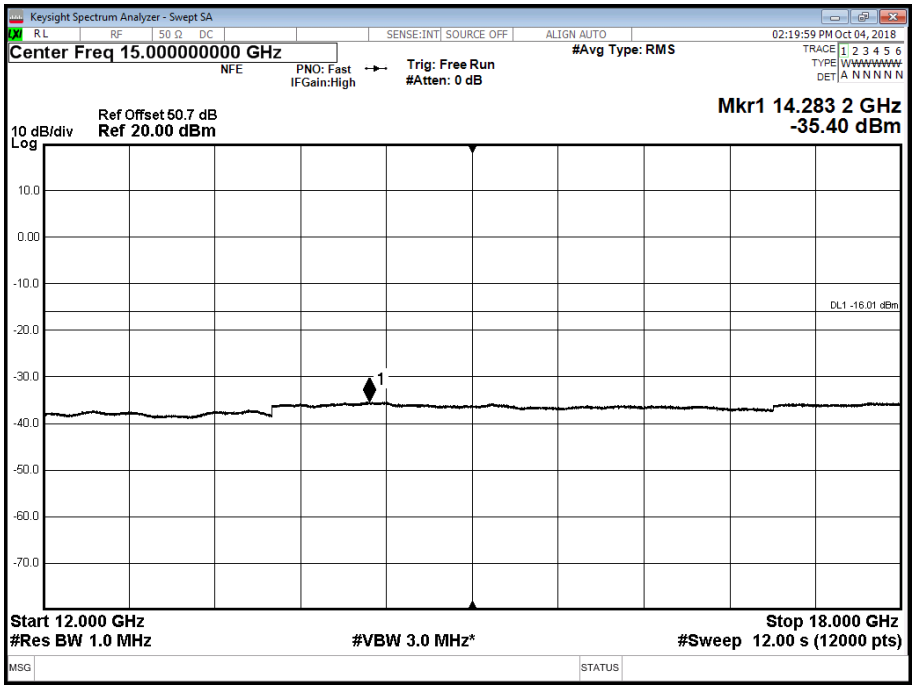
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 20.0 MHz - Channel Position T - Band 1 - Range 0.009 to 4000 MHz



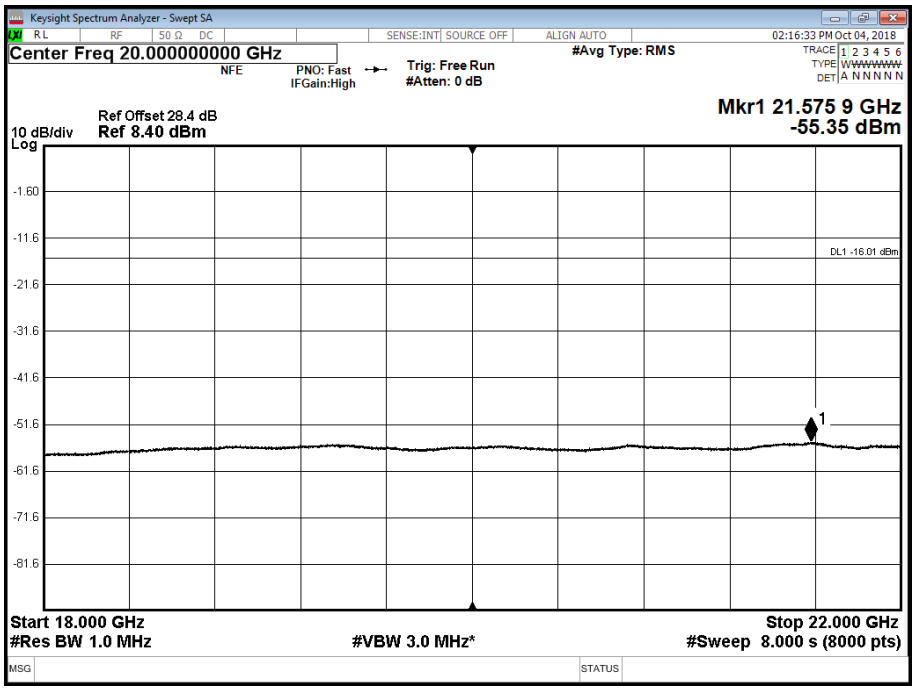
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 20.0 MHz - Channel Position T - Band 2 - Range 4000 to 12000 MHz



Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 20.0 MHz - Channel Position T - Band 3 - Range 12000 to 18000 MHz



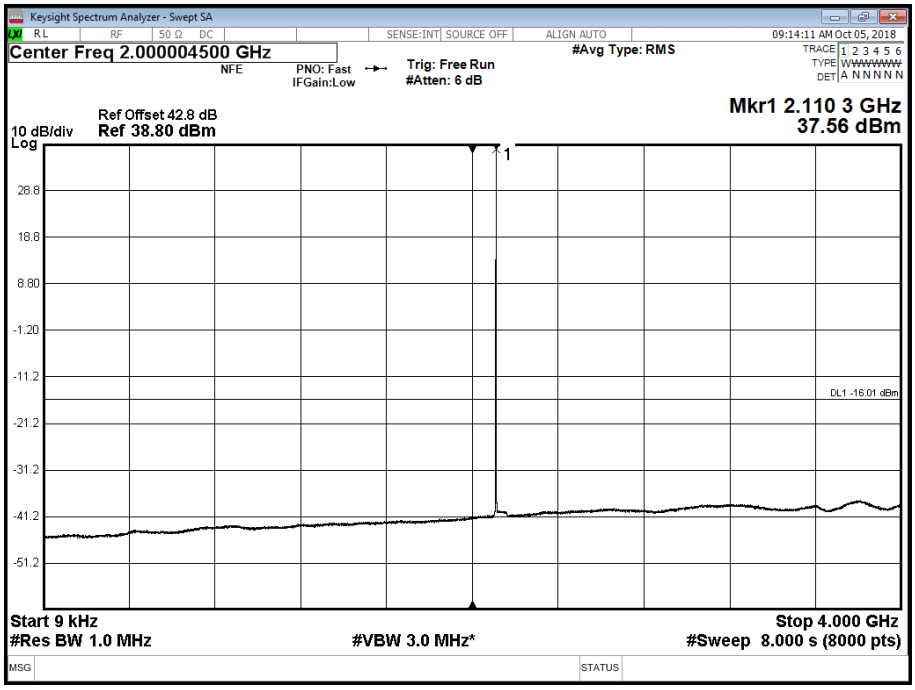
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 20.0 MHz - Channel Position T - Band 4 - Range 18000 to 22000 MHz



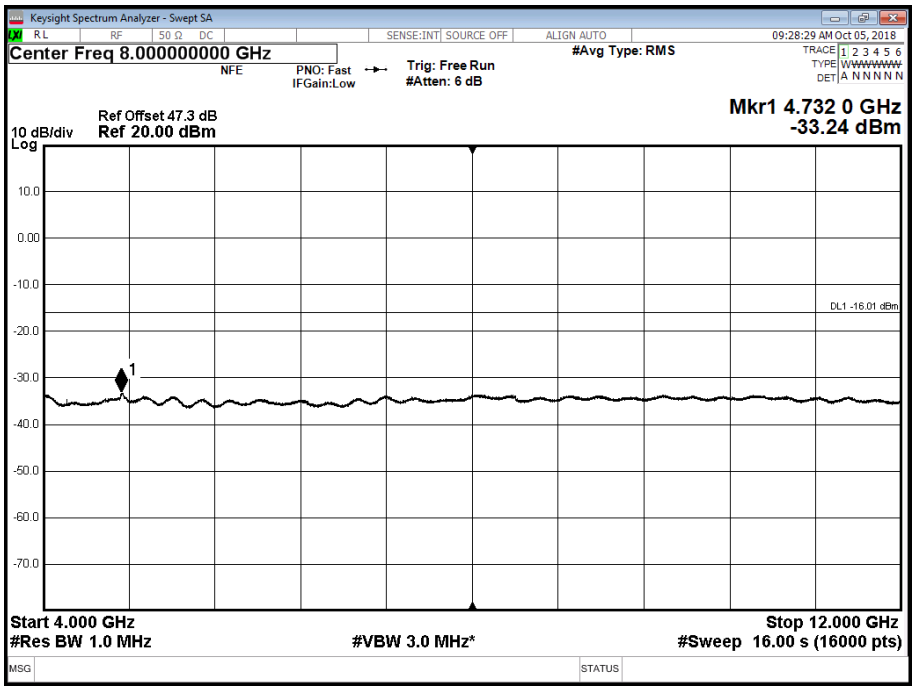
Configuration B

Maximum Output Power 37 dBm

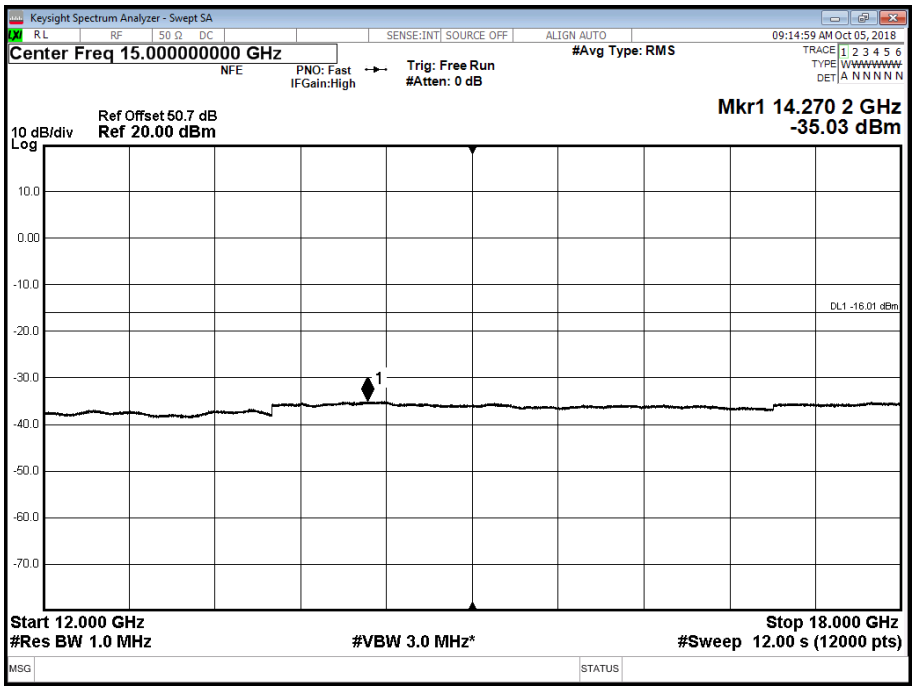
Antenna A - NB-IoT SA Modulation N:QPSK - NB-IoT SA Carrier Bandwidth N:180 kHz - Channel Position B - Band 1 - Range 0.009 to 4000 MHz



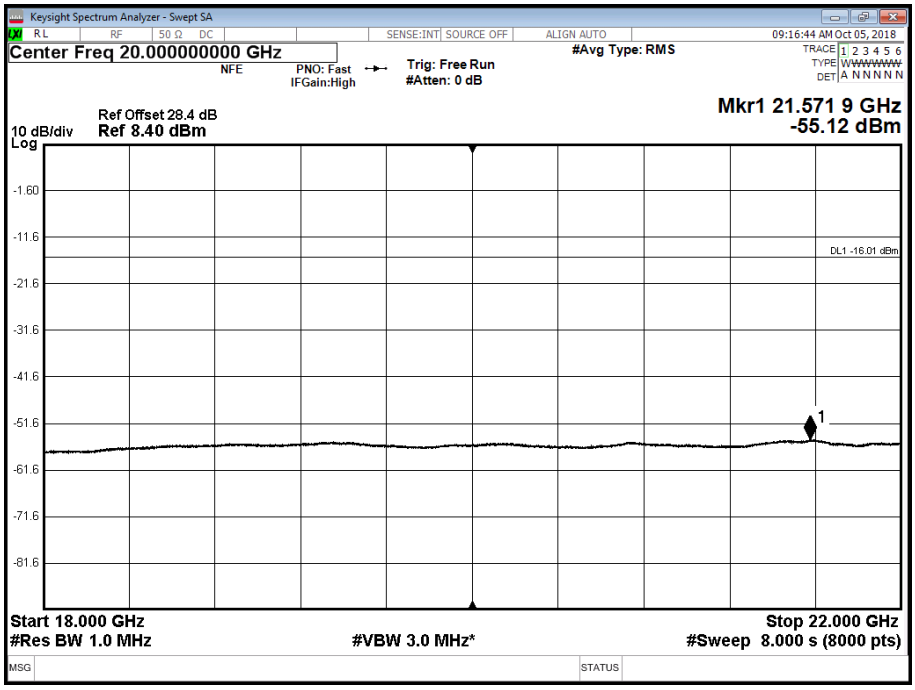
Antenna A - NB-IoT SA Modulation N:QPSK - NB-IoT SA Carrier Bandwidth N:180 kHz - Channel Position B - Band 2 - Range 4000 to 12000 MHz



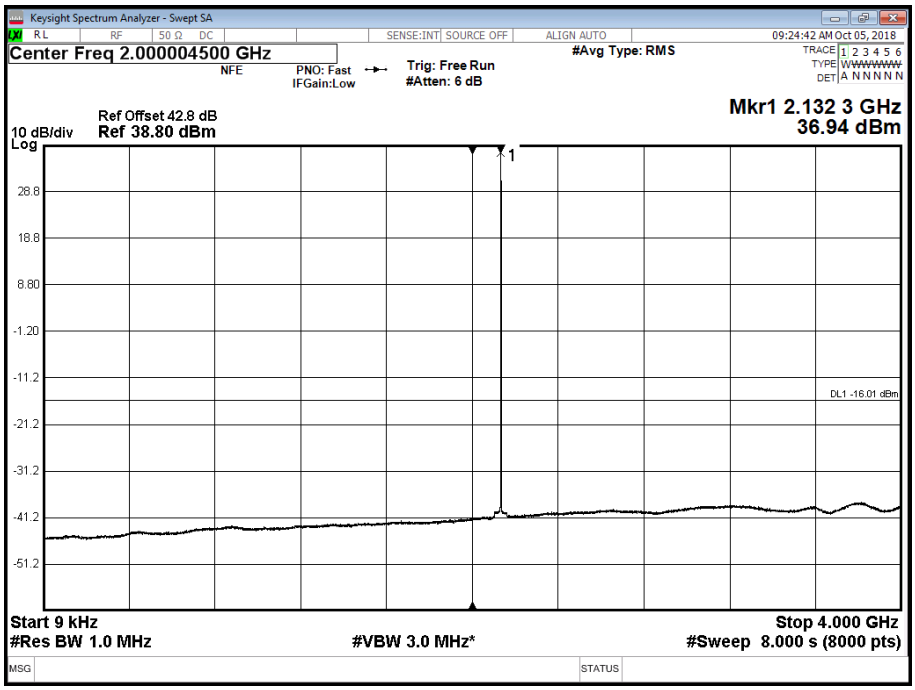
Antenna A - NB-IoT SA Modulation N:QPSK - NB-IoT SA Carrier Bandwidth N:180 kHz - Channel Position B - Band 3 - Range 12000 to 18000 MHz



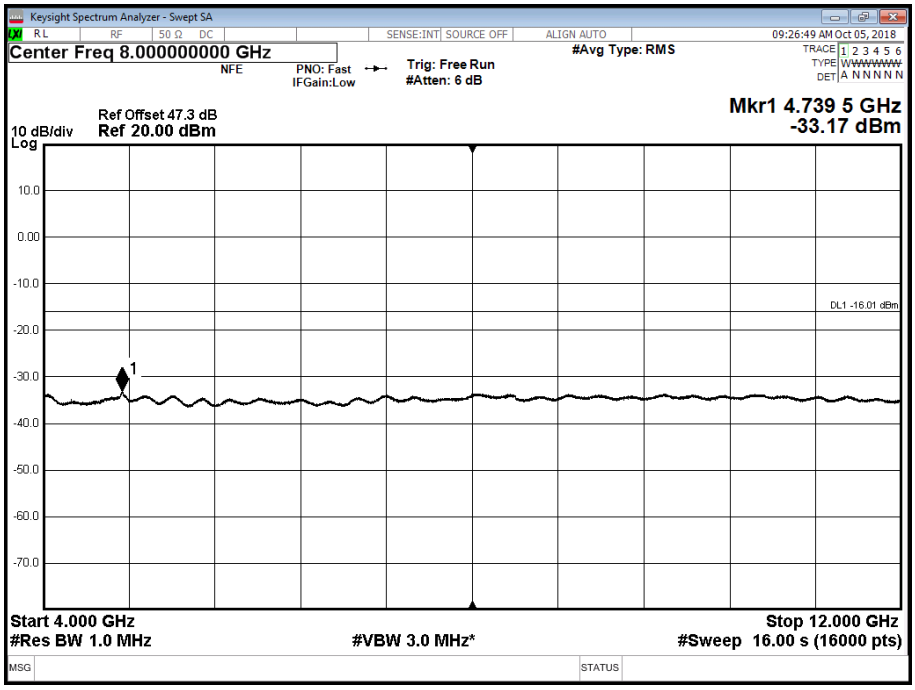
Antenna A - NB-IoT SA Modulation N:QPSK - NB-IoT SA Carrier Bandwidth N:180 kHz - Channel Position B - Band 4 - Range 18000 to 22000 MHz



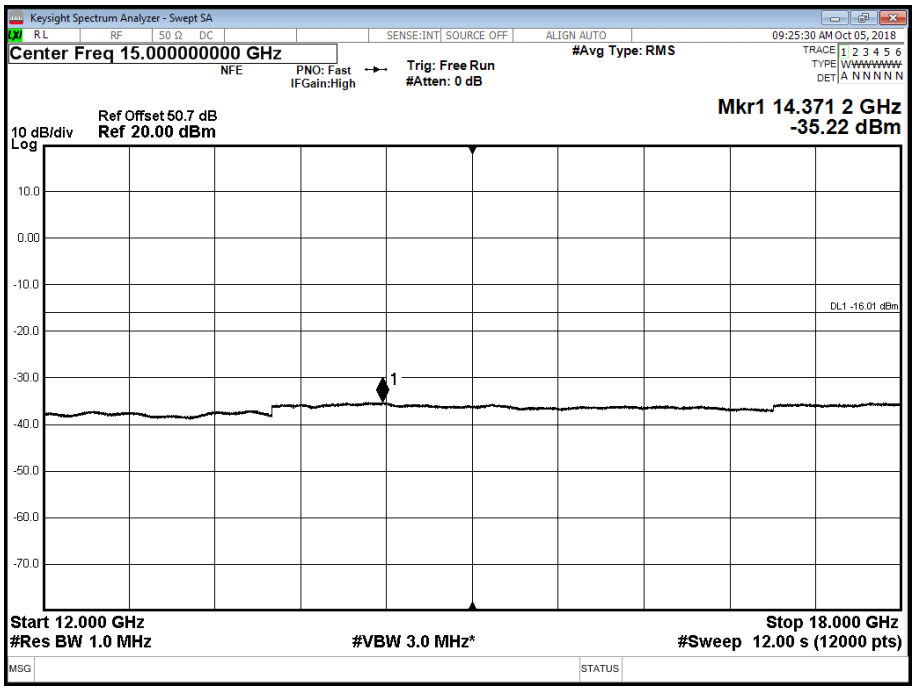
Antenna A - NB-IoT SA Modulation N:QPSK - NB-IoT SA Carrier Bandwidth N:180 kHz - Channel Position M - Band 1 - Range 0.009 to 4000 MHz



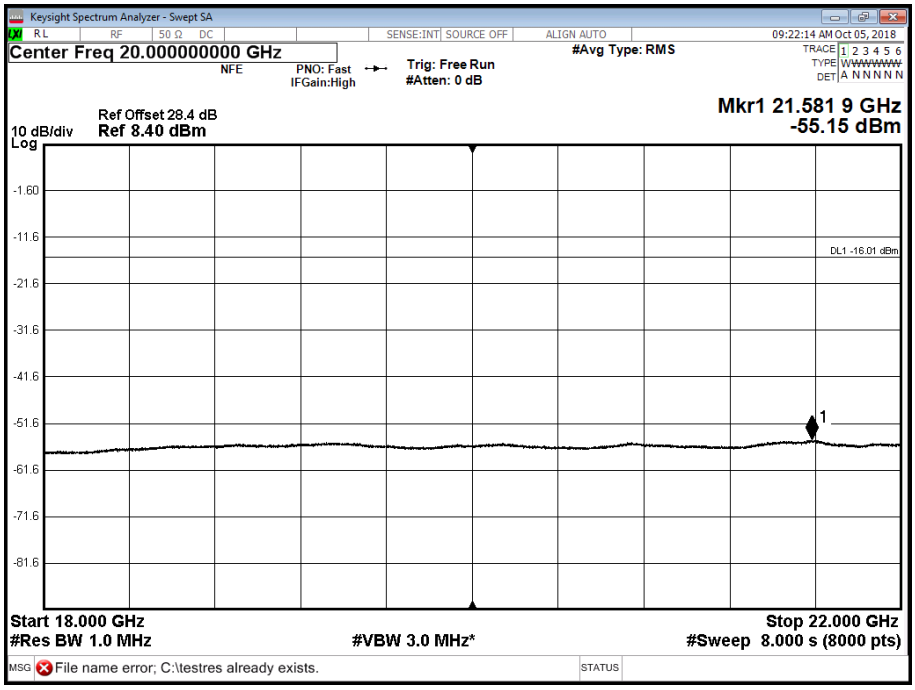
Antenna A - NB-IoT SA Modulation N:QPSK - NB-IoT SA Carrier Bandwidth N:180 kHz - Channel Position M - Band 2 - Range 4000 to 12000 MHz



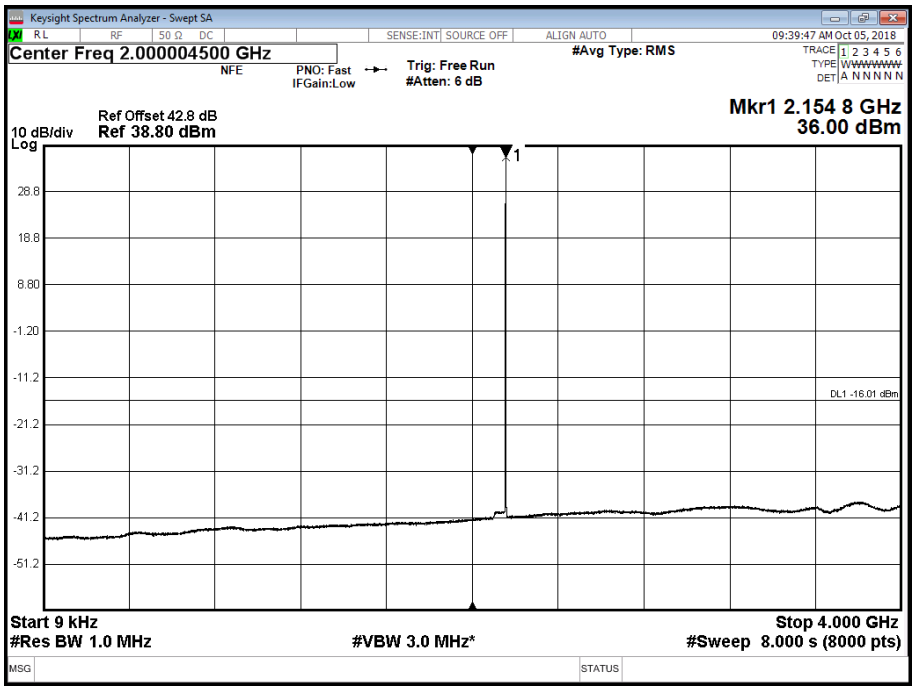
Antenna A - NB-IoT SA Modulation N:QPSK - NB-IoT SA Carrier Bandwidth N:180 kHz - Channel Position M - Band 3 - Range 12000 to 18000 MHz



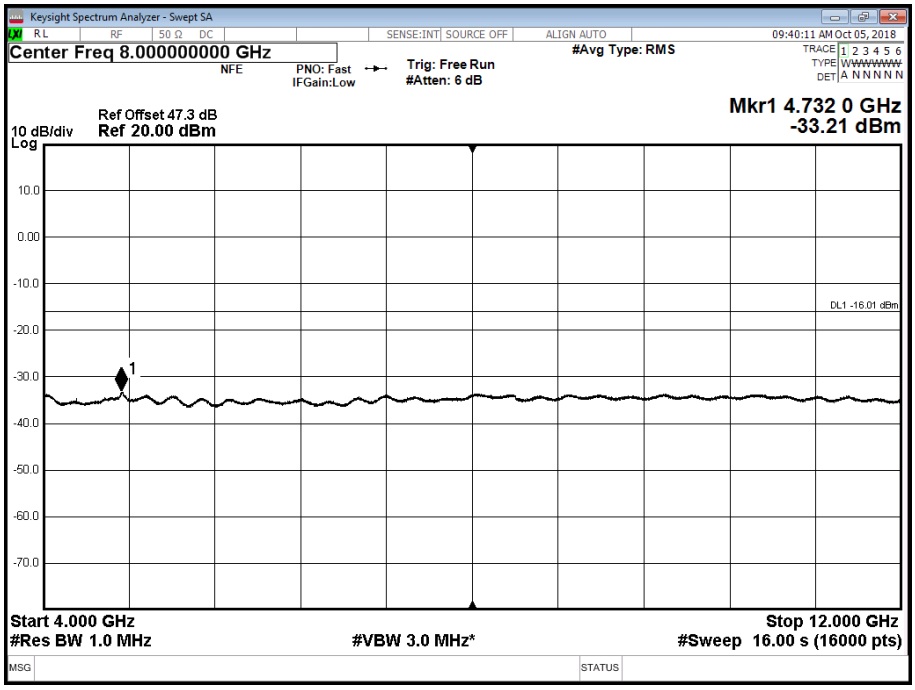
Antenna A - NB-IoT SA Modulation N:QPSK - NB-IoT SA Carrier Bandwidth N:180 kHz - Channel Position M - Band 4 - Range 18000 to 22000 MHz



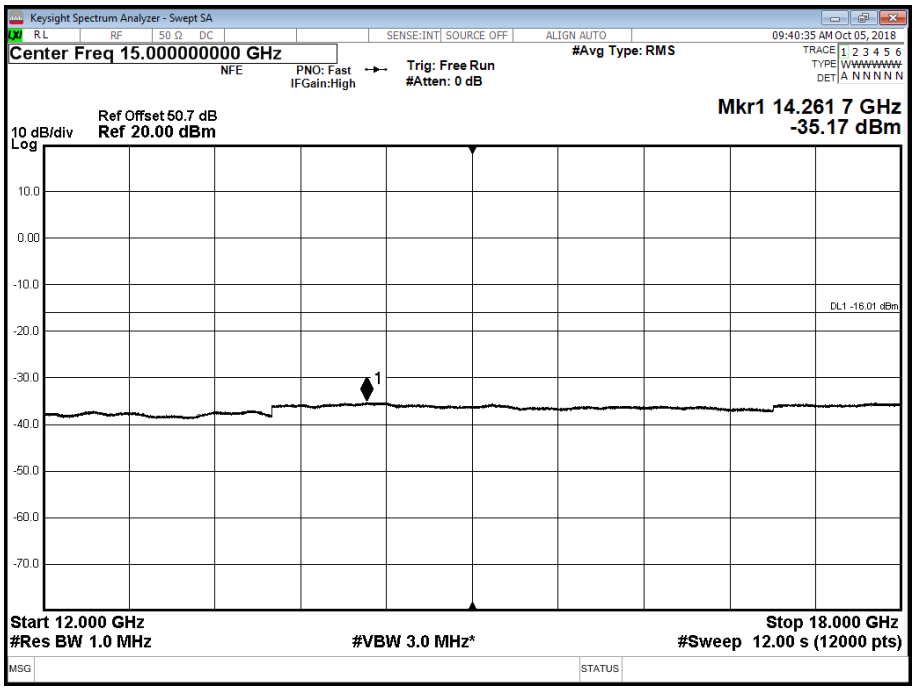
Antenna A - NB-IoT SA Modulation N:QPSK - NB-IoT SA Carrier Bandwidth N:180 kHz - Channel Position T - Band 1 - Range 0.009 to 4000 MHz



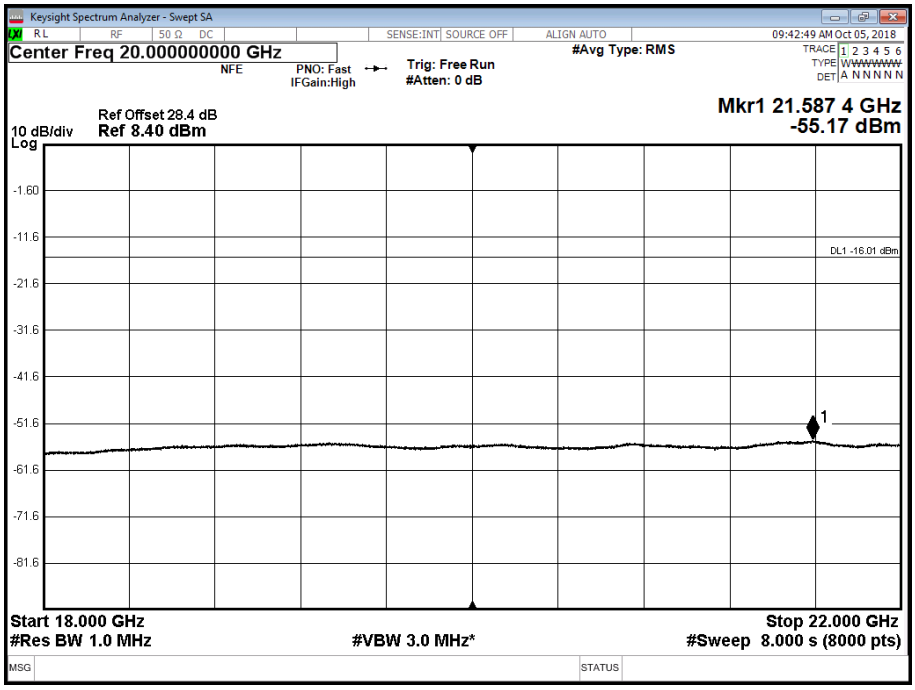
Antenna A - NB-IoT SA Modulation N:QPSK - NB-IoT SA Carrier Bandwidth N:180 kHz - Channel Position T - Band 2 - Range 4000 to 12000 MHz



Antenna A - NB-IoT SA Modulation N:QPSK - NB-IoT SA Carrier Bandwidth N:180 kHz - Channel Position T - Band 3 - Range 12000 to 18000 MHz



Antenna A - NB-IoT SA Modulation N:QPSK - NB-IoT SA Carrier Bandwidth N:180 kHz - Channel Position T - Band 4 - Range 18000 to 22000 MHz



Limit	-16dBm

2.5 RADIATED EMISSIONS

2.5.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1051
FCC CFR 47 Part 27, Clause 27.53 (h)
Industry Canada RSS-139, Clause 6.5

2.5.2 Date of Test and Modification State

22 October 2018 - Modification State 0

2.5.3 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.5.4 Environmental Conditions

Ambient Temperature	22.3°C
Relative Humidity	35.5%

2.5.5 Test Method

The test was applied in accordance with test method requirements of ANSI/TIA-603-C-2004.

A preliminary profile of the Spurious Radiated Emissions was obtained by operating the EUT on a remotely controlled turntable within the chamber. Measurements of emissions from the EUT were obtained with the Measurement Antenna in both Horizontal and Vertical Polarisations.

The Applicant declared that the highest internally generated frequency would be up to 2200MHz and so the upper limit for measurement was calculated at 10 times this, which is 22GHz.

Emissions identified within the range 30MHz – 22GHz were then formally measured using a Peak detector as the worst case.

In the frequency Range 30MHz – 1GHz, the measurement was performed with a resolution bandwidth of 100kHz.

In the frequency Range 1GHz – 22GHz, the measurement was performed with a resolution bandwidth of 1MHz.

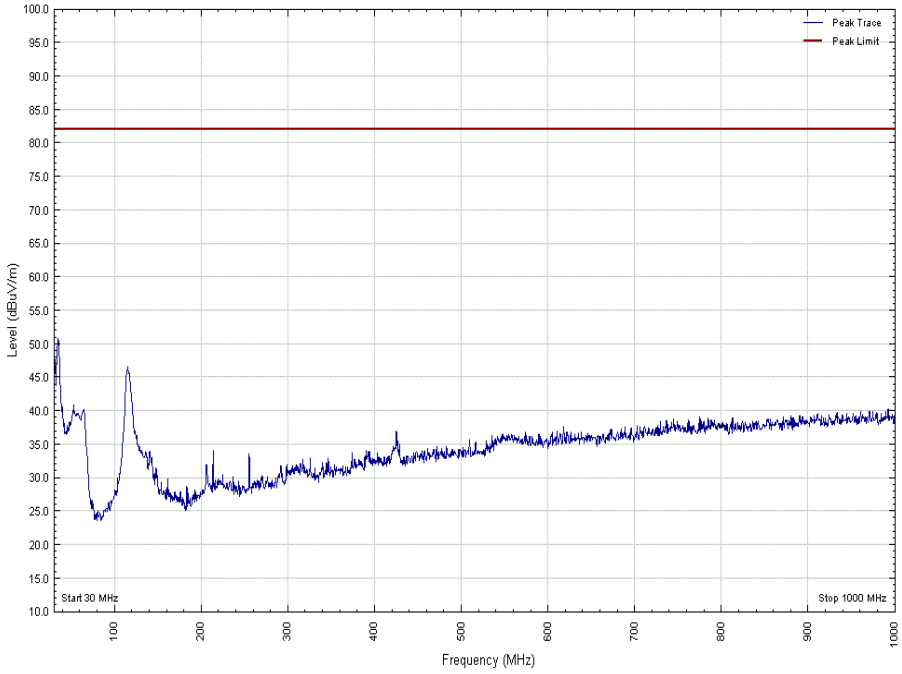
The measurements were performed at a 3m distance unless otherwise stated

2.5.6 Test Results

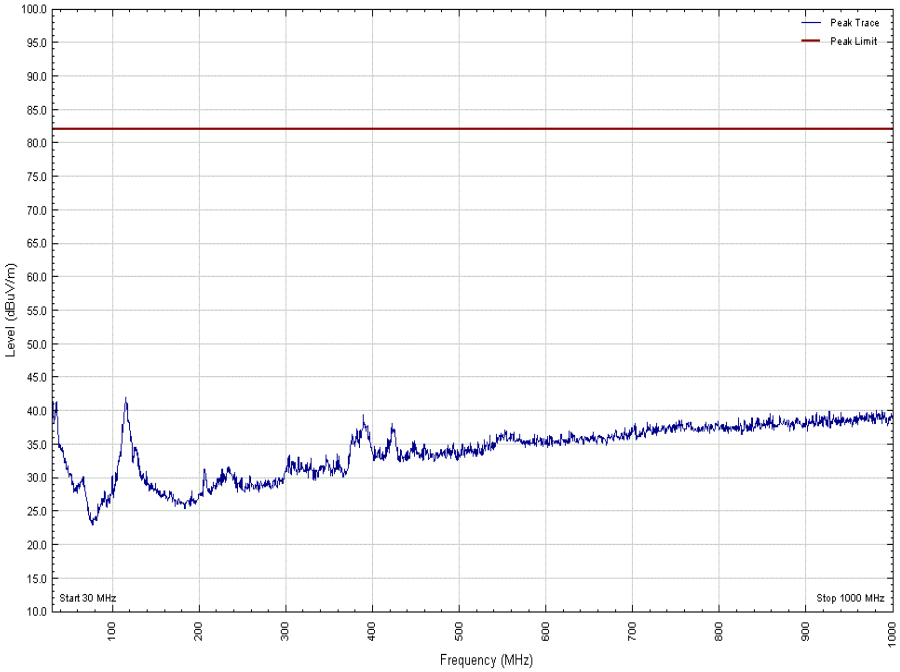
Configuration A

Maximum Output Power 37 dBm

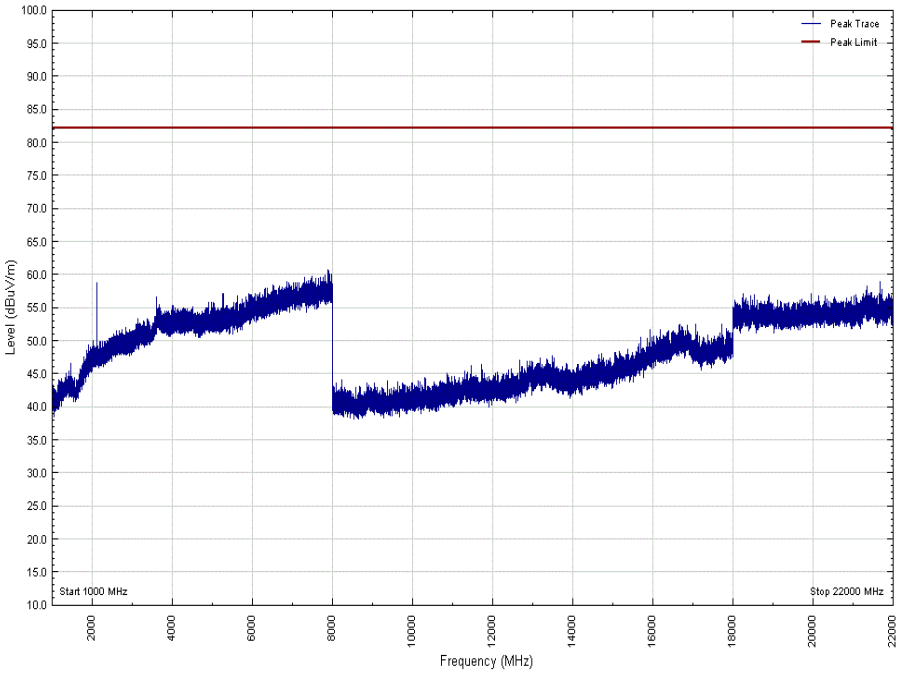
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 10.0 MHz - Channel Position B - Band 4 - Range 30 MHz to 1 GHz_V



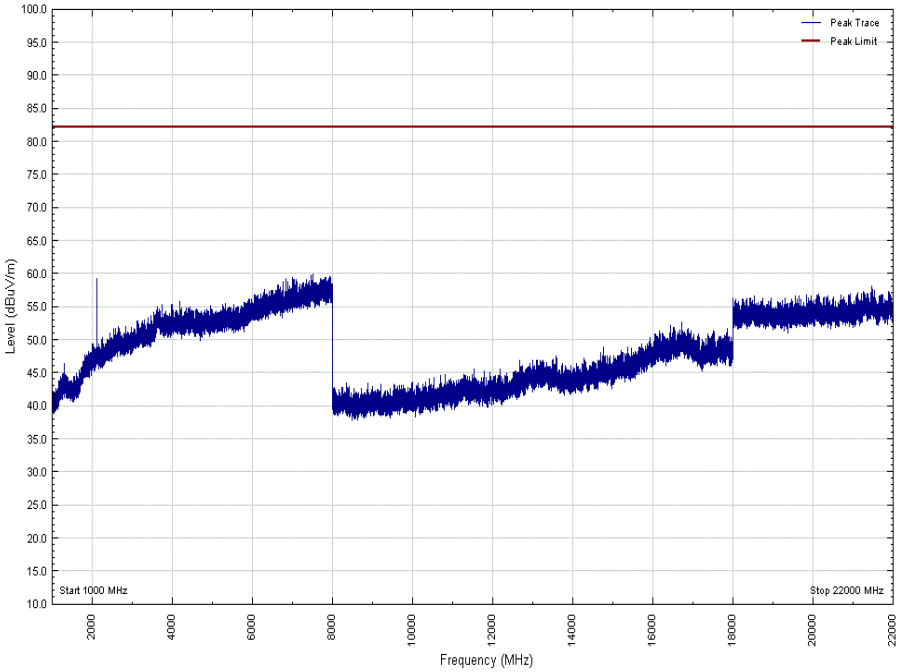
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 10.0 MHz - Channel Position B - Band 4 - Range 30 MHz to 1 GHz_H



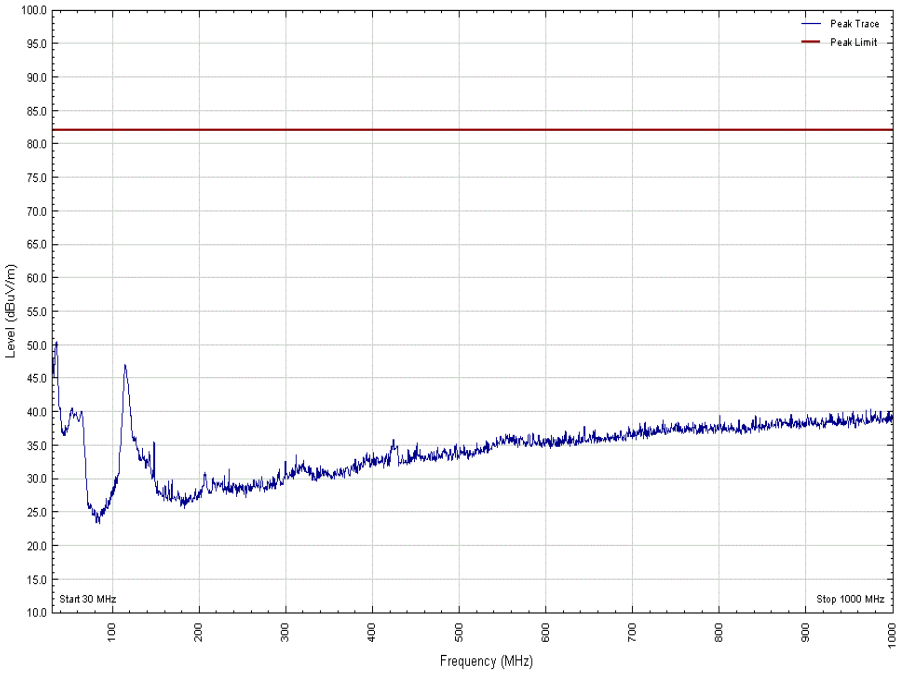
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 10.0 MHz - Channel Position B - Band 4 - Range 1 GHz to 22 GHz_V



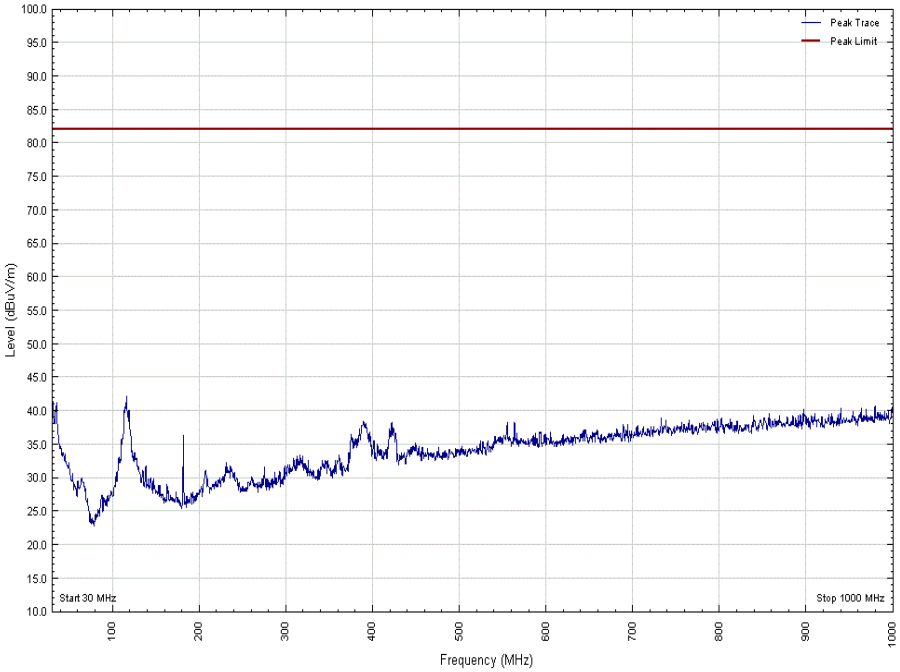
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 10.0 MHz - Channel Position B - Band 4 - Range 1 GHz to 22 GHz_H



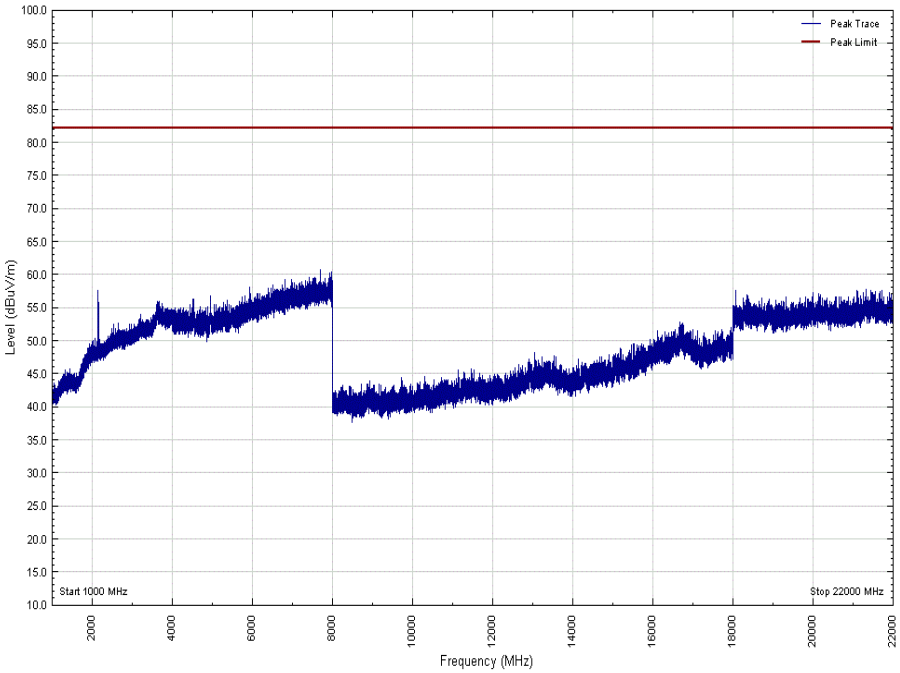
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 10.0 MHz - Channel Position T - Band 4 - Range 30 MHz to 1 GHz_V



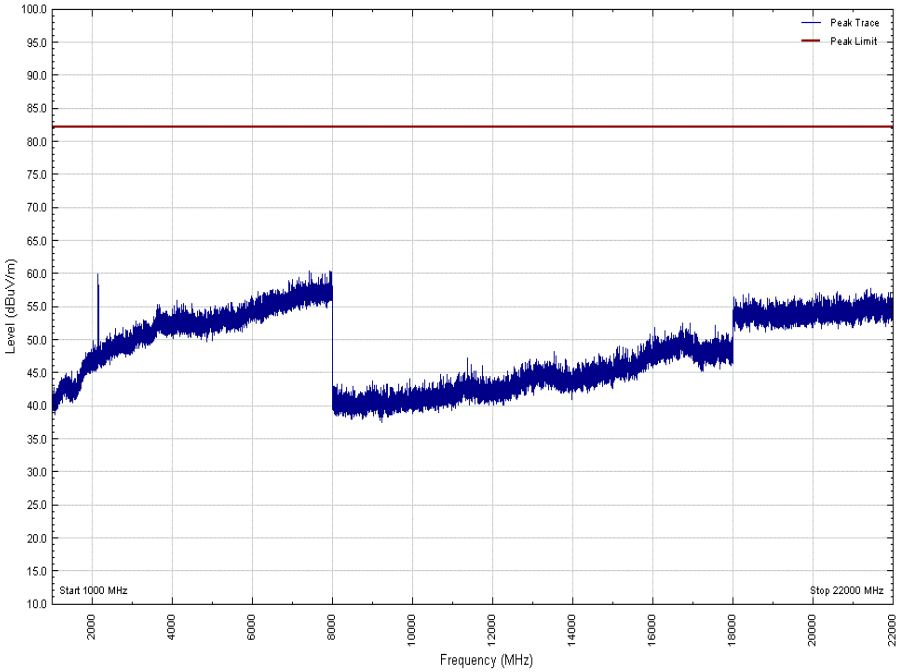
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 10.0 MHz - Channel Position T - Band 4 - Range 30 MHz to 1 GHz_H



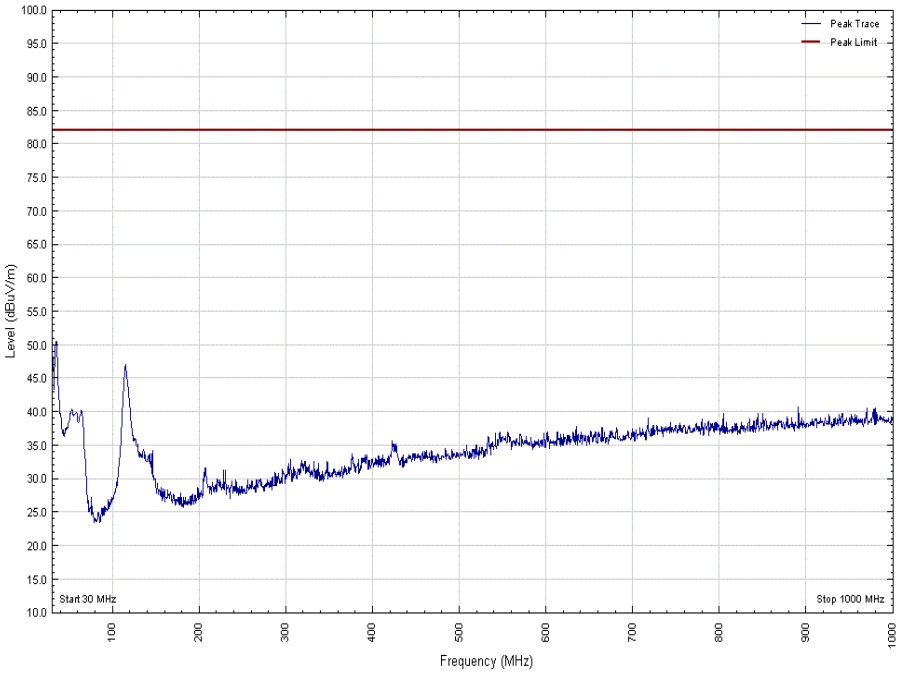
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 10.0 MHz - Channel Position T - Band 4 - Range 1 GHz to 22 GHz_V



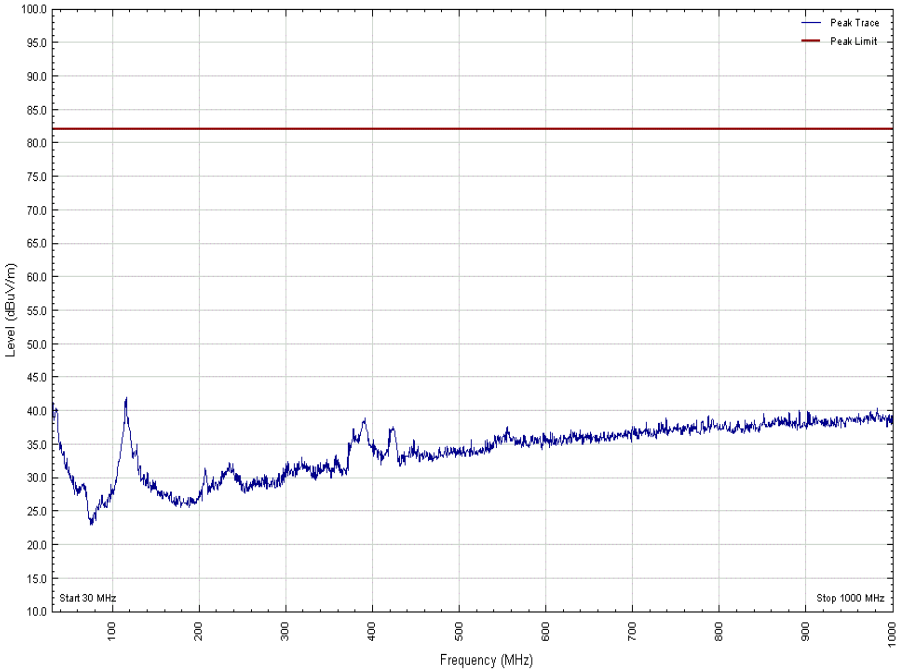
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 10.0 MHz - Channel Position T - Band 4 - Range 1 GHz to 22 GHz_H



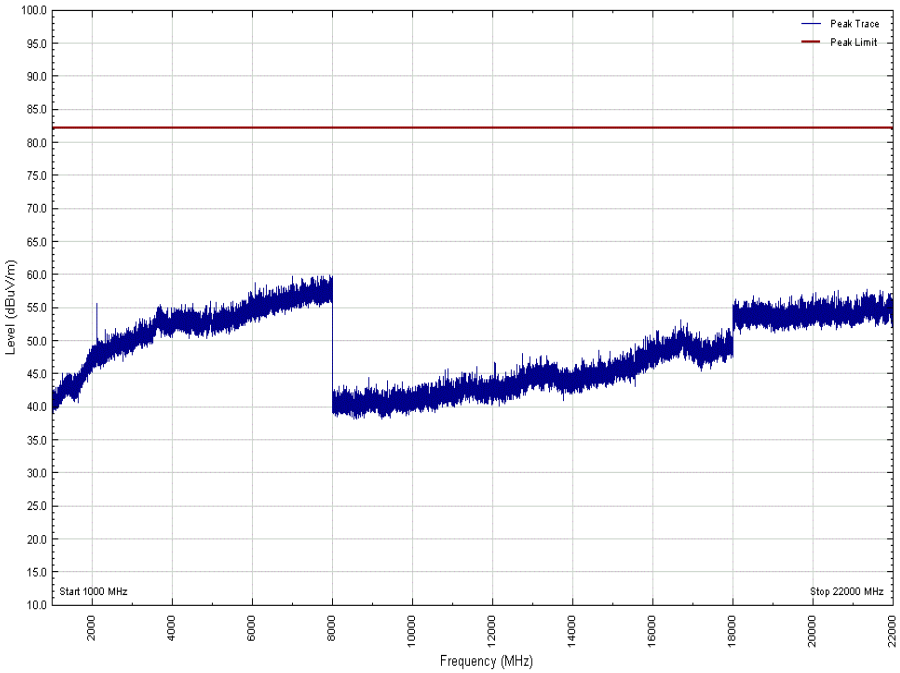
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 15.0 MHz - Channel Position B - Band 4 - Range 30 MHz to 1 GHz_V



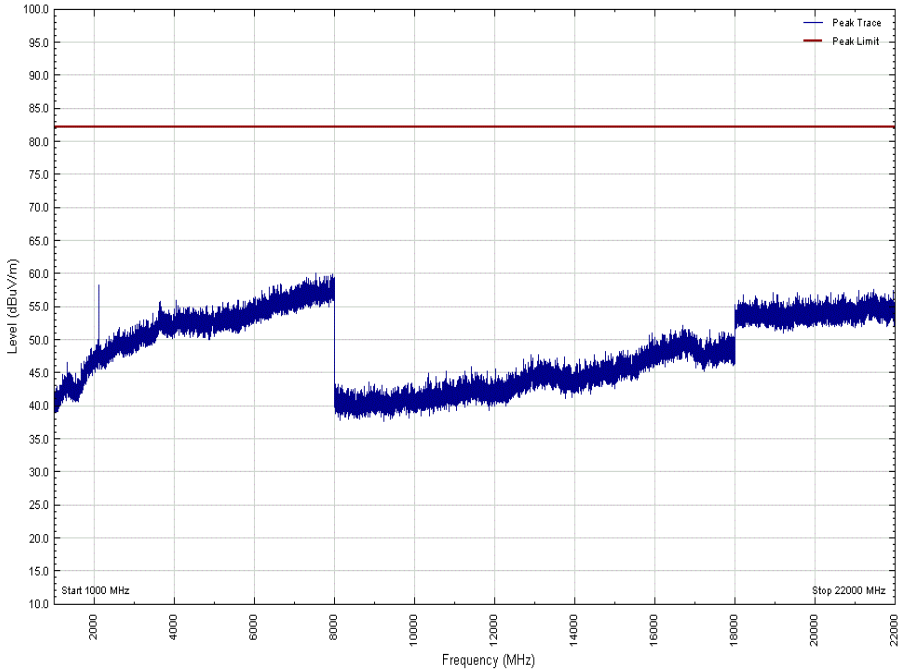
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 15.0 MHz - Channel Position B - Band 4 - Range 30 MHz to 1 GHz_H



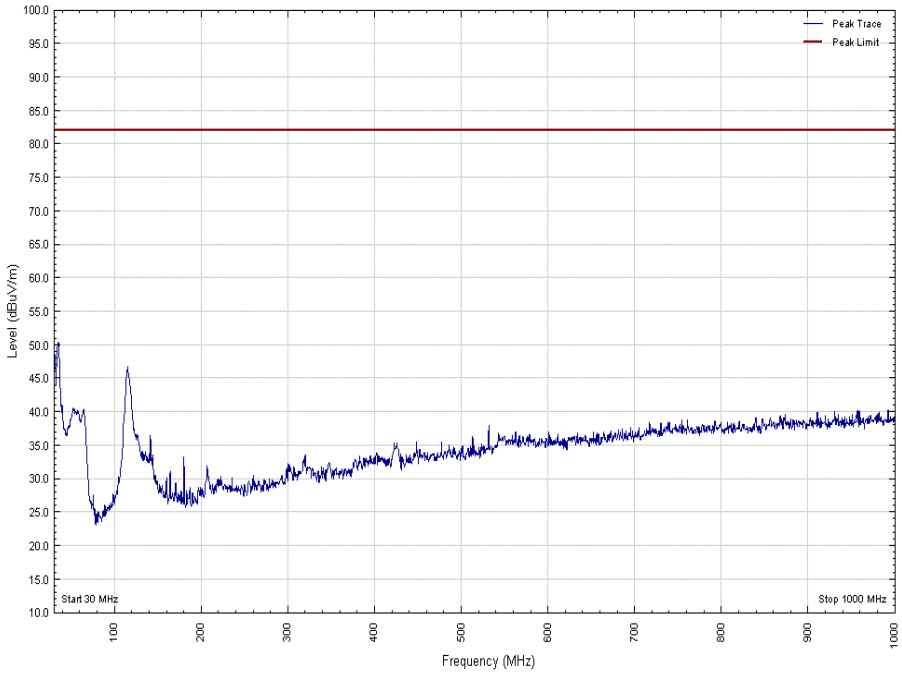
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 15.0 MHz - Channel Position B - Band 4 - Range 1 GHz to 22 GHz_V



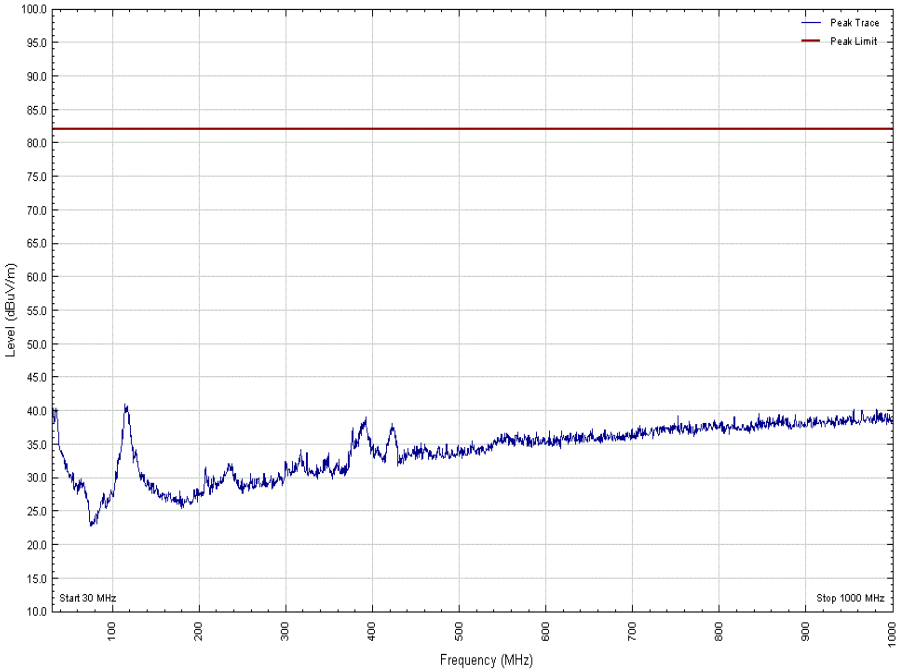
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 15.0 MHz - Channel Position B - Band 4 - Range 1 GHz to 22 GHz_H



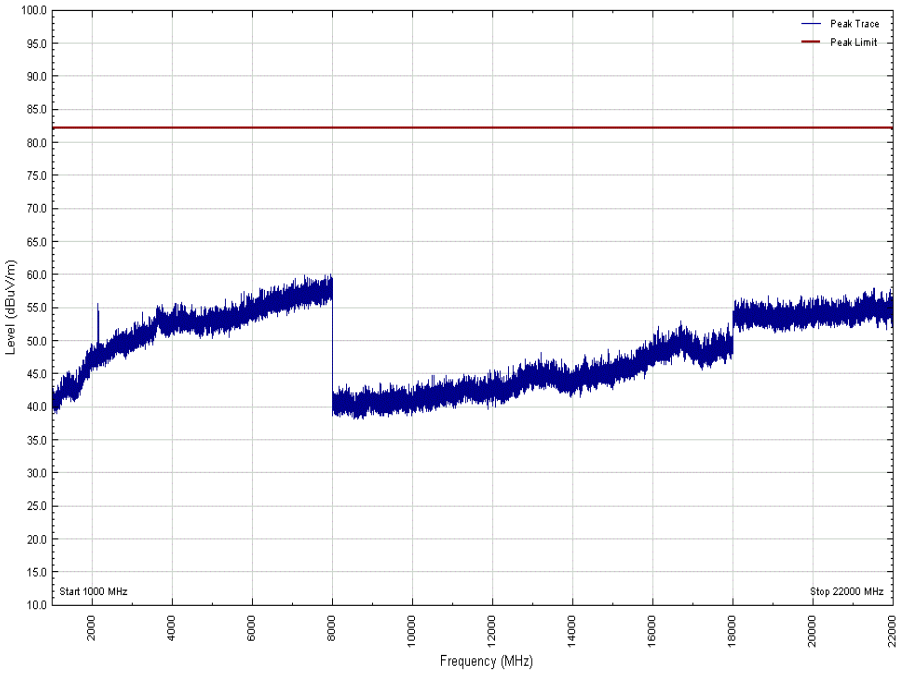
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 15.0 MHz - Channel Position T - Band 4 - Range 30 MHz to 1 GHz_V



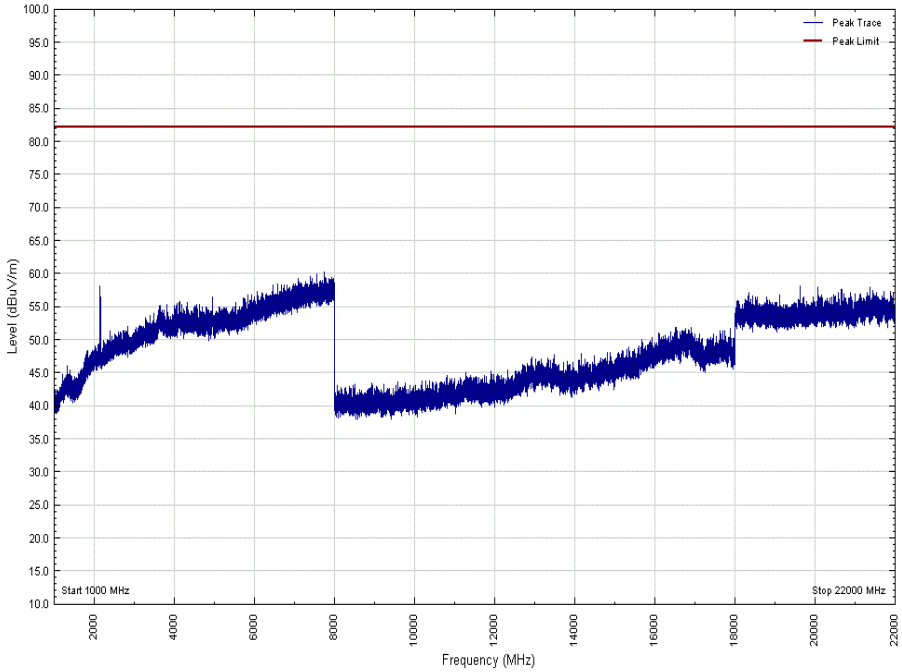
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 15.0 MHz - Channel Position T - Band 4 - Range 30 MHz to 1 GHz_H



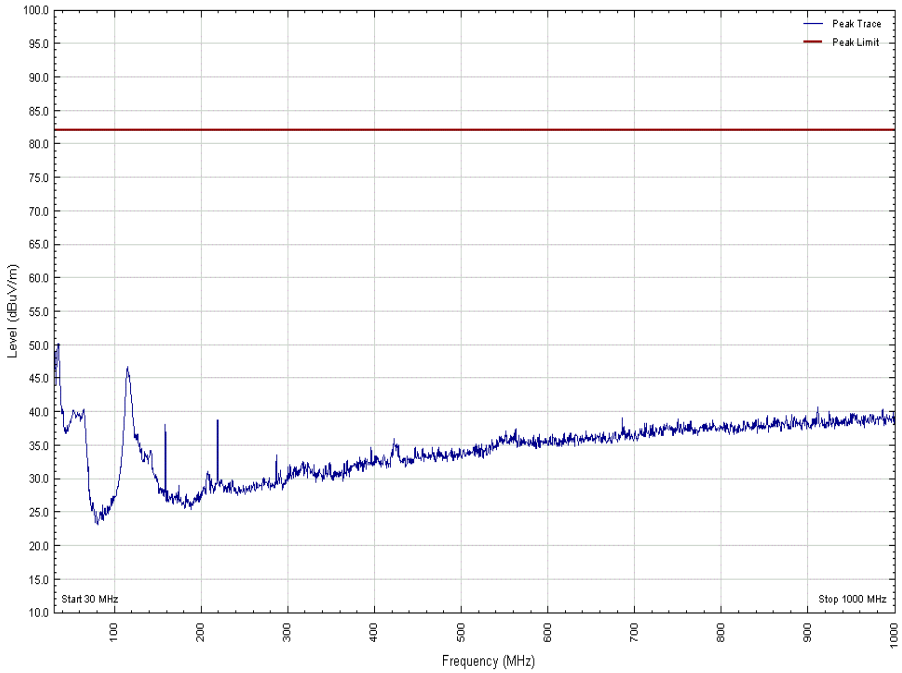
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 15.0 MHz - Channel Position T - Band 4 - Range 1 GHz to 22 GHz_V



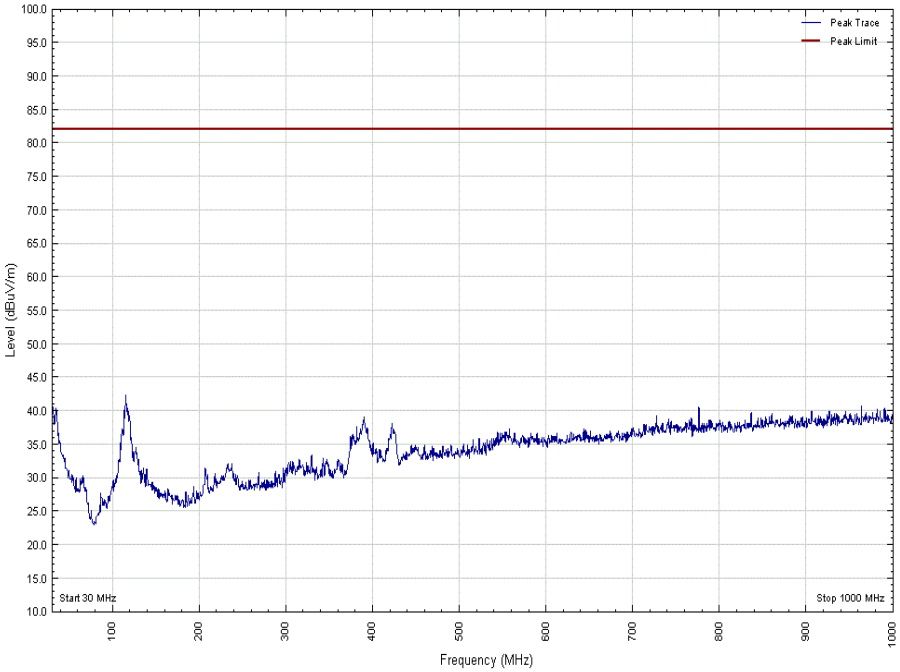
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 15.0 MHz - Channel Position T - Band 4 - Range 1 GHz to 22 GHz_H



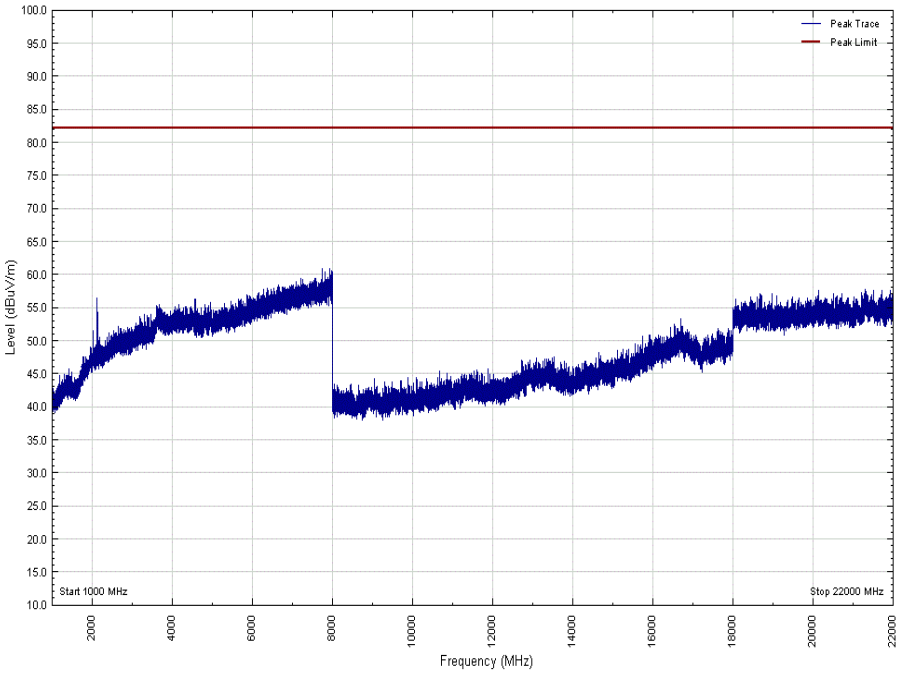
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 20.0 MHz - Channel Position B - Band 4 - Range 30 MHz to 1 GHz_V



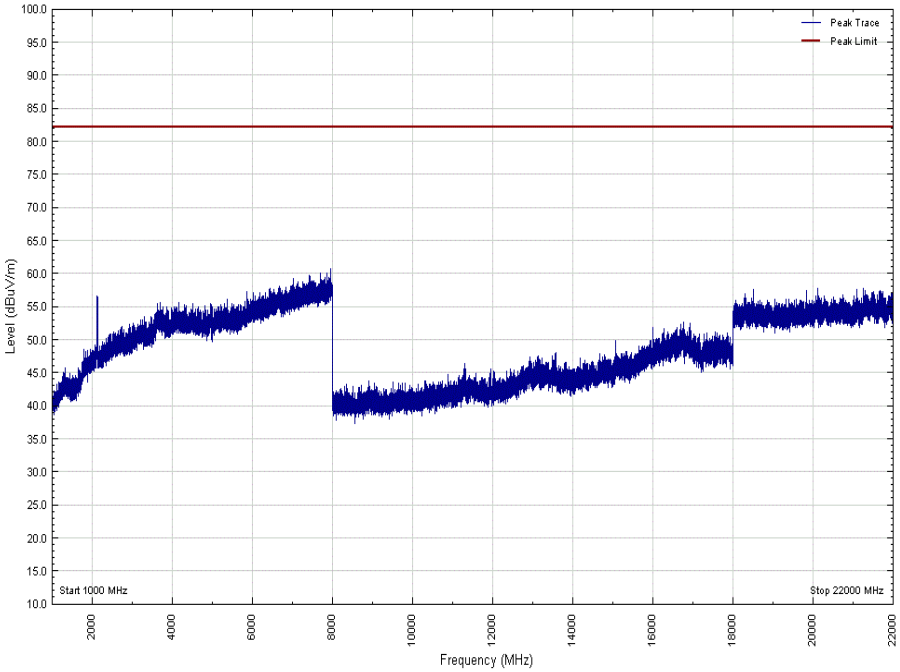
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 20.0 MHz - Channel Position B - Band 4 - Range 30 MHz to 1 GHz_H



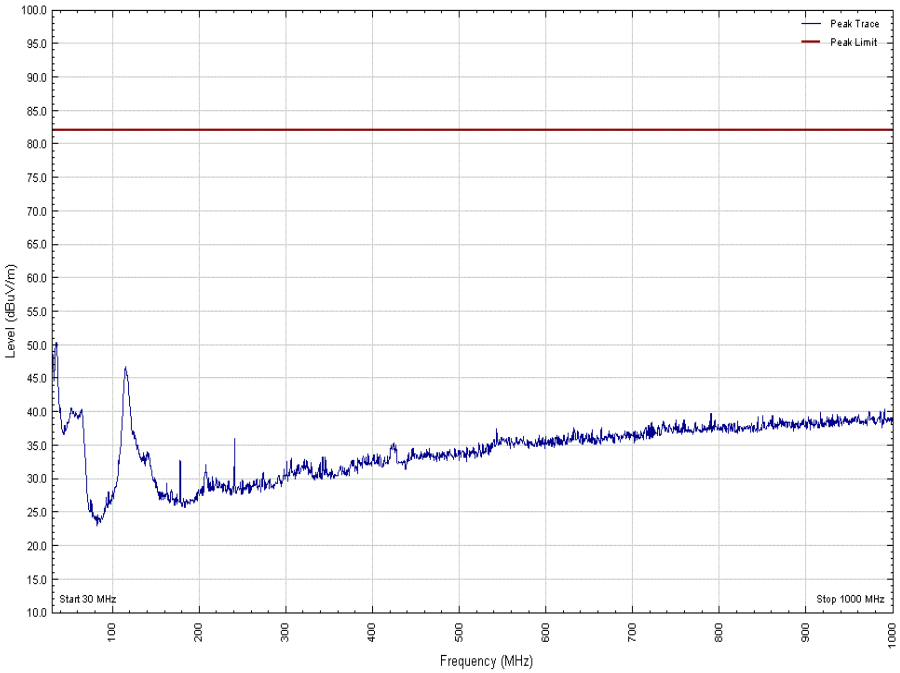
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 20.0 MHz - Channel Position B - Band 4 - Range 1 GHz to 22 GHz_V



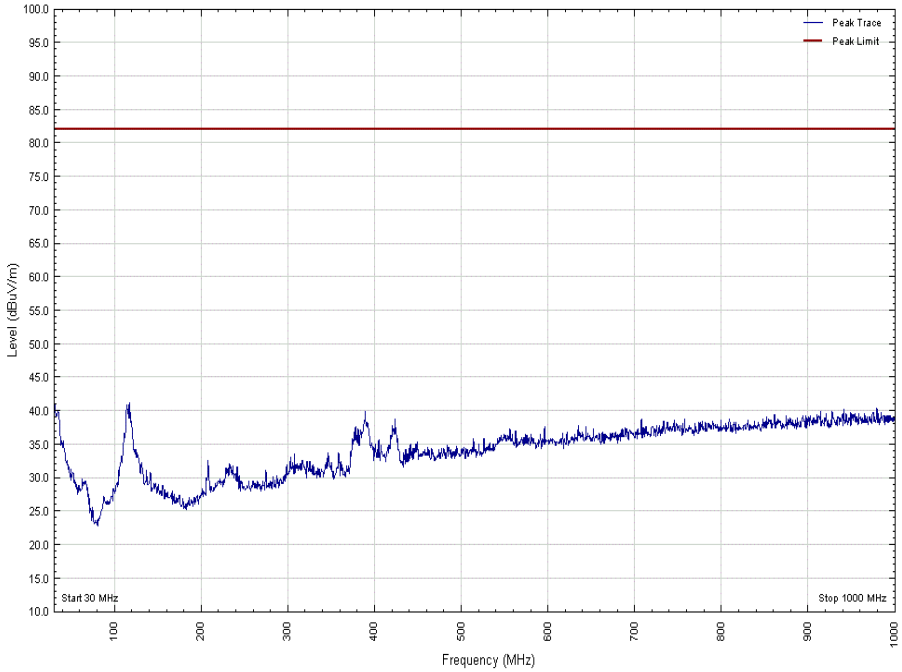
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 20.0 MHz - Channel Position B - Band 4 - Range 1 GHz to 22 GHz_H



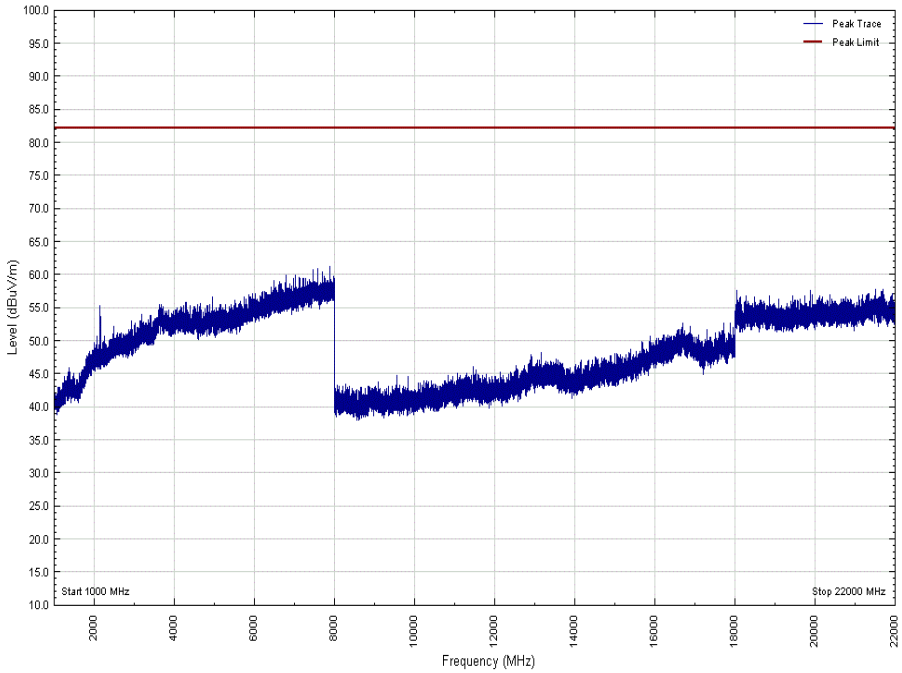
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 20.0 MHz - Channel Position T - Band 4 - Range 30 MHz to 1 GHz_V



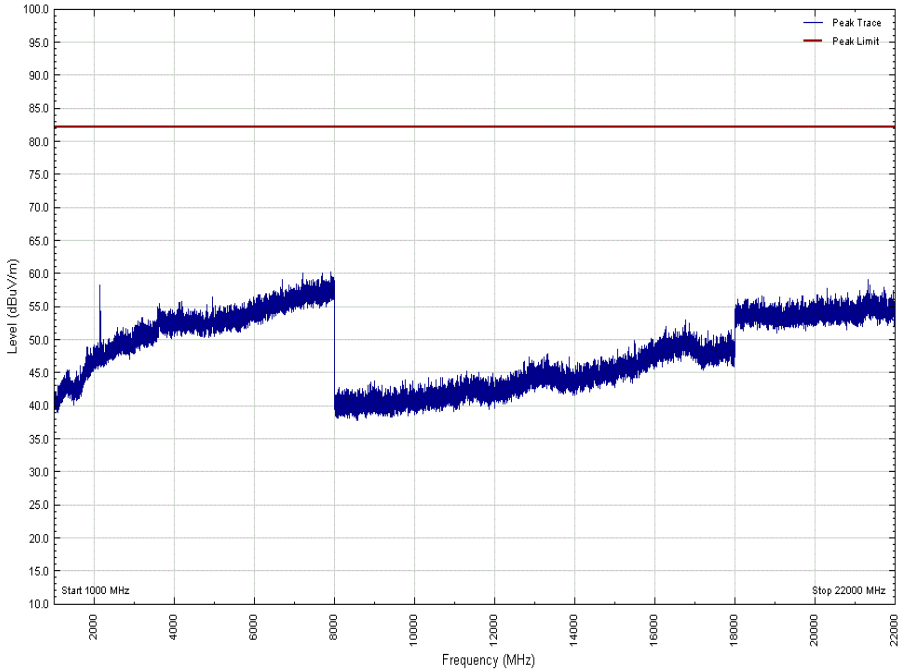
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 20.0 MHz - Channel Position T - Band 4 - Range 30 MHz to 1 GHz_H



Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 20.0 MHz - Channel Position T - Band 4 - Range 1 GHz to 22 GHz_V



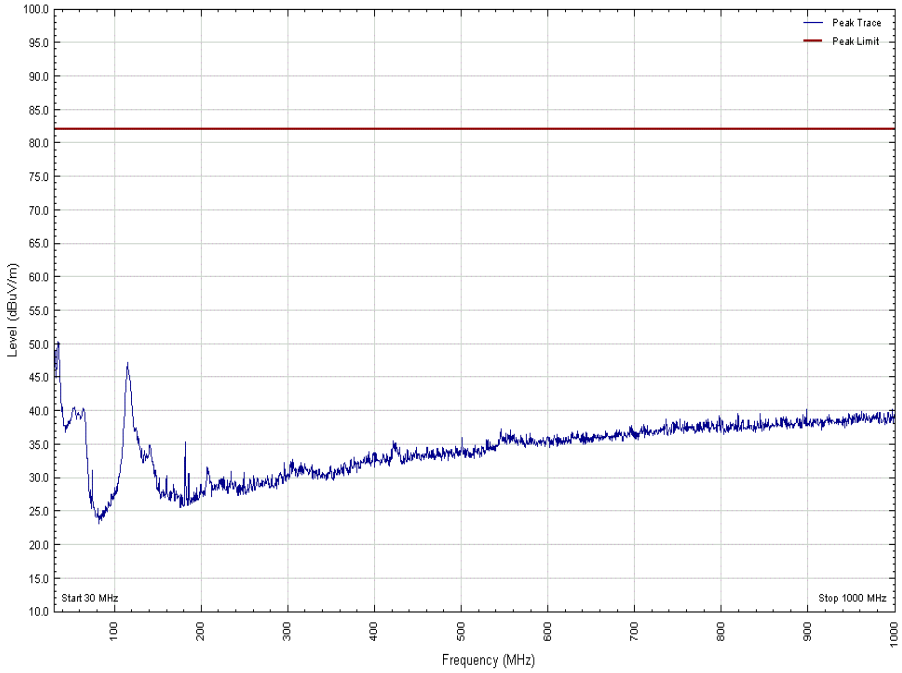
Antenna A - E-UTRA / NB-IoT GB Modulation 64QAM - E-UTRA / NB-IoT GB Carrier Bandwidth 20.0 MHz - Channel Position T - Band 4 - Range 1 GHz to 22 GHz_H



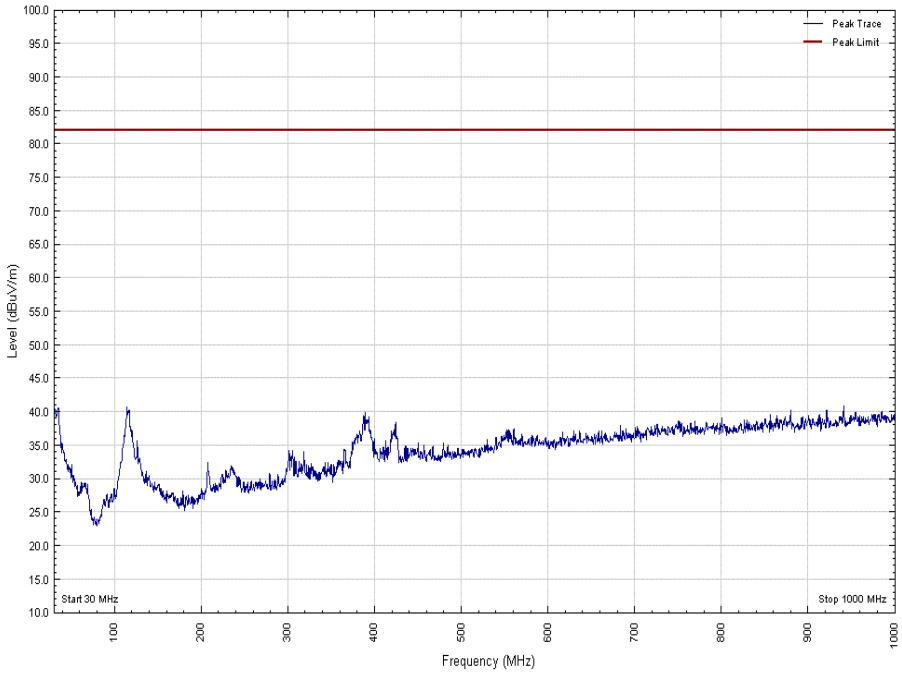
Configuration B

Maximum Output Power 37 dBm

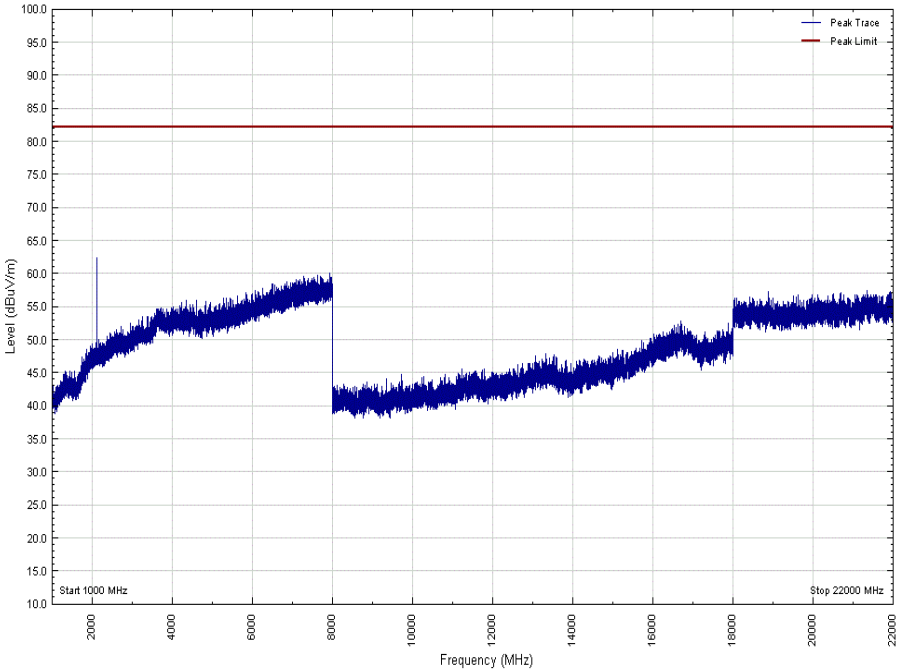
Antenna A - NB-IoT SA Modulation N:64QAM - NB-IoT SA Carrier Bandwidth N:180 kHz - Channel Position B - Band 4 - Range 30 MHz to 1 GHz_V



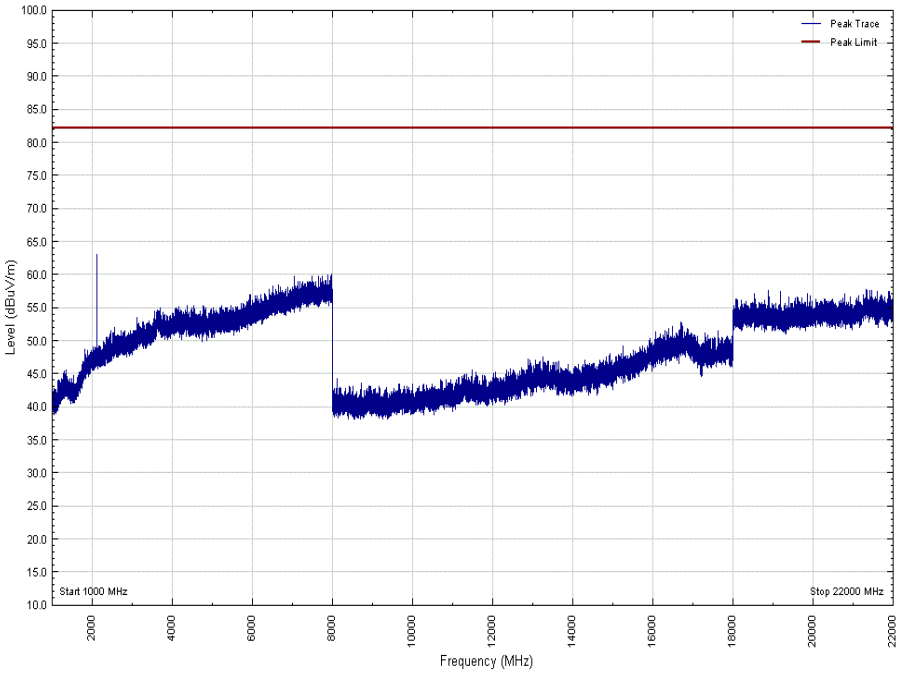
Antenna A - NB-IoT SA Modulation N:64QAM - NB-IoT SA Carrier Bandwidth N:180 kHz - Channel Position B - Band 4 - Range 30 MHz to 1 GHz_H



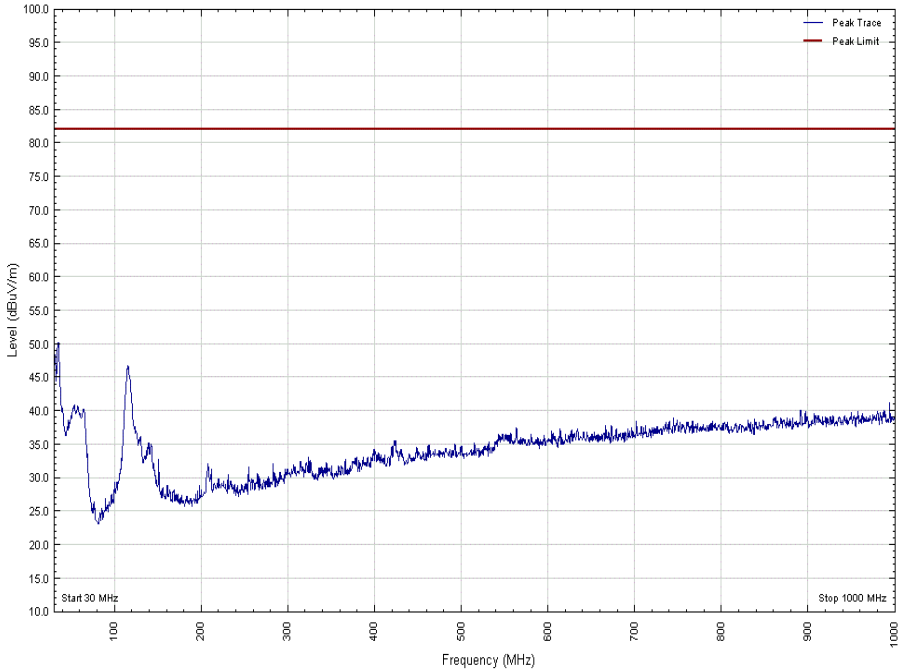
Antenna A - NB-IoT SA Modulation N:64QAM - NB-IoT SA Carrier Bandwidth N:180 kHz - Channel Position B - Band 4 - Range 1 GHz to 22 GHz_V



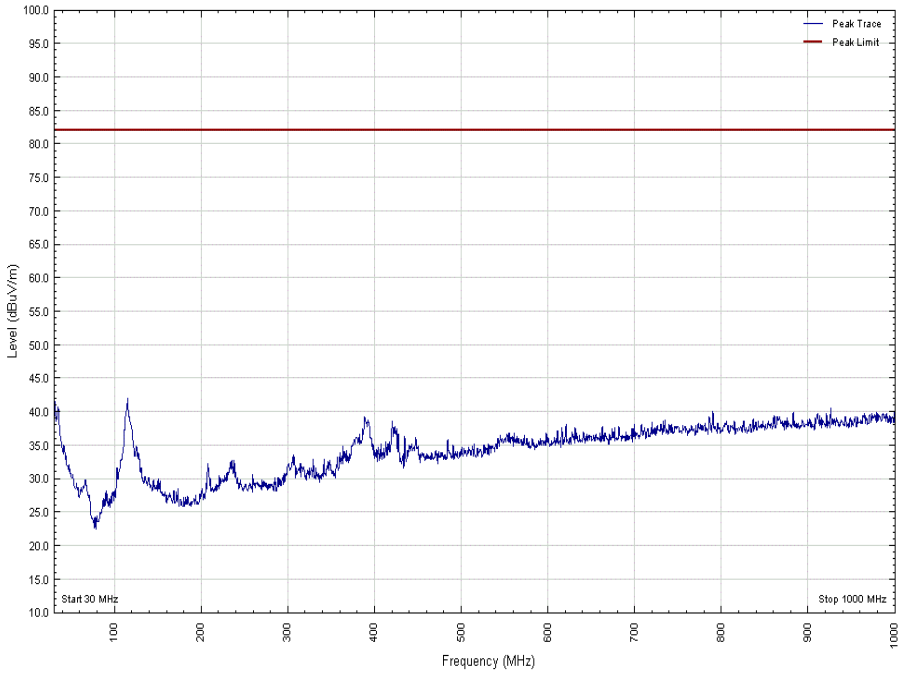
Antenna A - NB-IoT SA Modulation N:64QAM - NB-IoT SA Carrier Bandwidth N:180 kHz - Channel Position B - Band 4 - Range 1 GHz to 22 GHz_H



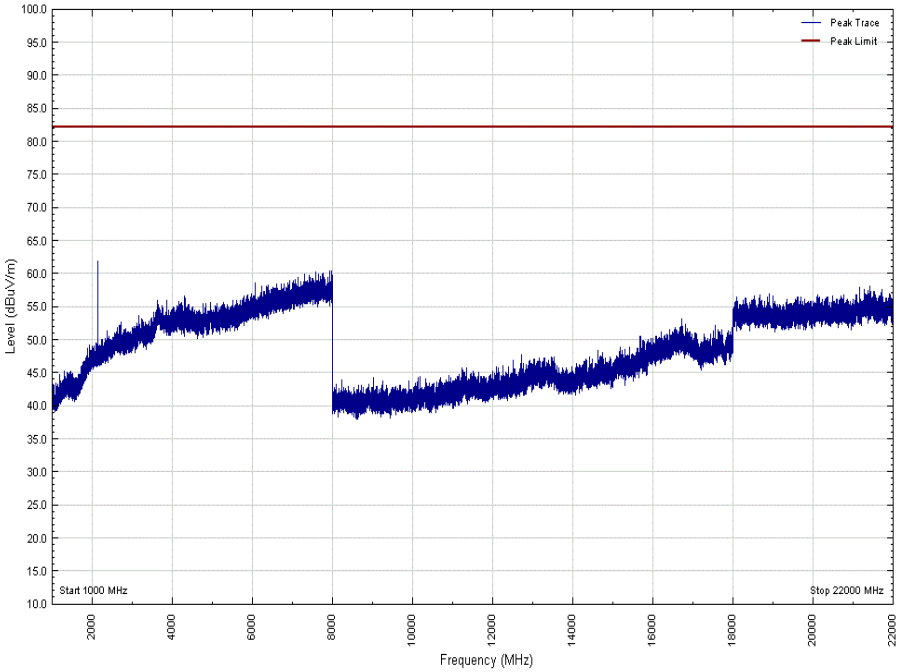
Antenna A - NB-IoT SA Modulation N:64QAM - NB-IoT SA Carrier Bandwidth N:180 kHz - Channel Position M - Band 4 - Range 30 MHz to 1 GHz_V



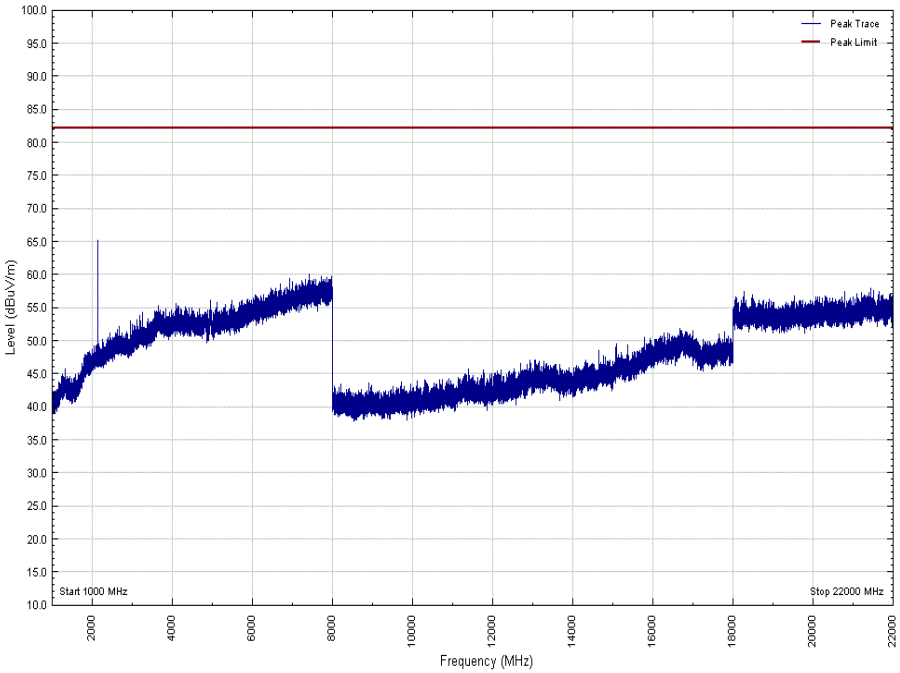
Antenna A - NB-IoT SA Modulation N:64QAM - NB-IoT SA Carrier Bandwidth N:180 kHz - Channel Position M - Band 4 - Range 30 MHz to 1 GHz_H



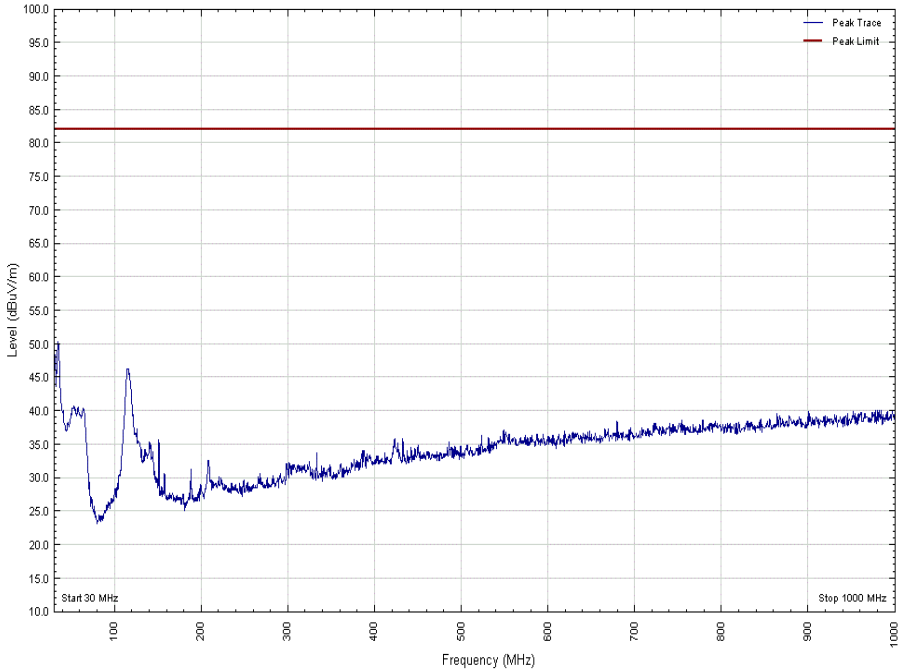
Antenna A - NB-IoT SA Modulation N:64QAM - NB-IoT SA Carrier Bandwidth N:180 kHz - Channel Position M - Band 4 - Range 1 GHz to 22 GHz_V



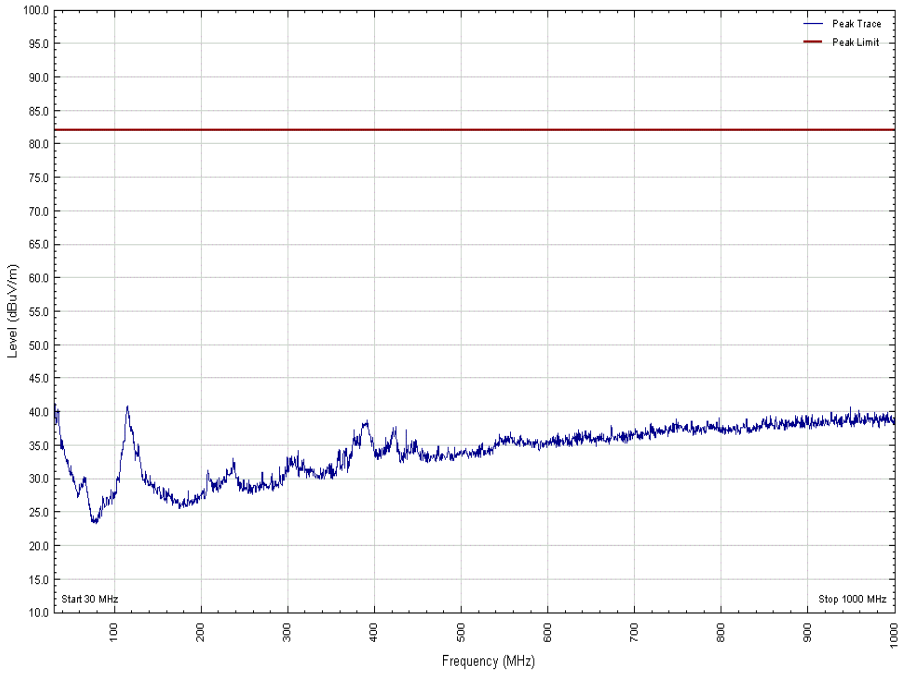
Antenna A - NB-IoT SA Modulation N:64QAM - NB-IoT SA Carrier Bandwidth N:180 kHz - Channel Position M - Band 4 - Range 1 GHz to 22 GHz_H



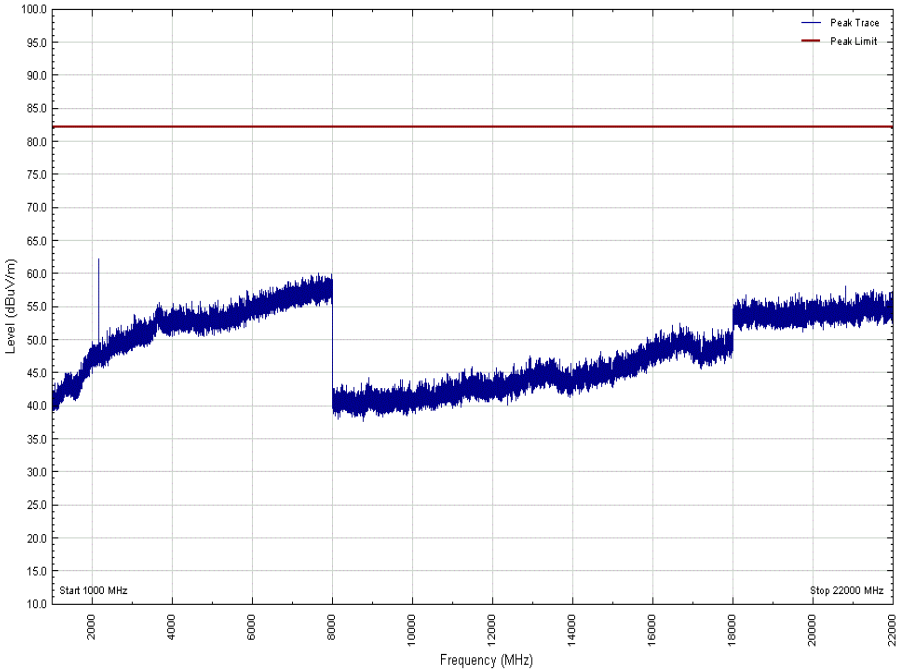
Antenna A - NB-IoT SA Modulation N:64QAM - NB-IoT SA Carrier Bandwidth N:180 kHz - Channel Position T - Band 4 - Range 30 MHz to 1 GHz_V



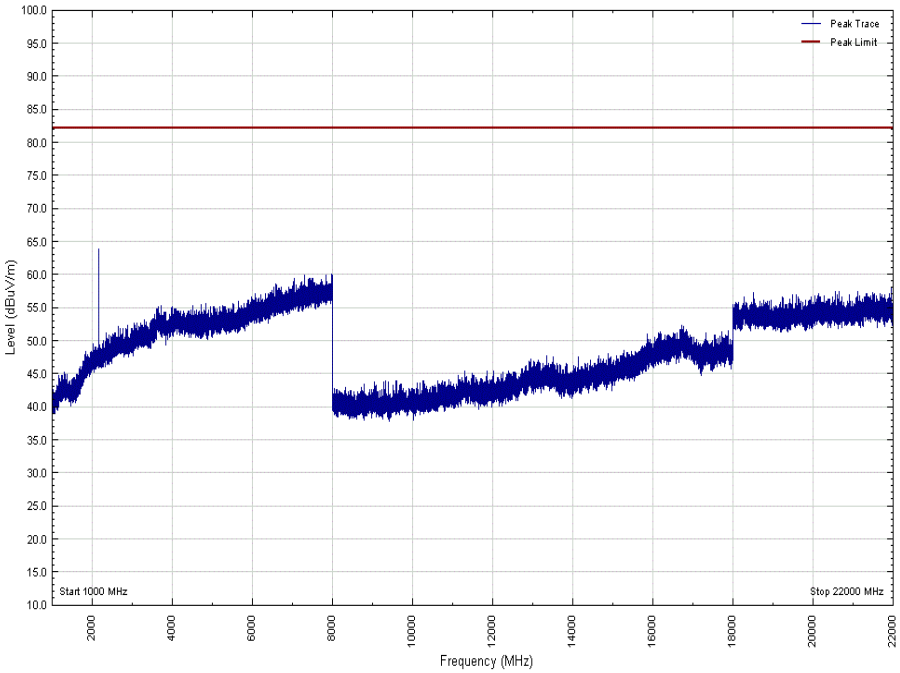
Antenna A - NB-IoT SA Modulation N:64QAM - NB-IoT SA Carrier Bandwidth N:180 kHz - Channel Position T - Band 4 - Range 30 MHz to 1 GHz_H



Antenna A - NB-IoT SA Modulation N:64QAM - NB-IoT SA Carrier Bandwidth N:180 kHz - Channel Position T - Band 4 - Range 1 GHz to 22 GHz_V



Antenna A - NB-IoT SA Modulation N:64QAM - NB-IoT SA Carrier Bandwidth N:180 kHz - Channel Position T - Band 4 - Range 1 GHz to 22 GHz_H



Product Service

SECTION 3

TEST EQUIPMENT USED

3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Maximum Peak Output Power and Peak to Average Ratio - Conducted					
Hygrometer	Rotronic	Hygropalm	2404	12	26-Apr-2019
Signal Analyser	N9030A	Keysight	4653	12	05-Feb-2019
PSU	Farnell	H60/25	1092	-	O/P Mon
DMM	Fluke	179	4006	12	13-Dec-2018
Attenuator	Weinschel	48-10-43	4868	12	01-Nov-2018
Attenuator	Weinschel	48-30-43	4871	12	17-Jul-2019
Attenuator	Weinschel	48-10-43	3593	12	16-Jul-2019
Network Analyser	R&S	ZVA 40	3548	12	02-Oct-2018
Calibration unit	R&S	ZV Z54	4368	12	06-Mar-2019
Occupied Bandwidth					
Hygrometer	Rotronic	Hygropalm	2404	12	26-Apr-2019
Signal Analyser	N9030A	Keysight	4653	12	05-Feb-2019
PSU	Farnell	H60/25	1092	-	O/P Mon
DMM	Fluke	179	4006	12	13-Dec-2018
Attenuator	Weinschel	48-10-43	4868	12	01-Nov-2018
Attenuator	Weinschel	48-30-43	4871	12	17-Jul-2019
Attenuator	Weinschel	48-10-43	3593	12	16-Jul-2019
Network Analyser	R&S	ZVA 40	3548	12	02-Oct-2018
Calibration unit	R&S	ZV Z54	4368	12	06-Mar-2019
Band Edge					
Hygrometer	Rotronic	Hygropalm	2404	12	26-Apr-2019
Signal Analyser	N9030A	Keysight	4653	12	05-Feb-2019
PSU	Farnell	H60/25	1092	-	O/P Mon
DMM	Fluke	179	4006	12	13-Dec-2018
Attenuator	Weinschel	48-10-43	4868	12	01-Nov-2018
Attenuator	Weinschel	48-30-43	4871	12	17-Jul-2019
Attenuator	Weinschel	48-10-43	3593	12	16-Jul-2019
Network Analyser	R&S	ZVA 40	3548	12	02-Oct-2018
Calibration unit	R&S	ZV Z54	4368	12	06-Mar-2019
Transmitter Spurious Emissions					
Hygrometer	Rotronic	Hygropalm	2404	12	26-Apr-2019
Signal Analyser	N9030A	Keysight	4653	12	05-Feb-2019
PSU	Farnell	H60/25	1092	-	O/P Mon
DMM	Fluke	179	4006	12	13-Dec-2018
Attenuator	Weinschel	48-10-43	4868	12	01-Nov-2018
Attenuator	Weinschel	48-30-43	4871	12	17-Jul-2019
Attenuator	Weinschel	48-10-43	3593	12	16-Jul-2019
Network Analyser	R&S	ZVA 40	3548	12	02-Oct-2018
Calibration unit	R&S	ZV Z54	4368	12	06-Mar-2019

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Radiated Emissions					
Antenna 18-40GHz (Double Ridge Guide)	Link Microtek Ltd	AM180HA-K-TU2	230	24	02-May-2020
Pre-Amplifier	Phase One	PS04-0086	1533	12	12-Jan-2019
18GHz - 40GHz Pre-Amplifier	Phase One	PSO4-0087	1534	12	02-Feb-2019
Screened Room (5)	Rainford	Rainford	1545	36	23-Jan-2021
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Multimeter	Iso-tech	IDM101	2419	12	23-Nov-2018
Antenna with permanent attenuator (Bilog)	Chase	CBL6143	2904	24	08-Aug-2019
1501A 4.0M Km Km Cable	Rhophase	KPS-1501A-4000-KPS	4301	12	19-Feb-2019
1 metre K-Type Cable	Florida Labs	KMS-180SP-39.4-KMS	4520	12	13-Feb-2019
EMI Receiver	Keysight Technologies	N9038A MXE	4628	12	04-Jul-2019
Double Ridged Waveguide Horn Antenna	ETS-Lindgren	3117	4722	12	01-Mar-2019
Mast Controller	Maturo Gmbh	NCD	4810	-	TU
Tilt Antenna Mast	Maturo Gmbh	TAM 4.0-P	4811	-	TU
9m N type RF cable	Rosenberger	2303-0 9.0m PNm PNm	4827	6	04-Jan-2019
4dB Attenuator	Pasternack	PE7047-4	4935	12	28-Nov-2018
Hygrometer	Rotronic	HP21	4989	12	26-Apr-2019
Cable (40GHz	Rosenberger	LU1-001-2000	5020	-	O/P Mon
Cable (18GHz	Rosenberger	LU7-071-1000	5100	12	04-Oct-2019
EmX Software	TUV SUD Product Service	EmX V.1.3.21	5125	-	Software

O/P Mon – Output Monitored with Calibrated Equipment
TU – Traceability Unscheduled

3.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:-

Test Discipline	Frequency / Parameter	MU
Conducted Maximum Peak Output Power	30 MHz to 20 GHz Amplitude	± 0.1 dB
Conducted Emissions	30 MHz to 20 GHz Amplitude	± 2.3 dB
Frequency Stability	30 MHz to 2 GHz	± 5.0 Hz
Occupied Bandwidth	Up to 20 MHz Bandwidth	± 1.1 Hz
Band Edge	30 MHz to 20 GHz Amplitude	± 2.3 dB
Radiated Emissions, Bilog Antenna, AOATS	30MHz to 1GHz Amplitude	5.1dB*
Radiated Emissions, Horn Antenna, AOATS	1GHz to 40GHz Amplitude	6.3dB*
Worst case error for both Time and Frequency measurement 12 parts in 10^6		

SECTION 4

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

4.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

This report relates only to the actual item/items tested.

Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation.

Results of tests not covered by our UKAS Accreditation Schedule are marked NUA (Not UKAS Accredited).

Product Service

ANNEX A

MODULE LIST

Configuration A/B			
Product	Product No	R-State	Serial No
mRRUS12 B4	KRC 161 326/4	R1E	C827530909
Software Version:	CXP9013268/9	Revision:	R73AM