Prüfbericht - Nr.: *Test Report No.:*	**50226141 001**	**Auftrags-Nr.:** *Order No:*	180103571	Seite 1 von 54 *Page 1 of 54*
Kunden-Referenz-Nr.: *Client Reference No.:*	N/A	**Auftragsdatum:** *Order date:*	01.02.2019	
Auftraggeber: *Client:*	Ring LLC 1523 26th St, Santa Monica, CA 90404, USA			
Prüfgegenstand: *Test item:*	Floodlight Battery			
Bezeichnung / Typ-Nr. : *Identification / Type No. :*	5B21S8			
Auftrags-Inhalt: *Order content:*	TÜV Rheinland – FCC/IC Service			
Prüfgrundlage: *Test specification:*	CFR47 FCC Part 15: Subpart C Section 15.247 CFR47 FCC Part 15: Subpart C Section 15.209 RSS-247 Issue 2 February 2017 RSS-Gen Issue 5 November 2018			
Wareneingangsdatum: *Date of receipt:*	21.01.2019			
Prüfmuster-Nr.: *Test sample No.:*	A000876441-001/003			
Prüfzeitraum: *Testing period:*	21.01.2019-27.02.2019			
Ort der Prüfung: *Place of testing:*	Refer to section 1.1.			
Prüflaboratorium: *Testing laboratory:*	TÜV Rheinland / CCIC (Ningbo) Co., Ltd.			
Prüfergebnis∗: *Test result∗:*	Pass			

geprüft von / *tested by:*			**kontrolliert von /** *reviewed by:*		
	Caidong Xie/Trainee	Caidong Xie			
28.02.2019	Season Yang/PE	Season Yang	28.02.2019	Feng Liang/TC	Feng Liang
Datum *Date*	**Name/Stellung** *Name/Position*	**Unterschrift** *Signature*	**Datum** *Date*	**Name/Stellung** *Name/Position*	**Unterschrift** *Signature*

Sonstiges/ *Other*

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

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

TEST SUMMARY

4.1.1 ANTENNA REQUIREMENT
Result:
Pass

4.1.2 6DB BANDWIDTH MEASUREMENT
Result:
Pass

4.1.3 99% EMISSION BANDWIDTH MEASUREMENT
Result:

4.1.4 MAXIMUM CONDUCTED OUTPUT POWER
Result:
Pass

4.1.5 EQUIVALENT ISOTROPICALLY RADIATED POWER
Result:
Pass

4.1.6 POWER SPECTRAL DENSITY
Result:
Pass

4.1.7 CONDUCTED SPURIOUS EMISSIONS MEASURED IN 100 KHZ BANDWIDTH
Result:
Pass

4.1.8 RADIATED SPURIOUS EMISSION
Result:
Pass

Contents

1 Test Sites

1.1 Test Facilities

Laboratory: TÜV Rheinland /CCIC(Ningbo) Co., Ltd.

1st Floor, Building 11, Scholar Innovation Park, No.1188 Zhongguan Road, Zhenhai District, Ningbo 315200 P.R. China.

The used test equipment is in accordance with CISPR 16-1 series standards for measurement of radio interference.

1.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

No.	Equipment	Model	Inventory no.	Last cal. date	Cal. due date
1.	EMI test receiver	ESR7	101929	2018.12.07	2019.12.06
2.	Spectrum analyzer	FSV40	101412	2018.12.07	2019.12.06
3.	Pre-amplifier	SCU-18F	180051	2018.12.07	2019.12.06
4.	Horn antenna	HF907	102653	2017.08.03	2020.08.02
5.	Bilog Antenna	CBL6112D	49033	2018.04.13	2021.04.12

1.3 Measurement Uncertainty

Test Item	Expanded Measurement Uncertainty (k=2)
Conducted Emission (9-150kHz)	3.70dB
Conducted Emission (150k-30MHz)	3.30dB
Radiated Emission (30-1000MHz)	4.52dB
Radiated Emission (1-18GHz)	4.37dB

2 General Product Information

2.1 Product Function and Intended Use

The EUT(equipment under test) is a Floodlight Battery which support Bluetooth and LoRa DTS function operated at 2.4GHz and 902-928MHz respectively. For the further information, refer to the user's manual.

2.2 Ratings and System Details

Operating Voltage : DC 6V
Testing Voltage : DC 6V
Rated power : Max. 9.5W
Protection Class : Class Ⅲ
Refer to the user's manual for further information.

Technical Specification of Bluetooth (BLE)

Technical Specification	Value
Operating Frequency band	2402 – 2480 MHz
Bluetooth Core Version	Bluetooth Low Energy 4.2
Channel separation	2MHz
Extreme Temperature Range	-20℃ ~ 55℃
Modulation	GFSK
Antenna Type	Internal Antenna
Antenna Gain	0dBi
Channel	0~39

Technical Specification of LoRa DTS

Technical Specification	Value
Operating Frequency band	902 – 928 MHz
LoRa DTS Core Version	
Extreme Temperature Range	-20℃ ~ 55℃
Bandwidth（KHz）	500
Modulation	LoRa DTS
Antenna Type	Internal Antenna
Antenna Gain	-2dBi
Channel（MHz）	902.5, 903.3, 904.1, 904.9, 905.7, 906.5, 907.3, 908.1, 908.9, 909.7, 910.5, 911.3, 912.1, 912.9, 913.7, 914.5, 915.3, 916.1, 916.9, 917.7, 918.5, 919.3, 920.1, 920.9, 921.7, 922.5, 923.3, 924.1, 924.9, 925.7, 926.5, 927.3 903, 904.6, 906.2, 907.8, 909.4, 911, 912.6 923.3, 923.9, 924.5, 925.1, 925.7, 926.3, 926.9

2.3 Independent Operation Modes

The basic operation modes are:
On, BLE, LoRa DTS

1. Transmitting on low channel
2. Transmitting on middle channel
3. Transmitting on high channel

2.4 Noise Generating and Noise Suppressing Parts

Refer to the Circuit diagram for further information.

2.5 Submitted Documents

Circuit diagram, PCB layout, Labels, user's manual, etc.

3 Test Set-up and Operation Modes

3.1 Principle of Configuration Selection

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

3.2 Test Operation and Test Software

During testing, Channel & Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power was selected according to the instruction given by the manufacturer. The setting of the RF output power expected by the customer shall be fixed on the firmware of the final end product.

All testing were performed according to the procedures in ANSI C63.10: 2013.

Test Software EMC32 V10.30 was used in the radiated emission test.

3.3 Special Accessories and Auxiliary Equipment

Description	Manufacturer	Model No.
notebook	Lenovo	T420

3.4 Countermeasures to achieve EMC Compliance

The tested sample contained noise suppression components as specified in the circuit diagram. No special measure is employed to achieve the requirement.

3.5 Test set-up

Diagram of Measurement Configuration for Radiation Test (Below 1GHz)

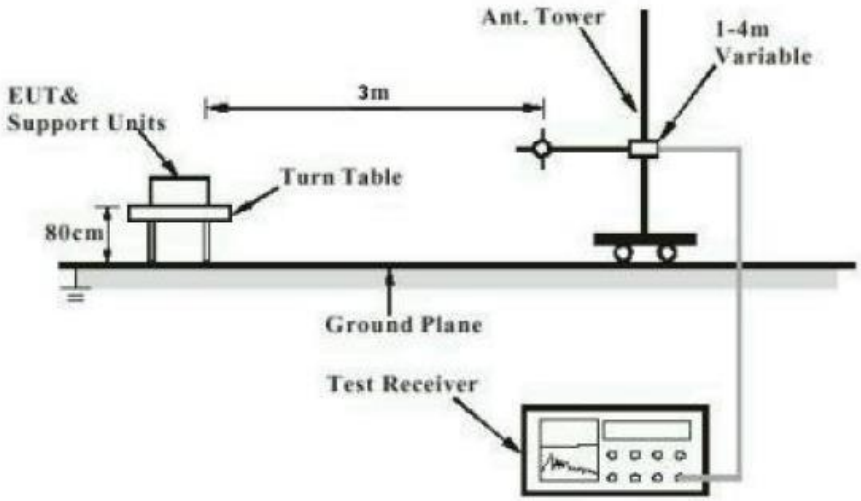


Diagram of Measurement Configuration for Radiation Test (Above 1GHz)

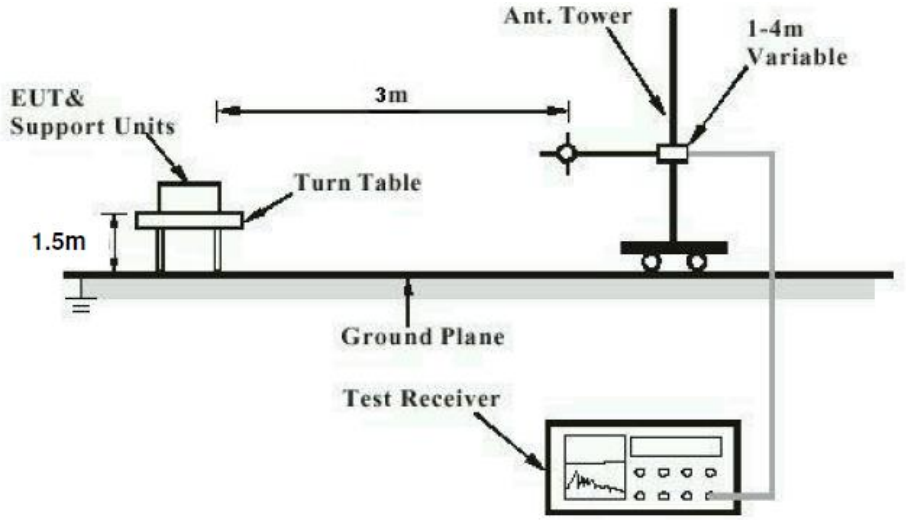
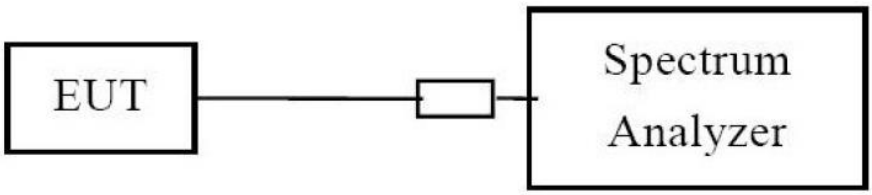


Diagram of Measurement Configuration for Conducted Transmitter Measurement



4 Test Results

4.1 Transmitter Requirement & Test Suites

4.1.1 Antenna Requirement

Result: **Pass**

Test Specification
Test standard : FCC Part 15.247(b)(4) and Part 15.203
Limits : the use of antennas with directional gains that do not exceed 6dBi

According to the manufacturer declared, the EUT has two internal antennas, the maximum directional gain of antennas is 0dBi, and the antennas connector are designed with permanent attachment and no consideration of replacement. Therefore the EUT is considered sufficient to comply with the provision. For more details, refer to EUT photo.

4.1.2 6dB Bandwidth Measurement

Result: **Pass**

Test Specification

Test standard	:	FCC Part 15.247(a)(2) RSS-247 Issue 2 February 2017 Clause 5.2(a)
Basic standard	:	ANSI C63.10: 2013
Limits	:	At least 500kHz
Kind of test site	:	Shielded Room

Test Setup

Date of testing	:	25.01.2019~15.02.2019
Input voltage	:	Powered by battery
Operational mode	:	On, BLE, LoRa DTS
Test channel	:	Lo, Mi, Hi
Temperature	:	18.3°C
Relative humidity	:	56.1%
Atmospheric pressure	:	101 kPa

Table 2: Test result of 6dB Bandwidth, BLE

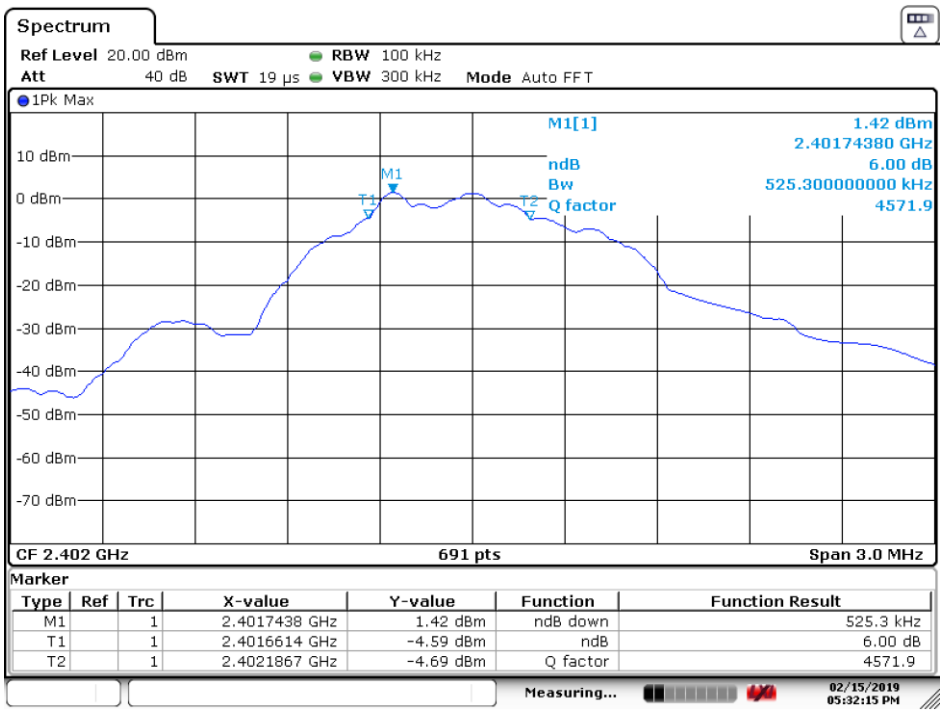
Channel	Channel Frequency (MHz)	6dB Bandwidth (kHz)	Limit (kHz)	Result
Low Channel	2402	525.3	500	Pass
Mid Channel	2440	529.7	500	Pass
High Channel	2480	525.3	500	Pass

Table 3: Test result of 6dB Bandwidth, LoRa DTS

Channel	Channel Frequency (MHz)	6dB Bandwidth (kHz)	Limit (kHz)	Result
Low Channel	902.5	620.8	500	Pass
Mid Channel	914.5	620.8	500	Pass
High Channel	927.3	625.2	500	Pass

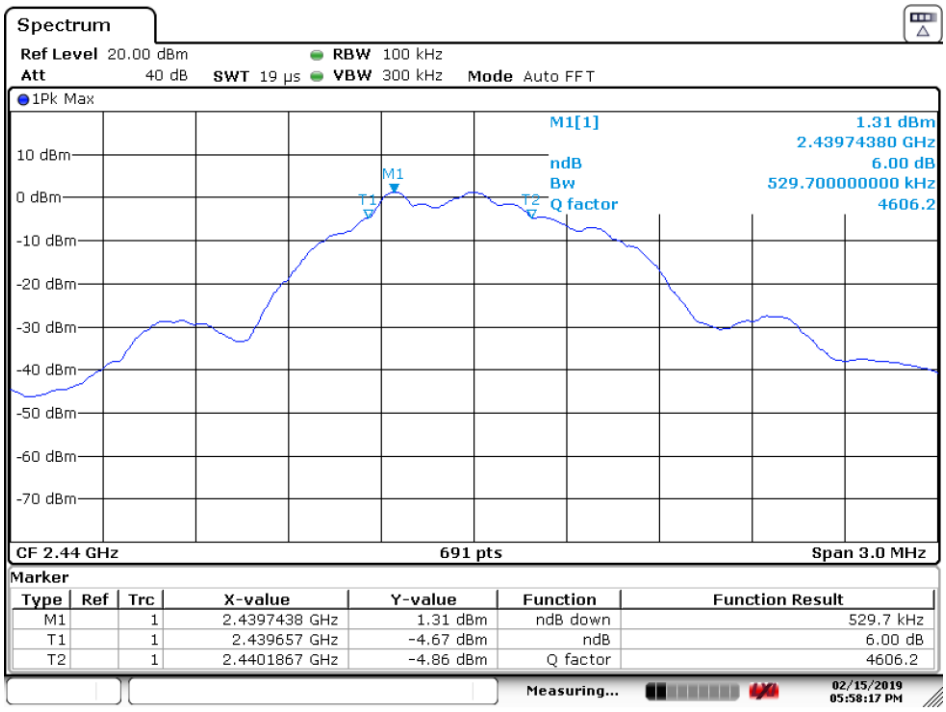
Figure 1: 6dB Bandwidth Measurement

Low Channel: 2402MHz



Date: 15.FEB.2019 17:32:15

Mid Channel: 2440MHz



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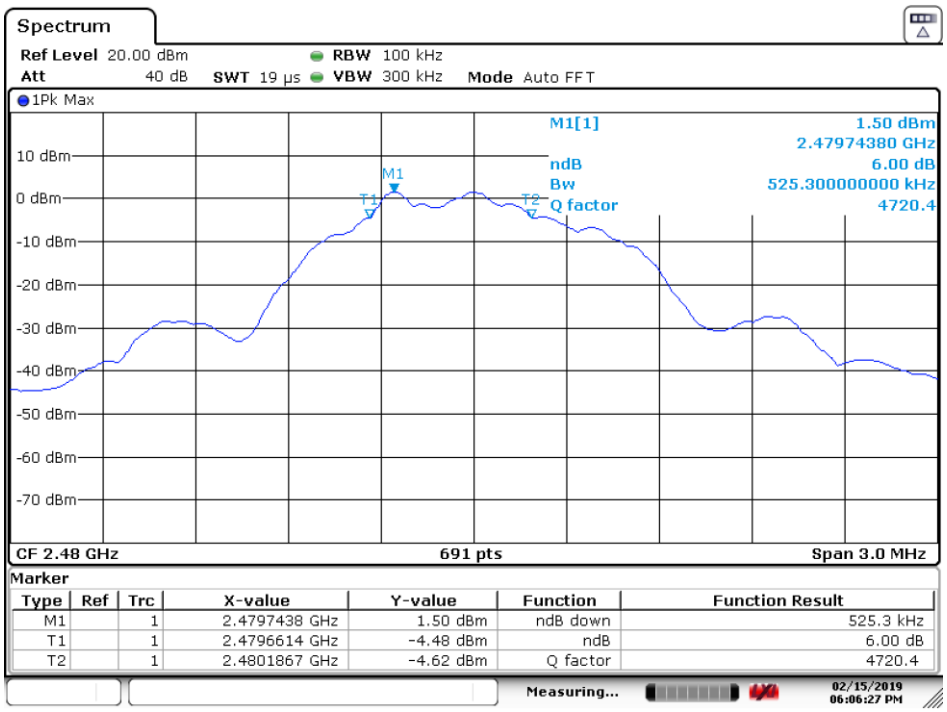
High Channel: 2480MHz



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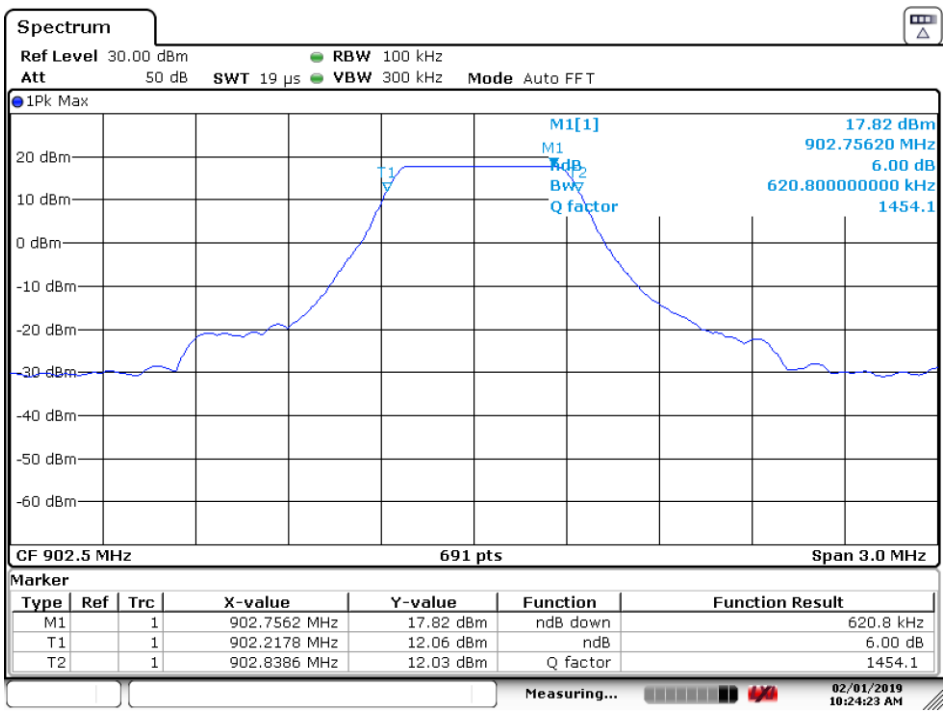
Low Channel: 902.5MHz



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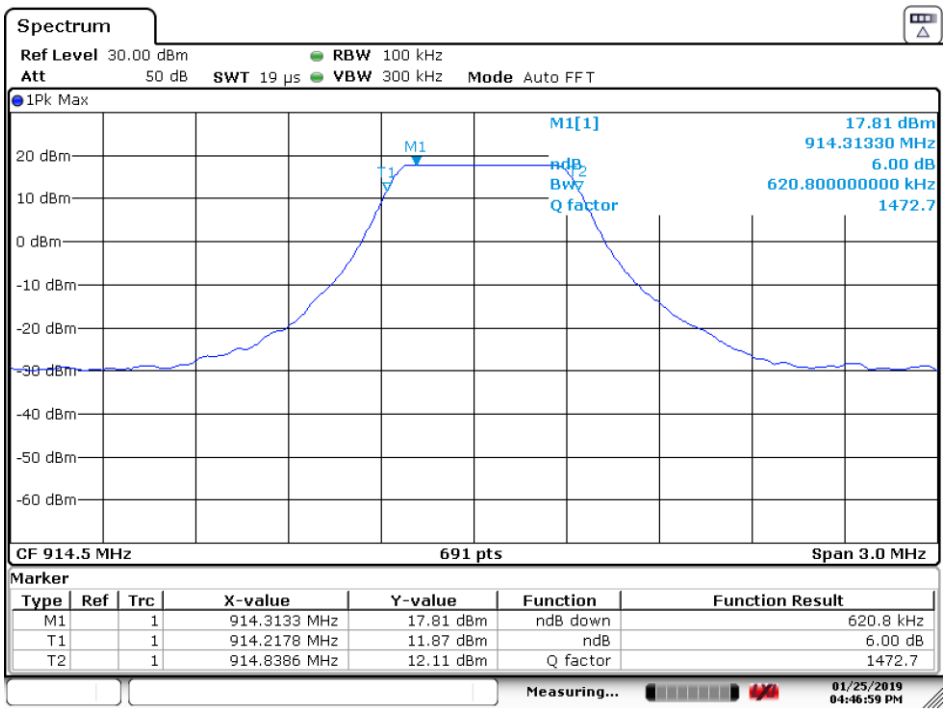
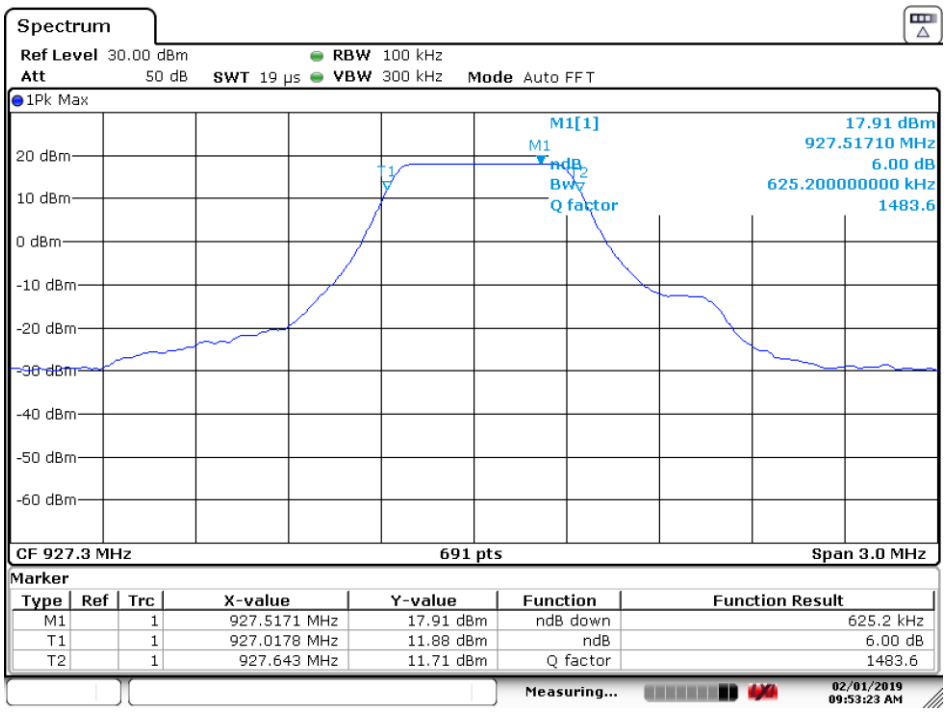
Mid Channel: 914.5MHz



Date: 25.JAN.2019 16:46:59

High Channel: 927.3MHz



Date: 1.FEB.2019 09:53:23

4.1.3 99% Emission Bandwidth Measurement

Result:

Test Specification		
Test standard	:	RSS-Gen Issue 5
Kind of test site	:	Shielded Room

Test Setup

Date of testing	:	27.02.2019
Input voltage	:	Powered by battery
Operational mode	:	On, BLE, LoRa DTS
Test channel	:	Lo, Mi, Hi
Temperature	:	20.1°C
Relative humidity	:	55.4%
Atmospheric pressure	:	101 kPa

Table 4 Test result of 99% Emission Bandwidth, BLE

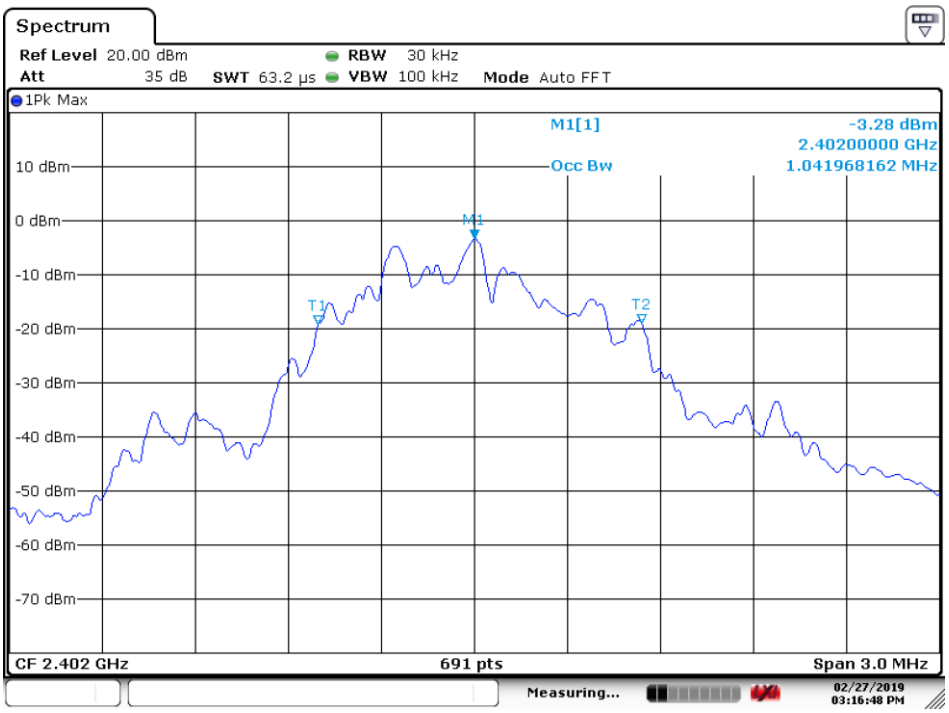
Channel	Channel Frequency (MHz)	99% Emission Bandwidth (MHz)
Low Channel	2402	1.041
Mid Channel	2440	1.041
High Channel	2480	1.037

Table 5: Test result of 99% Emission Bandwidth, LoRa DTS

Channel	Channel Frequency (MHz)	99% Emission Bandwidth (kHz)
Low Channel	902.5	503.61
Mid Channel	914.5	497.82
High Channel	927.3	497.82

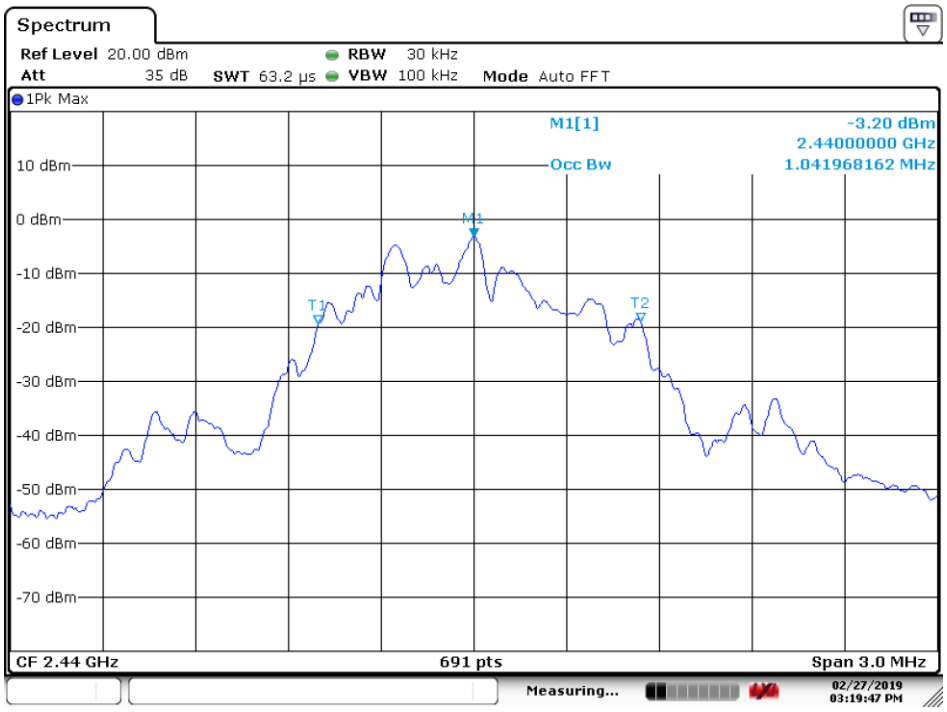
Figure 2: 99% Emission Bandwidth Measurement

Low Channel: 2402MHz



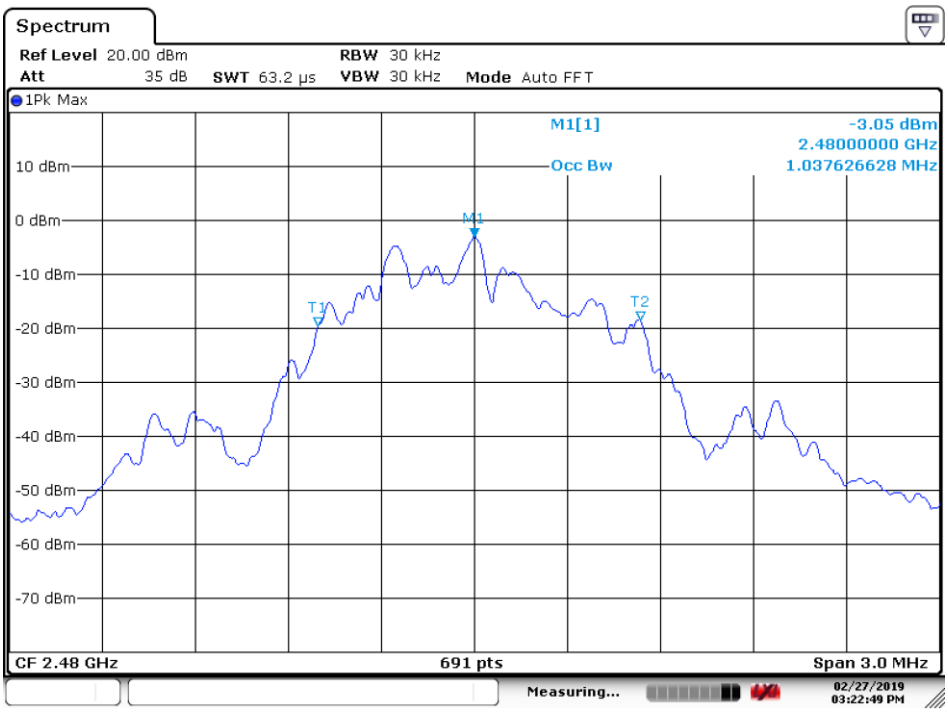
Date: 27.FEB.2019 15:16:48

Mid Channel: 2440MHz



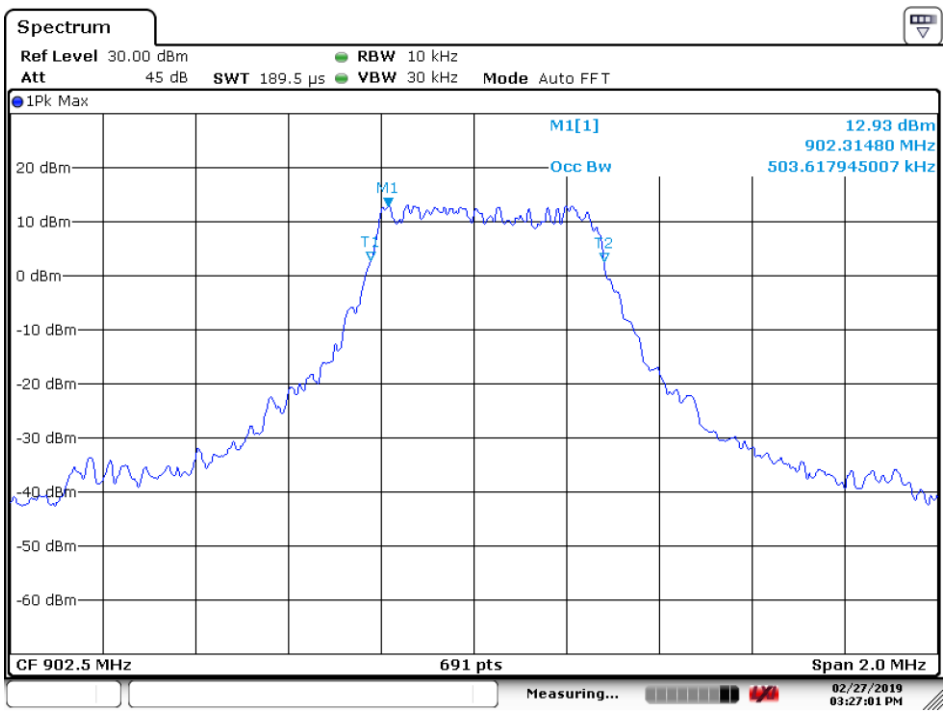
Date: 27.FEB.2019 15:19:48

High Channel: 2480MHz



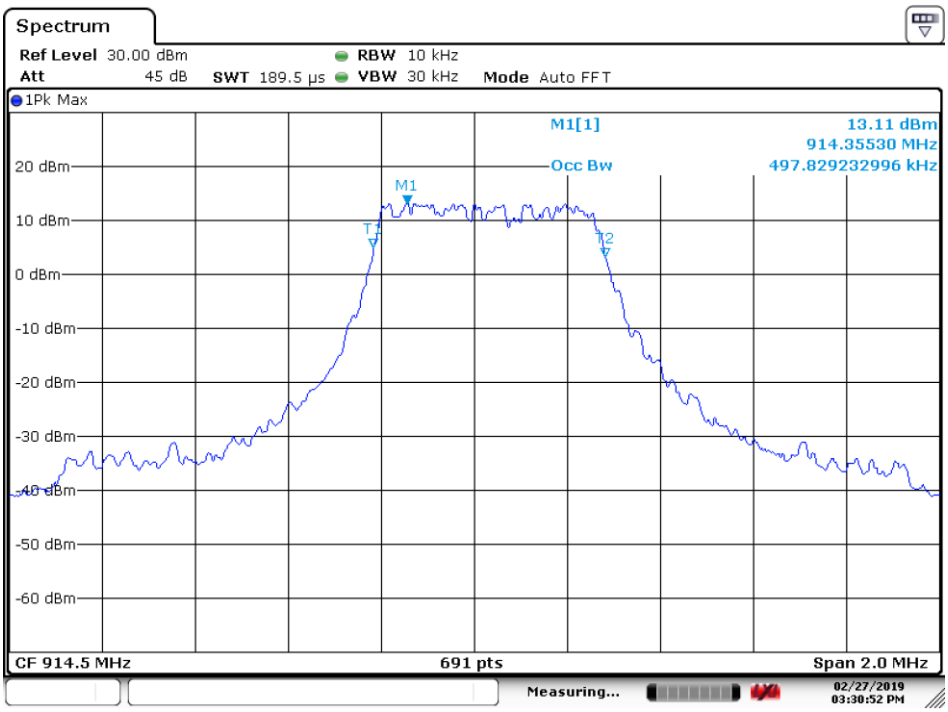
Date: 27.FEB.2019 15:22:50

Low Channel: 902.5MHz



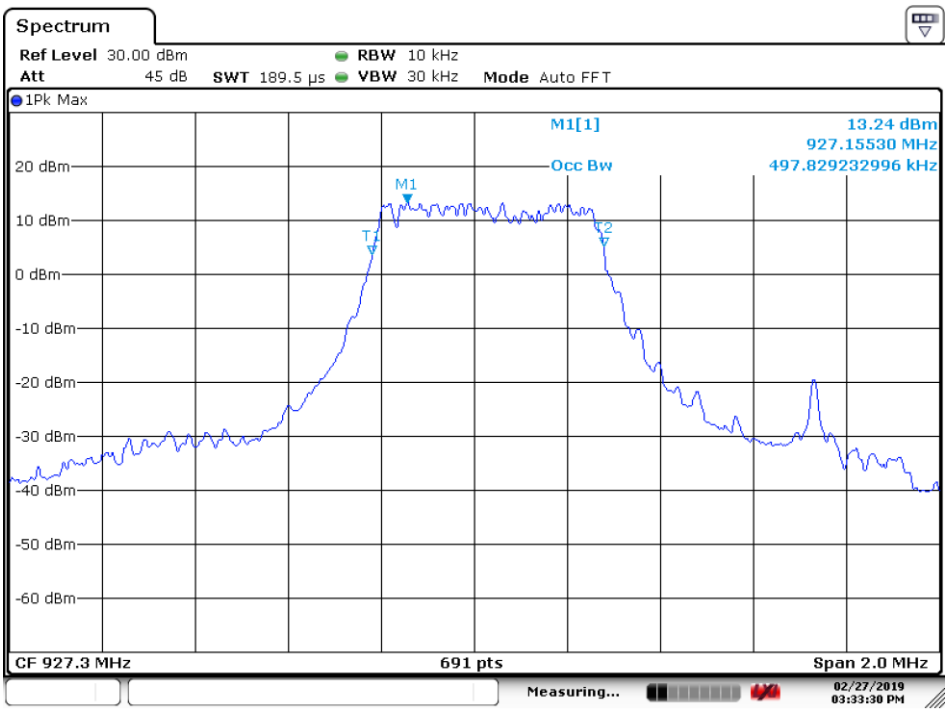
Date: 27.FEB.2019 15:27:01

Mid Channel: 914.5MHz



Date: 27.FEB.2019 15:30:52

High Channel: 927.3MHz



Date: 27.FEB.2019 15:33:31

4.1.4 Maximum Conducted Output Power

Result: **Pass**

Test Specification		
Test standard	:	FCC Part 15.247(b)(3) RSS-247 Issue 2 February 2017 Clause 5.4(d)
Basic standard	:	ANSI C63.10: 2013
Limits	:	For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz: 1 Watt (30dBm)
Kind of test site	:	Shielded Room

Test Setup

Date of testing	:	25.01.2019~15.02.2019
Input voltage	:	Powered by battery
Operational mode	:	On, BLE, LoRa DTS
Test channel	:	Lo, Mi, Hi
Temperature	:	18.3°C
Relative humidity	:	56.1%
Atmospheric pressure	:	101 kPa

Table 6: Test result of Peak Output Power, BLE

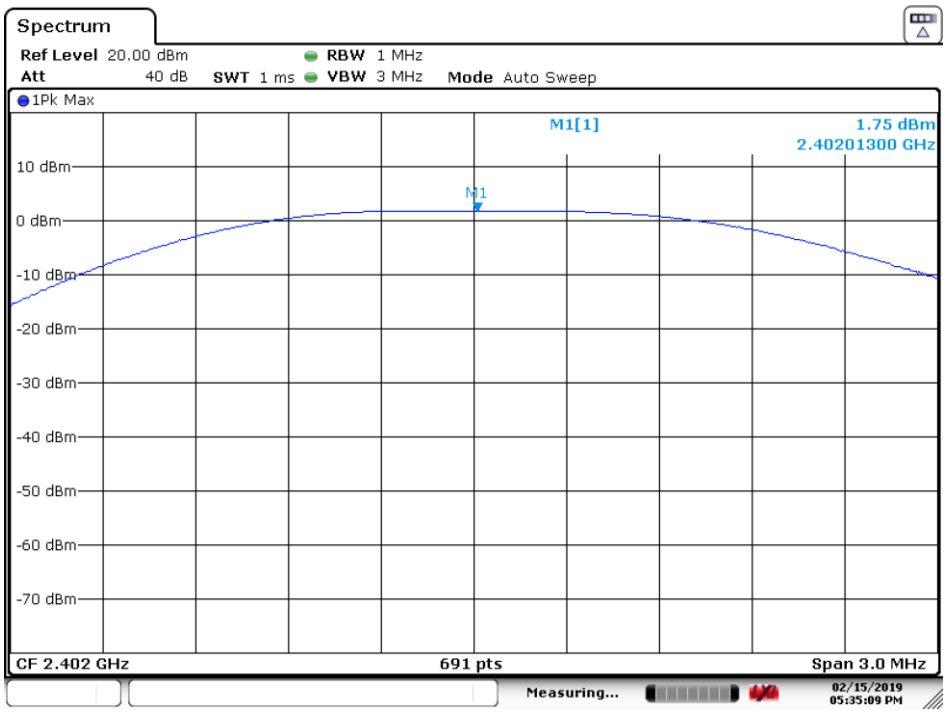
Channel	Channel Frequency (MHz)	Peak Output Power (dBm)	Limit (dBm)
Low Channel	2402	1.75	30
Mid Channel	2440	1.5	30
High Channel	2480	1.63	30

Table 7: Test result of Peak Output Power, LoRa DTS

Channel	Channel Frequency (MHz)	Peak Output Power (dBm)	Limit (dBm)
Low Channel	902.5	17.92	30
Mid Channel	914.5	17.99	30
High Channel	927.3	17.98	30

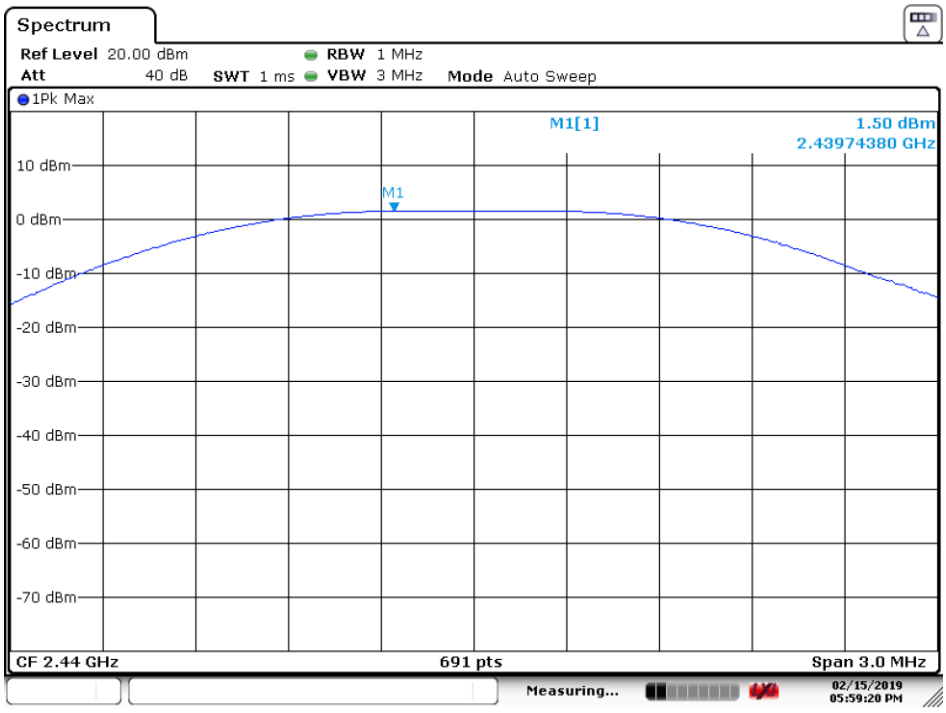
Figure 3: Maximum Conducted Output Power

Low Channel: 2402MHz



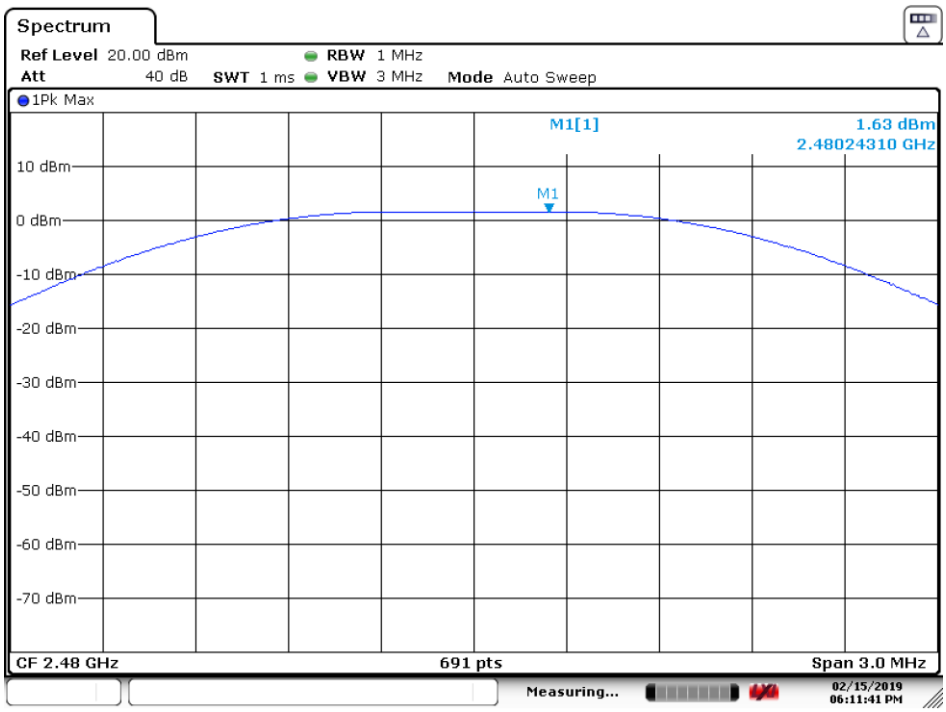
Date: 15.FEB.2019 17:35:10

Mid Channel: 2440MHz



Date: 15.FEB.2019 17:59:20

High Channel: 2480MHz



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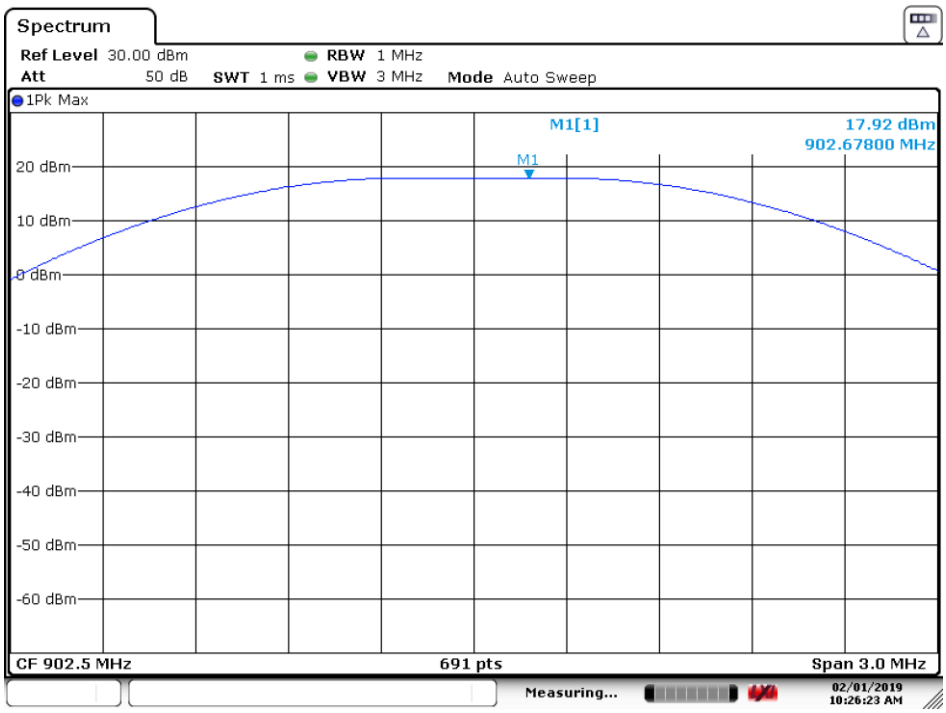
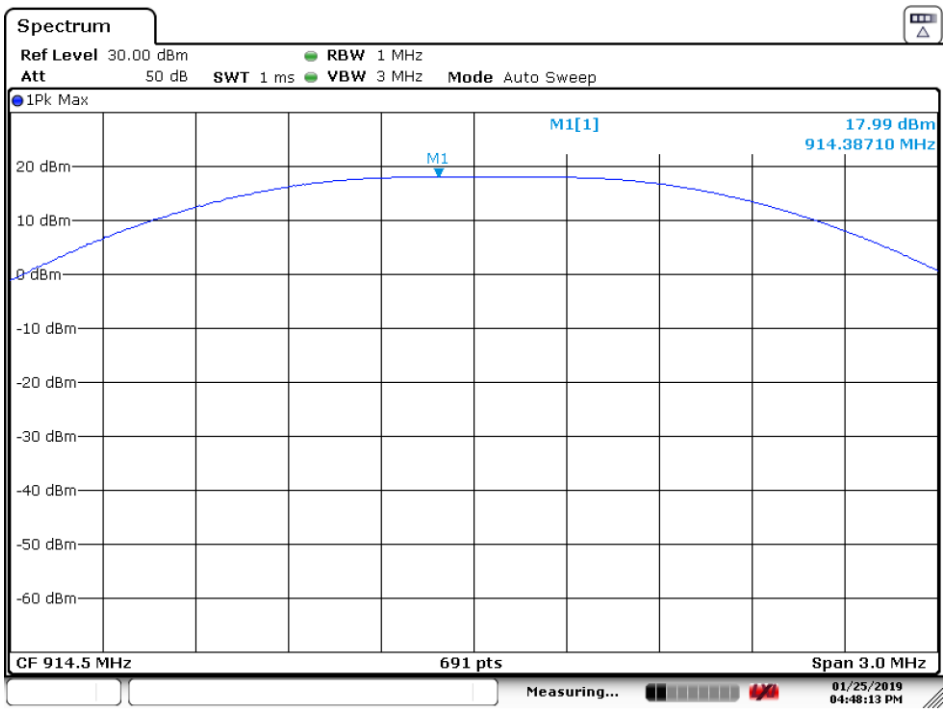
Low Channel: 902.5MHz



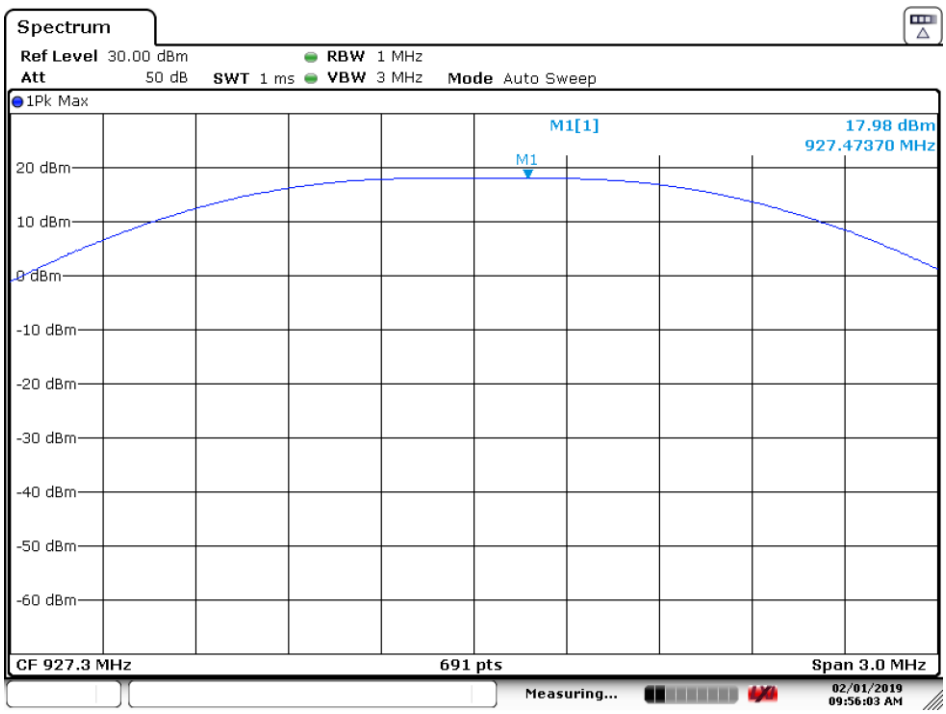
Date: 1.FEB.2019 10:26:23

Mid Channel: 914.5MHz



Date: 25.JAN.2019 16:48:12

High Channel: 927.3MHz



Date: 1.FEB.2019 09:56:03

4.1.5 Equivalent Isotropically Radiated Power

Result: **Pass**

Test Specification		
Test standard	:	RSS-247 Issue 2 February 2017 Clause 5.4(d)
Limits	:	For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz: 4 Watt (36dBm)
Kind of test site	:	Shielded Room

Test Setup

Date of testing	:	25.01.2019~15.02.2019
Input voltage	:	Powered by battery
Operational mode	:	On, BLE, LoRa DTS
Test channel	:	Lo, Mi, Hi
Temperature	:	18.3°C
Relative humidity	:	56.1%
Atmospheric pressure	:	101 kPa

Table 8: Test result of E.I.R.P., BLE

Channel	Channel Frequency (MHz)	Peak Output Power (dBm)	Limit (dBm)	Antenna Gain	E.I.R.P. (dBm)
Low Channel	2402	1.75	36	0 dBi	1.75
Mid Channel	2440	1.5	36	0 dBi	1.5
High Channel	2480	1.63	36	0 dBi	1.63

Table 9: Test result of E.I.R.P., LoRa DTS

Channel	Channel Frequency (MHz)	Peak Output Power (dBm)	Limit (dBm)	Antenna Gain	E.I.R.P. (dBm)
Low Channel	902.5	17.92	36	-2 dBi	15.92
Mid Channel	914.5	17.99	36	-2 dBi	15.99
High Channel	927.3	17.98	36	-2 dBi	15.98

4.1.6 Power Spectral Density

Result: **Pass**

Test Specification

Test standard	:	FCC Part 15.247(e) RSS-247 Issue 2 February 2017 Clause 5.2(b)
Basic standard	:	ANSI C63.10: 2013
Limits	:	8 dBm in any 3 kHz band
Kind of test site	:	Shielded Room

Test Setup

Date of testing	:	25.01.2019~15.02.2019
Input voltage	:	Powered by battery
Operational mode	:	On, BLE, LoRa DTS
Test channel	:	Lo, Mi, Hi
Temperature	:	19°C
Relative humidity	:	54.1%
Atmospheric pressure	:	101 kPa

Table 10: Test result of Power Spectral Density, BLE

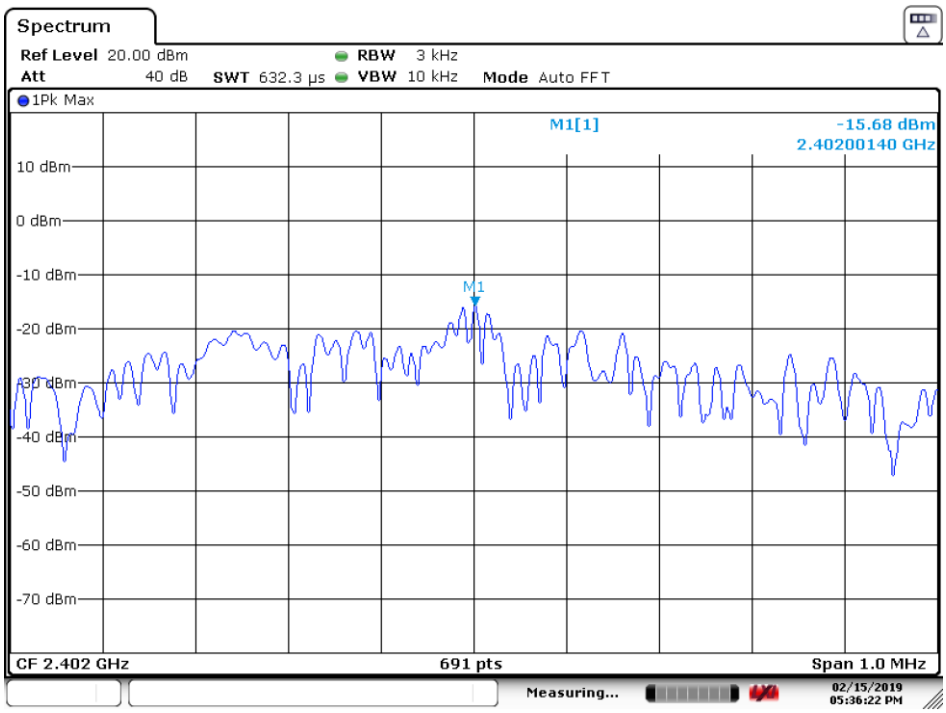
Channel	Channel Frequency (MHz)	Measured Power Density (dBm)	Limit (dBm)	Result
Low Channel	2402	-15.68	8.0	Pass
Mid Channel	2440	-15.65	8.0	Pass
High Channel	2480	-15.46	8.0	Pass

Table 11: Test result of Power Spectral Density, LoRa DTS

Channel	Channel Frequency (MHz)	Measured Power Density (dBm)	Limit (dBm)	Result
Low Channel	902.5	5.55	8.0	Pass
Mid Channel	914.5	5.89	8.0	Pass
High Channel	927.3	5.45	8.0	Pass

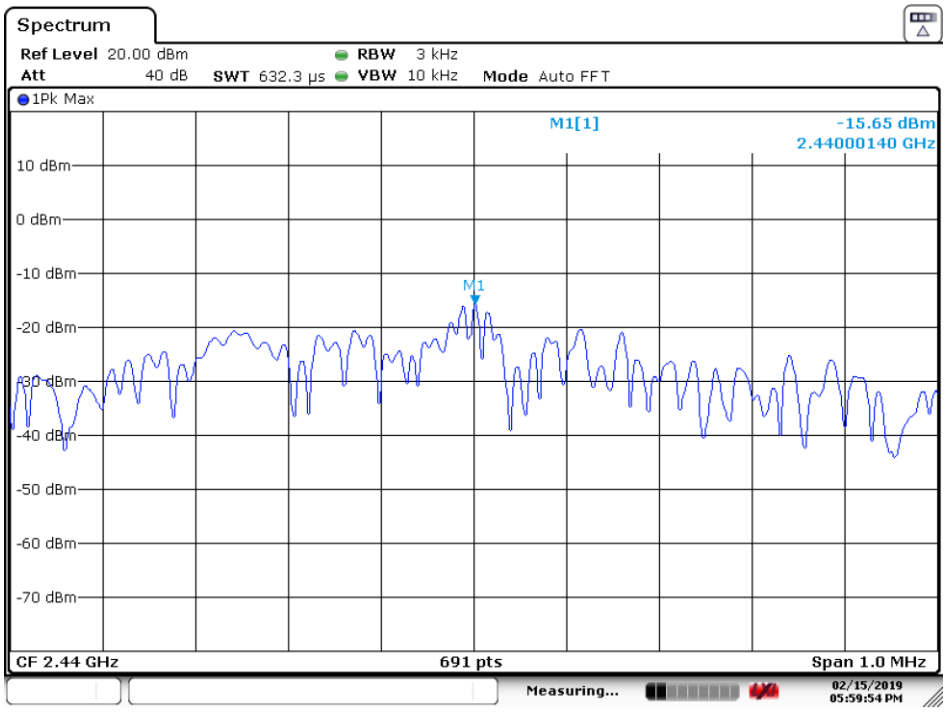
Figure 4: Power Spectral Density

Low Channel: 2402MHz



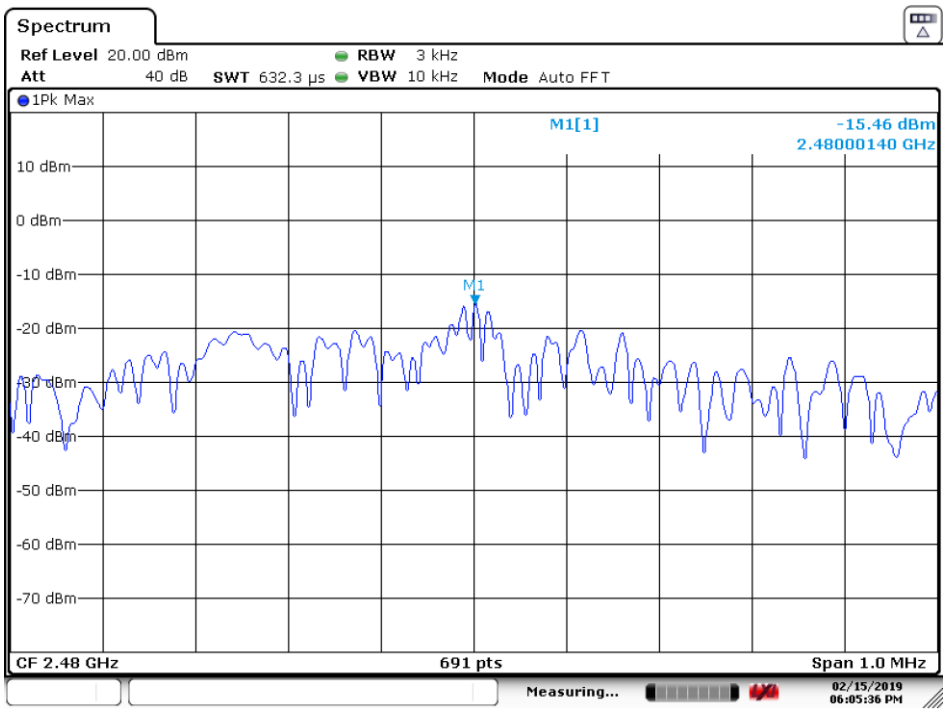
Date: 15.FEB.2019 17:36:22

Mid Channel: 2440MHz



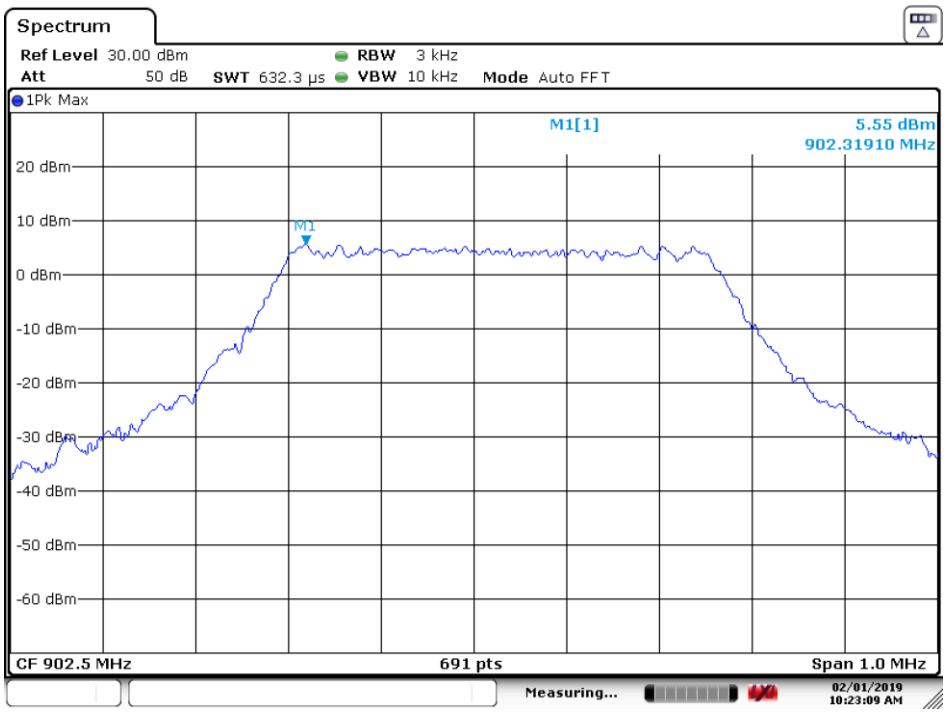
Date: 15.FEB.2019 17:59:54

High Channel: 2480MHz



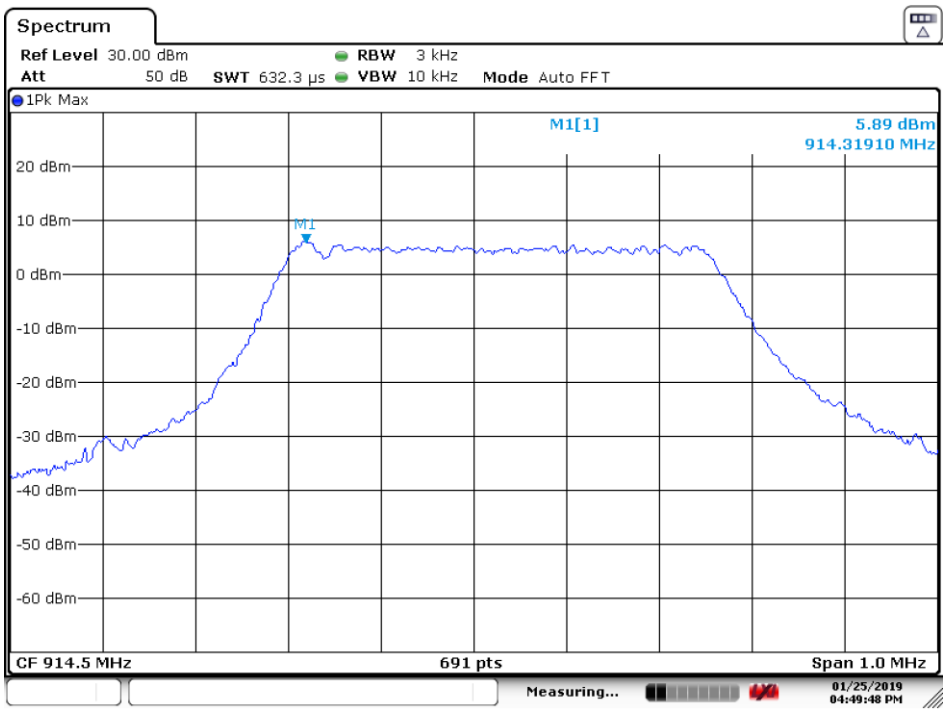
Date: 15.FEB.2019 18:05:37

Low Channel: 902.5MHz



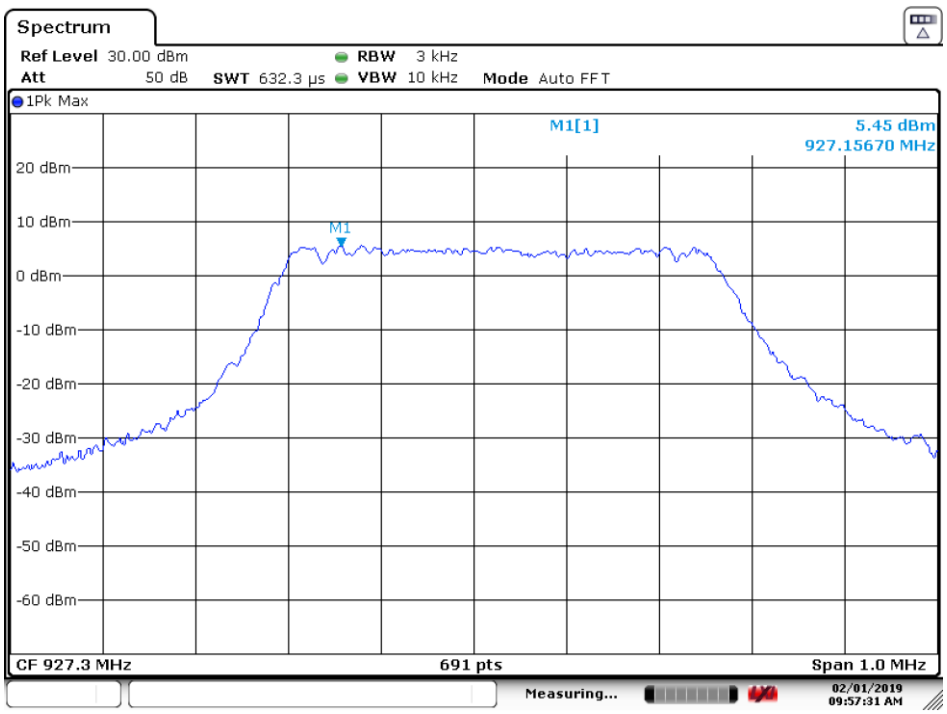
Date: 1.FEB.2019 10:23:09

Mid Channel: 914.5MHz



Date: 25.JAN.2019 16:49:48

High Channel: 927.3MHz



Date: 1.FEB.2019 09:57:31

4.1.7 Conducted Spurious Emissions Measured in 100 kHz Bandwidth

Result: **Pass**

Test Specification		
Test standard	:	FCC Part 15.247(d) RSS-247 Issue 2 February 2017 Clause 5.5
Basic standard	:	ANSI C63.10: 2013
Limits	:	20dB (below that in the 100kHz bandwidth within the band that contains the highest level of the desired power);
Kind of test site	:	Shielded Room

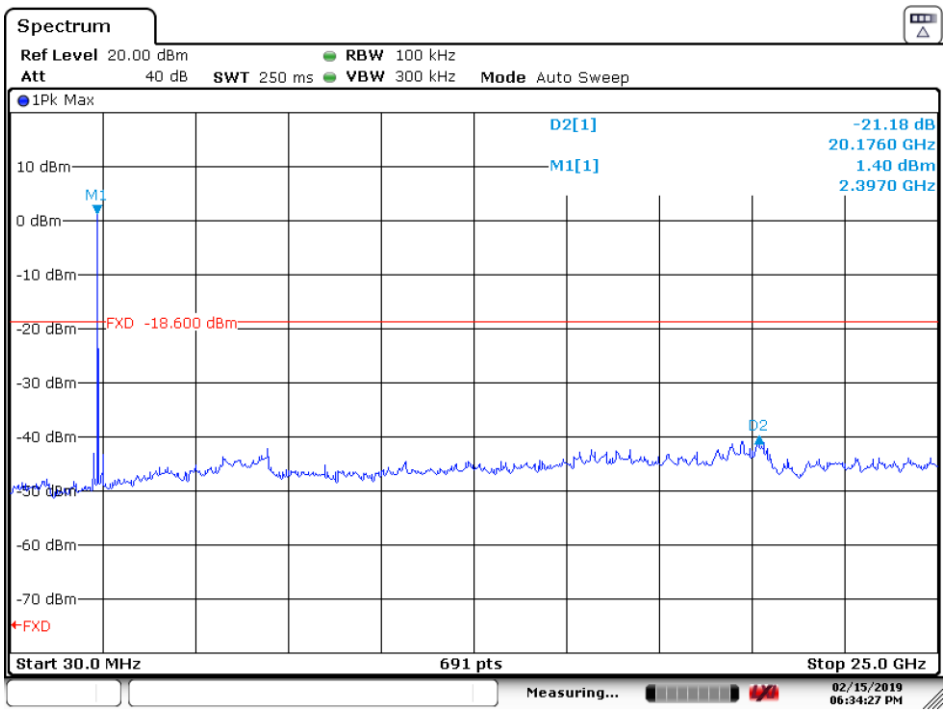
Test Setup

Date of testing	:	21.01.2019~15.02.2019
Input voltage	:	Powered by battery
Operational mode	:	On, BLE, LoRa DTS
Test channel	:	Lo, Mi, Hi
Temperature	:	20.1°C
Relative humidity	:	54.6%
Atmospheric pressure	:	101 kPa

All emissions are more than 20dB below fundamental, compliance is achieved as well.

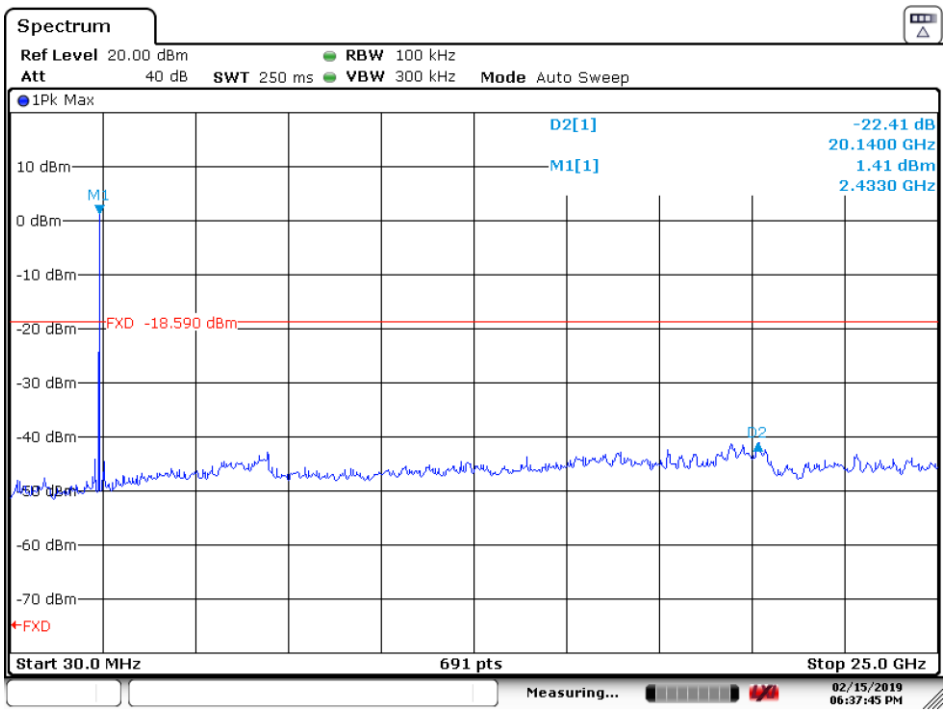
Figure 5: Conducted Spurious Emission

Low Channel: 2402MHz



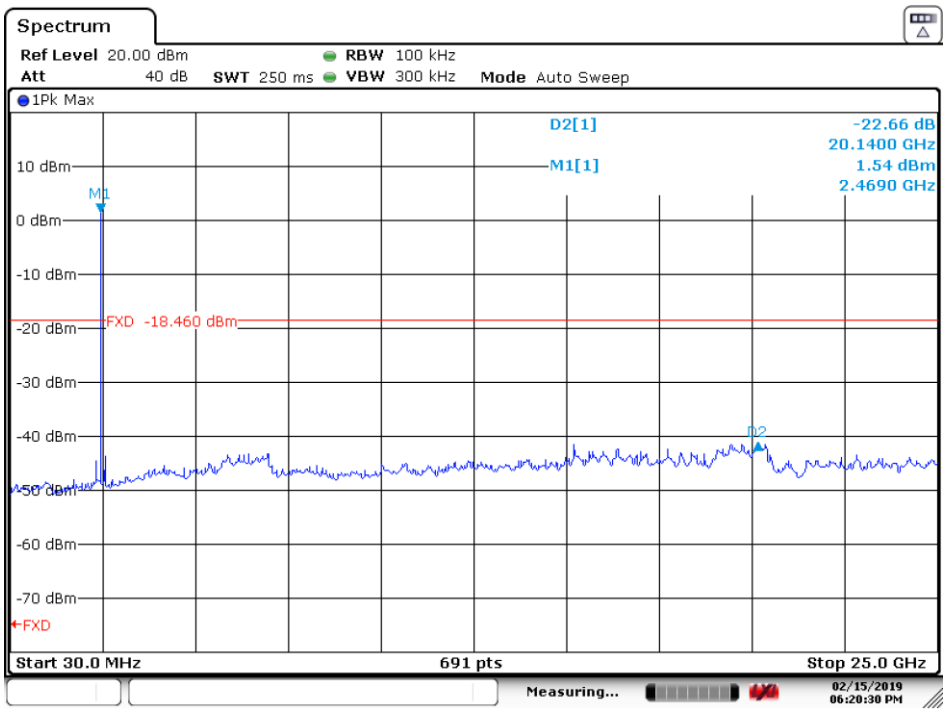
Date: 15.FEB.2019 18:34:27

Mid Channel: 2440MHz



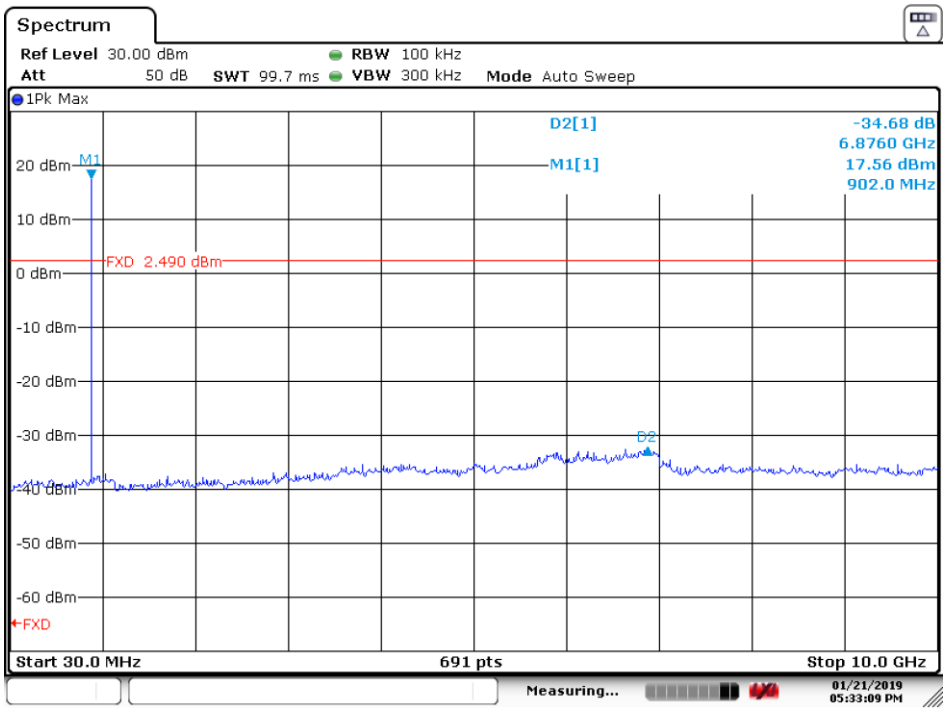
Date: 15.FEB.2019 18:37:45

High Channel: 2480MHz



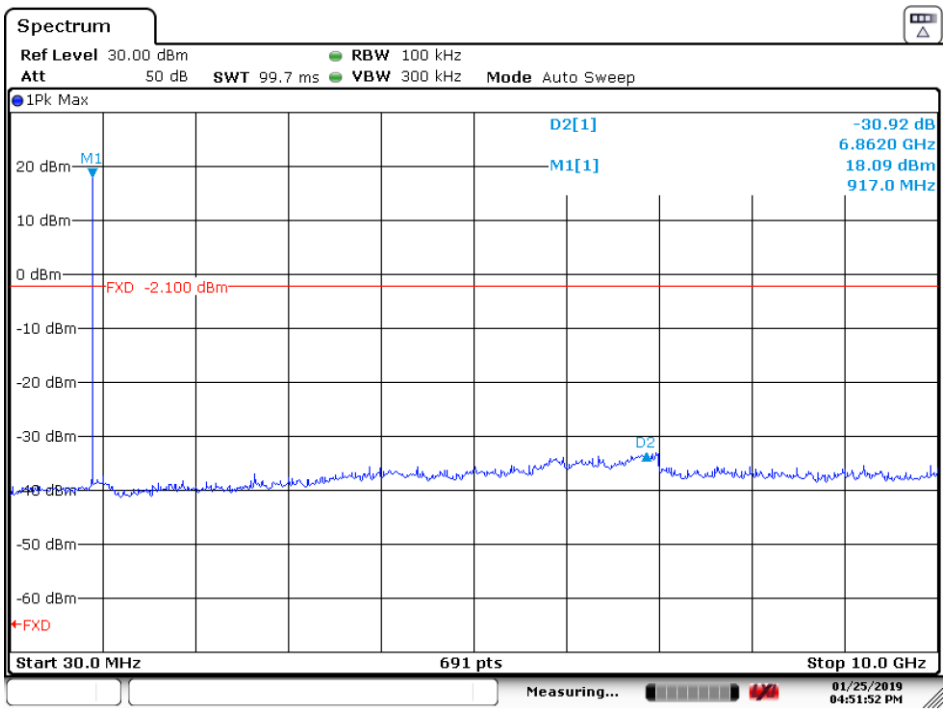
Date: 15.FEB.2019 18:20:31

Low Channel: 902.5MHz



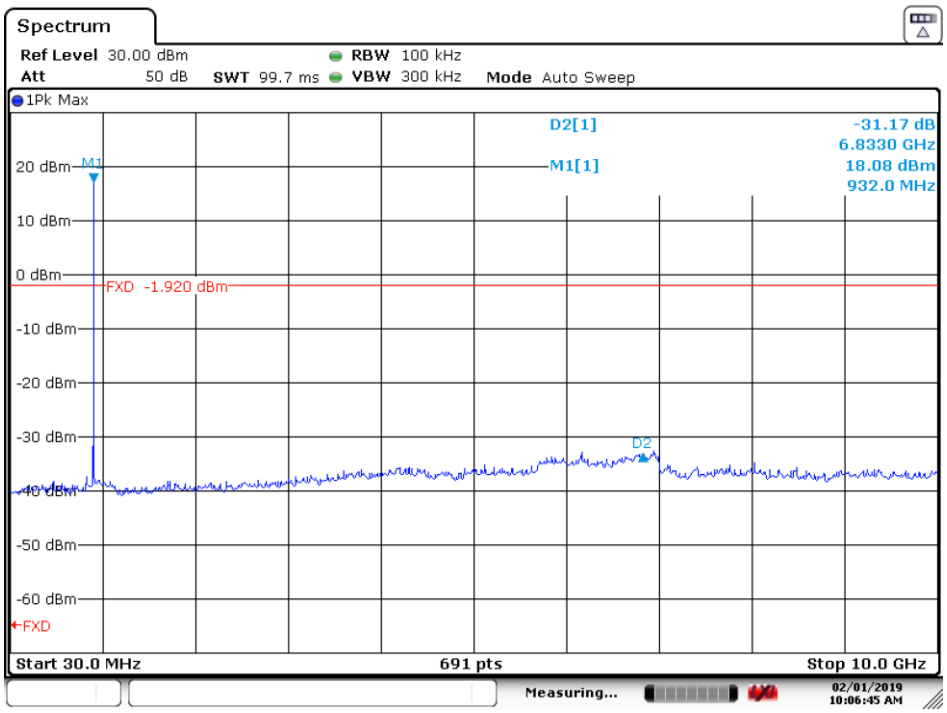
Date: 21.JAN.2019 17:33:09

Mid Channel: 914.5MHz



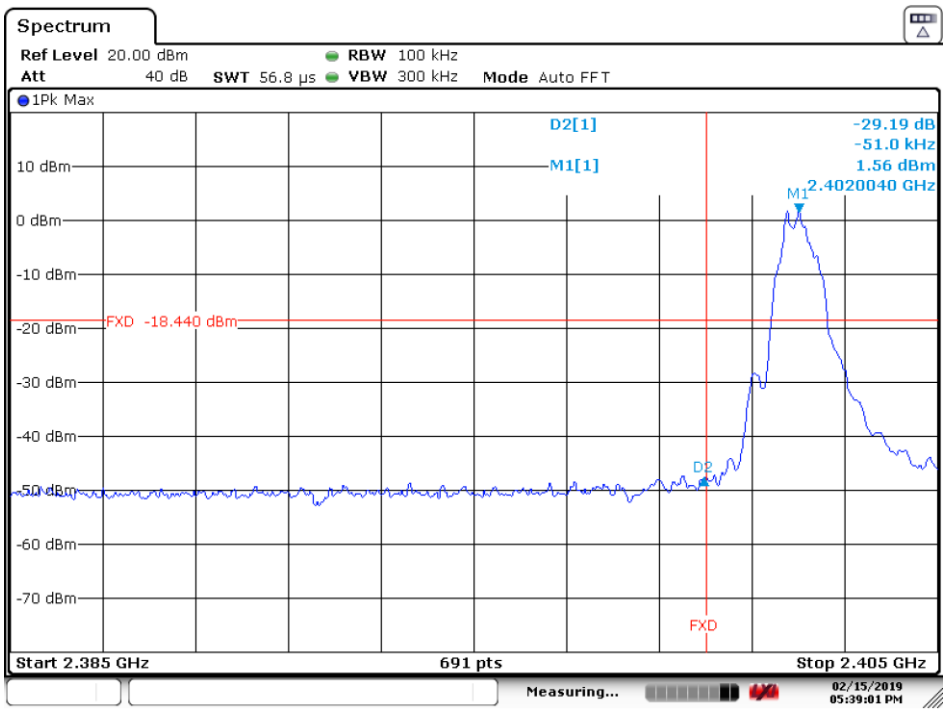
Date: 25.JAN.2019 16:51:52

High Channel: 927.3MHz

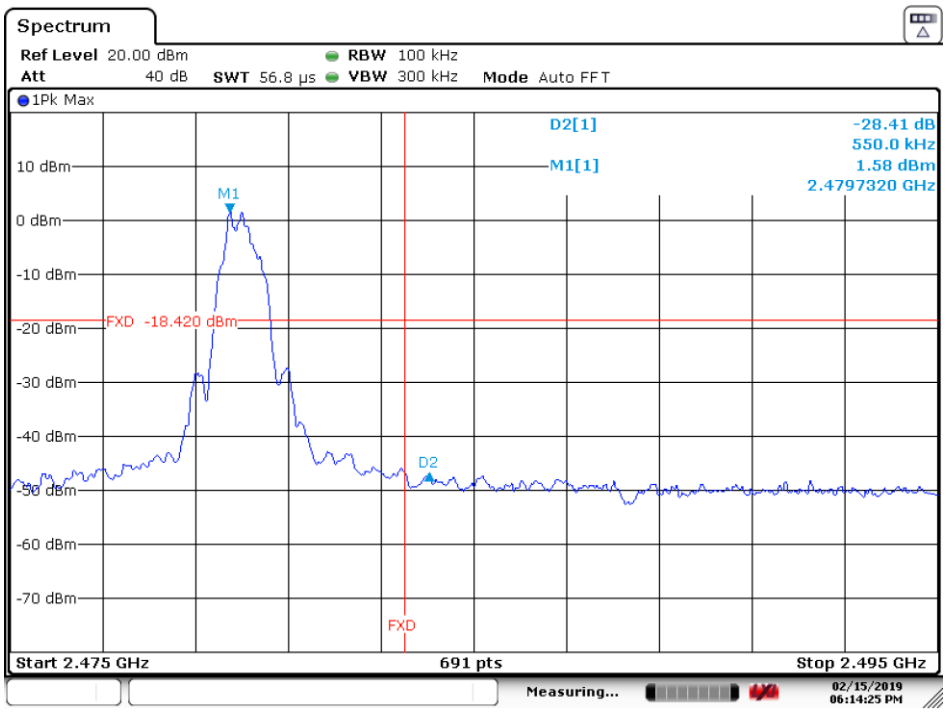


Date: 1.FEB.2019 10:06:45

Band edge BLE

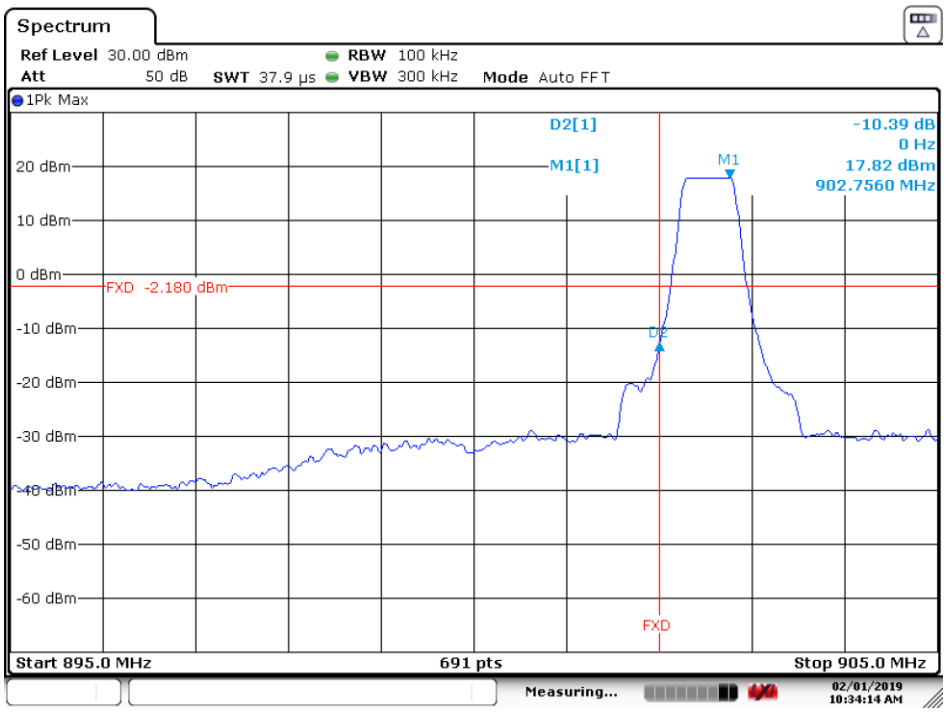


Date: 15.FEB.2019 17:39:02

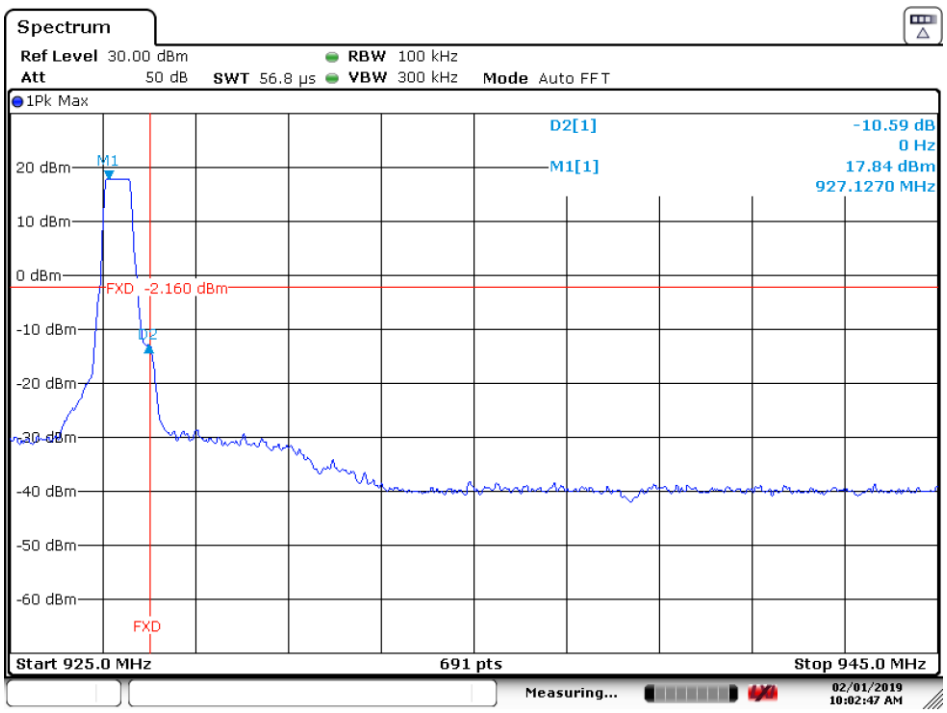


Date: 15.FEB.2019 18:14:26

Band edge LoRa DTS



Date: 1.FEB.2019 10:34:14



Date: 1.FEB.2019 10:02:47

4.1.8 Radiated Spurious Emission

Result: **Pass**

Test Specification		
Test standard	:	FCC Part 15.247(d) & FCC Part 15.205 RSS-247 Issue 2 February 2017 Clause 3.3
Basic standard	:	ANSI C63.10: 2013
Limits	:	Refer to 15.209(a) of FCC part 15.247(d) & RSS-GEN Issue 5
Kind of test site	:	3m Semi-anechoic Chamber

Test Setup

Date of testing	:	21.01.2019~15.02.2019
Input voltage	:	Powered by battery
Operational mode	:	On, BLE, LoRa DTS
Test channel	:	Lo, Mi, Hi
Temperature	:	19.9°C
Relative humidity	:	56.3%
Atmospheric pressure	:	101 kPa

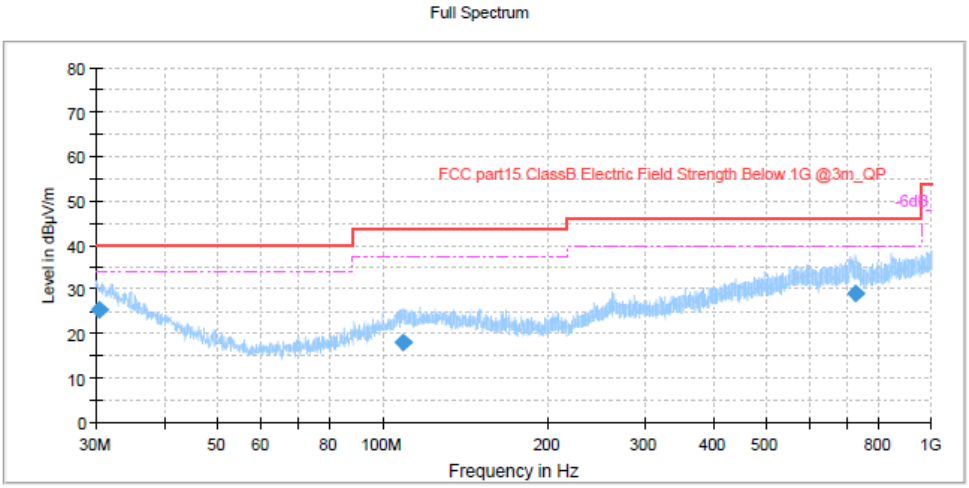
Remark:
Testing was carried out within frequency range 9kHz to the tenth harmonics. Only the worst case spurious emissions configuration of the each mode were reported.

The measurement result is calculated based on the following formula by the test software:
Emission Level = Reading level + Correction（Antenna factor + Cable loss – Preamplifier）

Figure 6: Test Results of Radiated Spurious Emissions

Below 1GHz_Light On
Horizontal

Full Spectrum

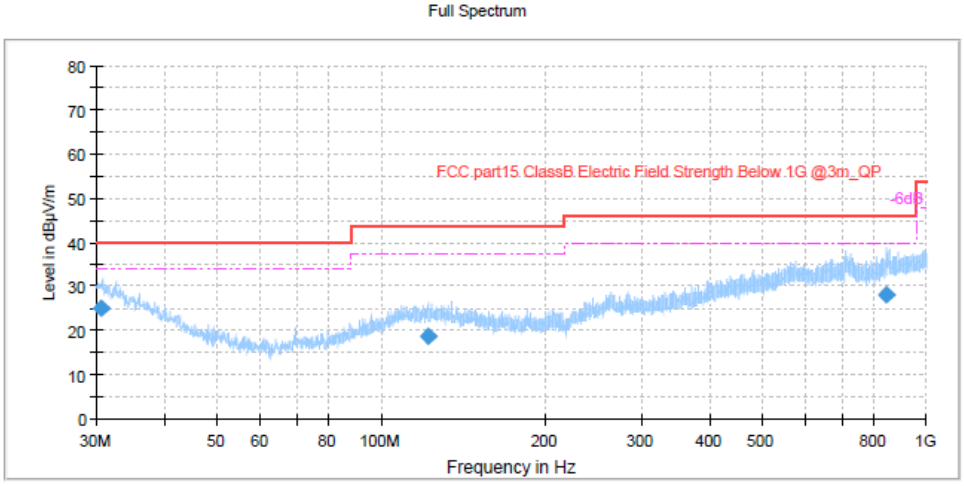


Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.452778	25.42	40.00	14.58	1000.0	120.000	107.0	H	307.0	25.1
108.956667	18.18	43.50	25.32	1000.0	120.000	331.0	H	39.0	18.9
728.540000	29.13	46.00	16.87	1000.0	120.000	104.0	H	159.0	28.0

Vertical

Full Spectrum

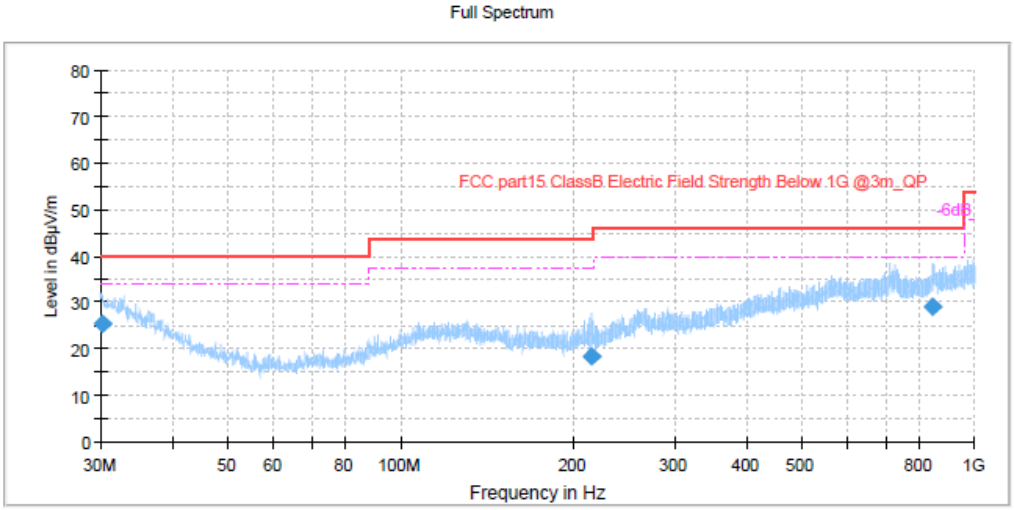


Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.694444	25.24	40.00	14.76	1000.0	120.000	120.0	V	333.0	24.9
121.657222	18.58	43.50	24.92	1000.0	120.000	143.0	V	313.0	19.3
845.047778	28.06	46.00	17.94	1000.0	120.000	301.0	V	304.0	29.4

Below 1GHz_BLE_Test Mode

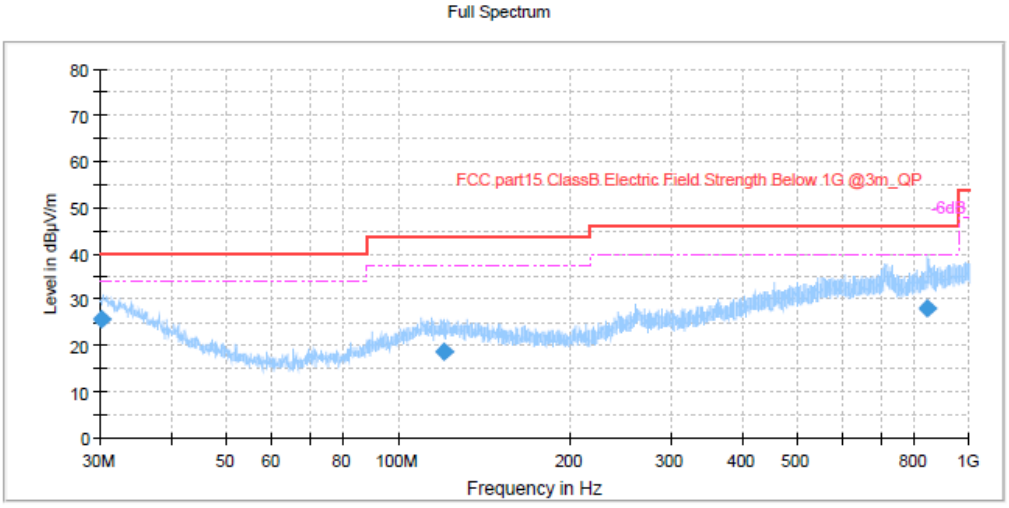
Low Channel: 2402MHz
Horizontal



Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.200000	25.56	40.00	14.44	1000.0	120.000	220.0	H	102.0	25.2
215.072778	18.54	43.50	24.96	1000.0	120.000	175.0	H	339.0	16.4
844.873889	29.15	46.00	16.85	1000.0	120.000	107.0	H	75.0	29.5

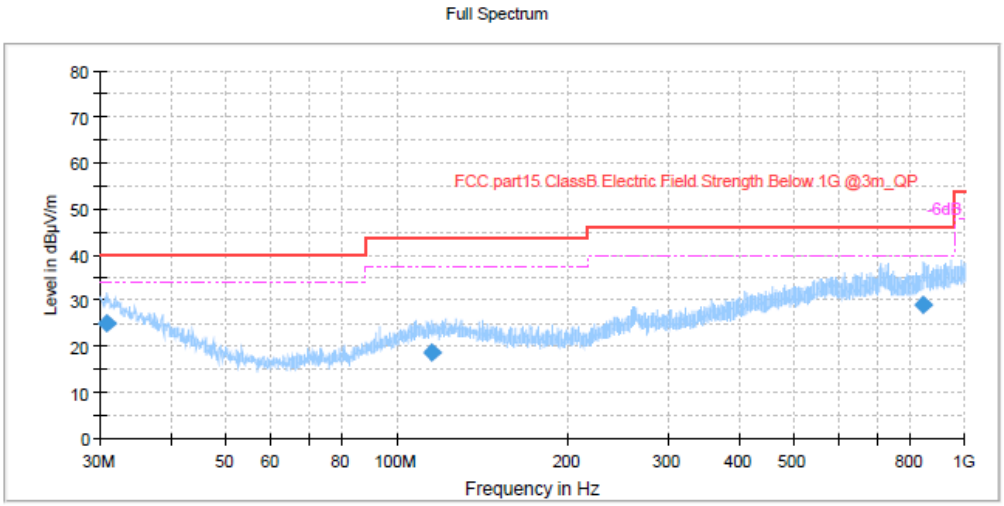
Vertical



Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.143333	25.72	40.00	14.28	1000.0	120.000	250.0	V	78.0	25.2
120.617778	18.65	43.50	24.85	1000.0	120.000	257.0	V	222.0	19.3
844.673889	28.13	46.00	17.87	1000.0	120.000	332.0	V	205.0	29.5

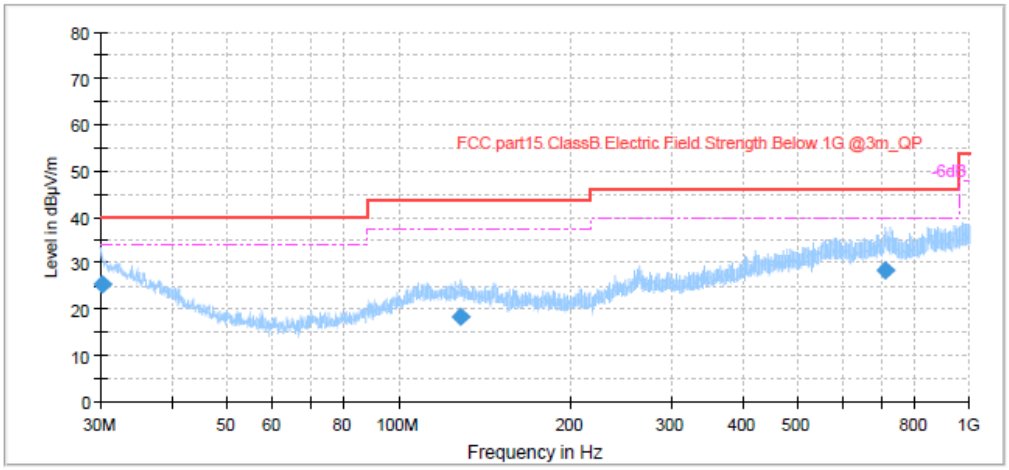
Mid Channel: 2440MHz
Horizontal



Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.856111	25.18	40.00	14.82	1000.0	120.000	394.0	H	41.0	24.9
115.298333	18.65	43.50	24.85	1000.0	120.000	293.0	H	19.0	19.4
845.277222	29.10	46.00	16.90	1000.0	120.000	159.0	H	161.0	29.4

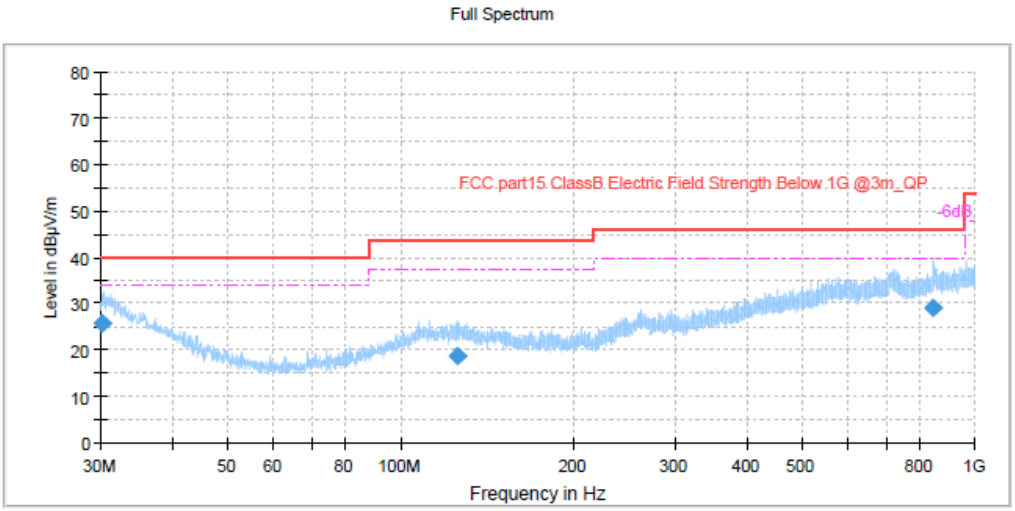
Vertical



Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.200000	25.60	40.00	14.40	1000.0	120.000	387.0	V	197.0	25.2
128.355000	18.43	43.50	25.07	1000.0	120.000	344.0	V	153.0	19.0
711.671111	28.50	46.00	17.50	1000.0	120.000	104.0	V	205.0	27.8

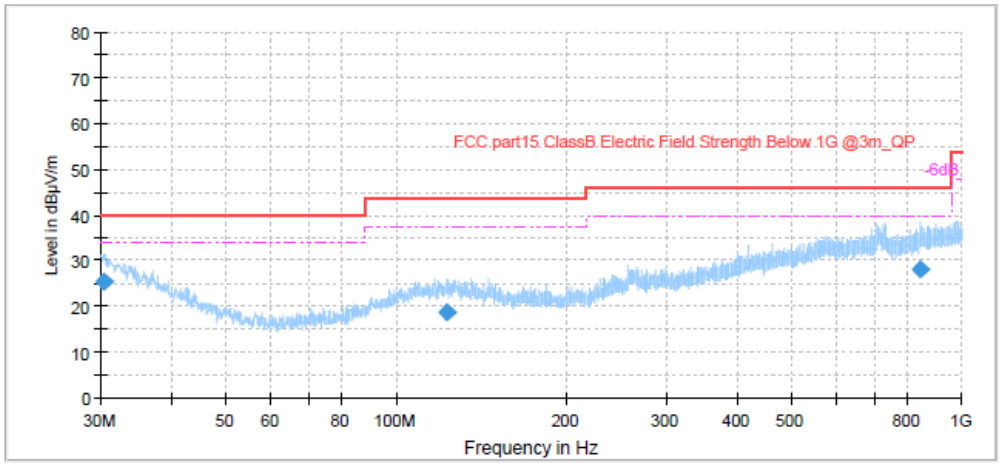
High Channel: 2480MHz
Horizontal



Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.183333	25.65	40.00	14.35	1000.0	120.000	181.0	V	300.0	25.2
125.822222	18.62	43.50	24.88	1000.0	120.000	370.0	V	349.0	19.1
844.913889	29.14	46.00	16.86	1000.0	120.000	293.0	V	150.0	29.5

Vertical



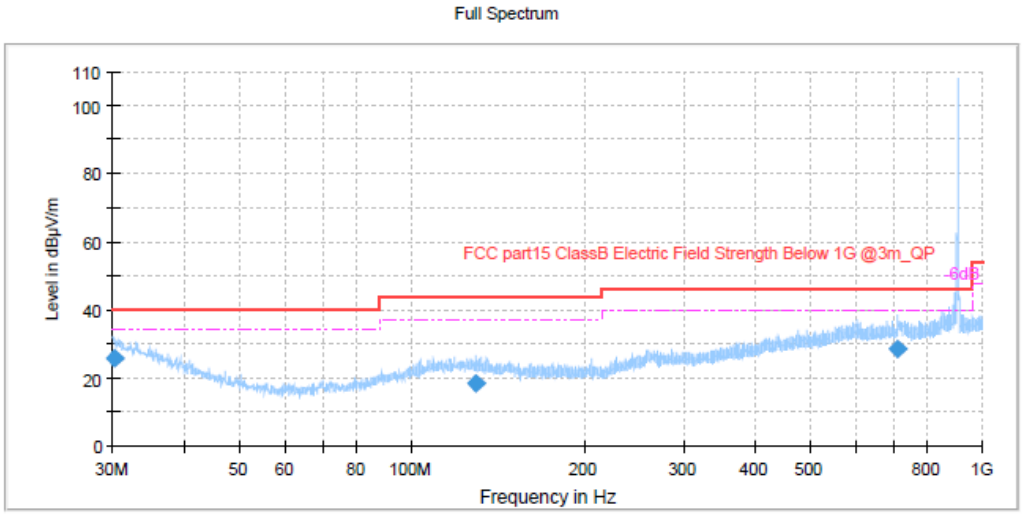
Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.385000	25.44	40.00	14.56	1000.0	120.000	111.0	V	164.0	25.1
122.641111	18.66	43.50	24.84	1000.0	120.000	318.0	V	159.0	19.3
844.793889	28.19	46.00	17.81	1000.0	120.000	179.0	V	46.0	29.5

Below 1GHz_LoRa DTS Test Mode

Low Channel: 902.5MHz

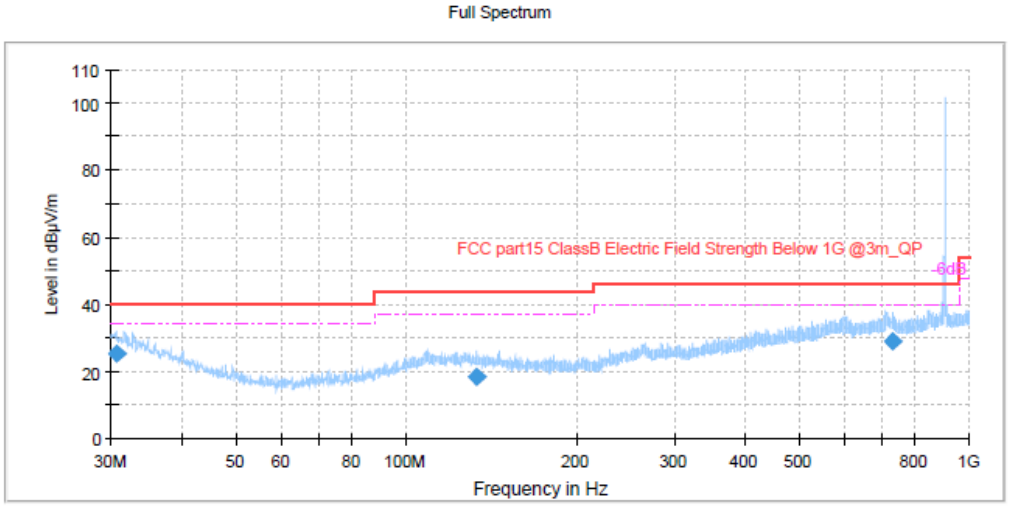
Horizontal



Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.320000	25.55	40.00	14.45	1000.0	120.000	386.0	H	189.0	25.1
129.109444	18.52	43.50	24.98	1000.0	120.000	183.0	H	164.0	19.0
709.638889	28.76	46.00	17.24	1000.0	120.000	100.0	H	251.0	27.8

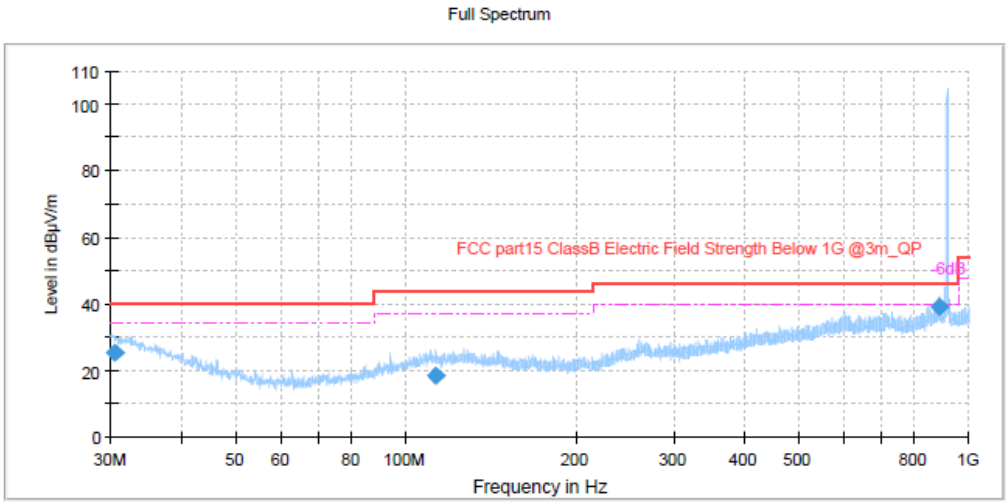
Vertical



Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.666667	25.36	40.00	14.64	1000.0	120.000	257.0	V	249.0	25.0
133.646667	18.23	43.50	25.27	1000.0	120.000	270.0	V	76.0	18.7
729.403889	29.22	46.00	16.78	1000.0	120.000	350.0	V	-3.0	28.1

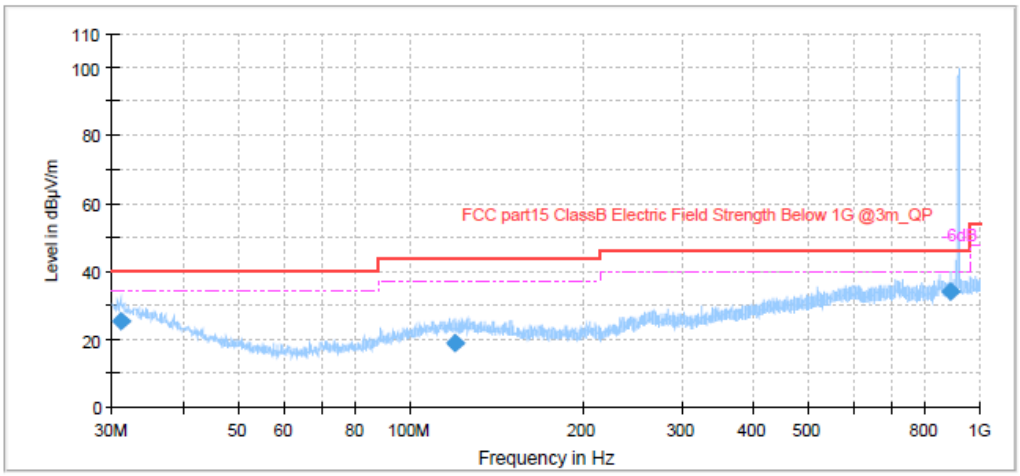
Mid Channel: 914.5MHz
Horizontal



Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.440000	25.50	40.00	14.50	1000.0	120.000	164.0	H	215.0	25.1
113.200000	18.58	43.50	24.92	1000.0	120.000	370.0	H	65.0	19.2
882.434444	38.99	46.00	7.01	1000.0	120.000	104.0	H	26.0	29.7

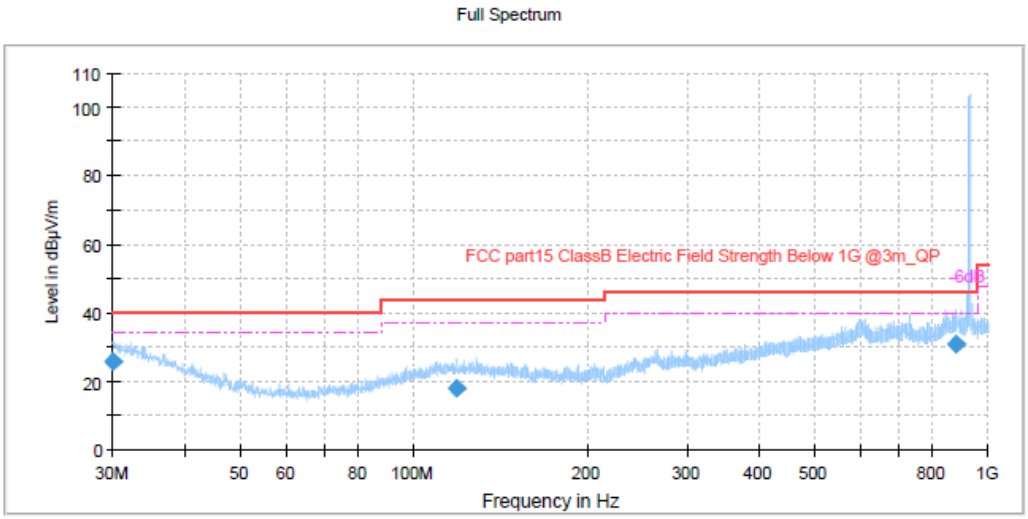
Vertical



Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
31.054444	25.22	40.00	14.78	1000.0	120.000	293.0	V	257.0	24.8
119.355556	18.77	43.50	24.73	1000.0	120.000	200.0	V	112.0	19.4
882.368333	34.08	46.00	11.92	1000.0	120.000	285.0	V	131.0	29.7

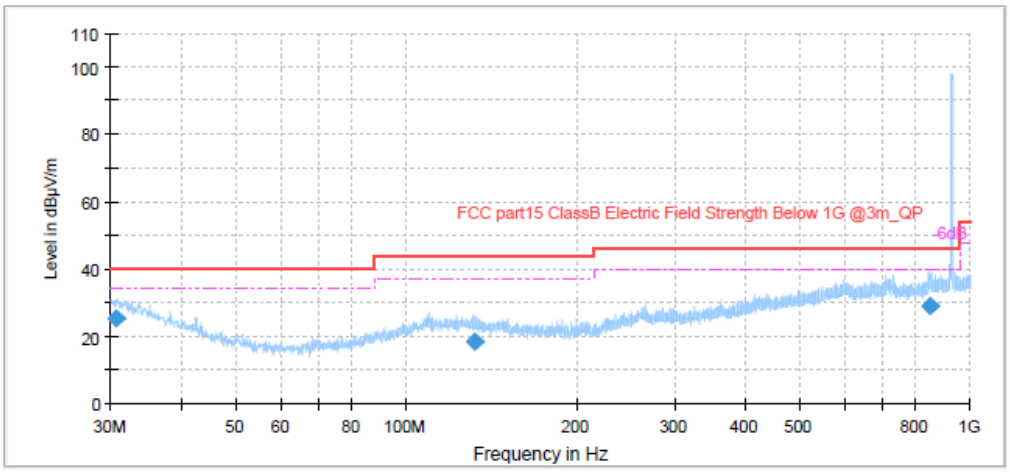
High Channel: 927.3MHz
Horizontal



Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.000000	25.66	40.00	14.34	1000.0	120.000	307.0	H	63.0	25.3
119.218333	17.76	43.50	25.74	1000.0	120.000	138.0	H	228.0	19.4
880.713333	30.88	46.00	15.12	1000.0	120.000	109.0	H	20.0	29.7

Vertical

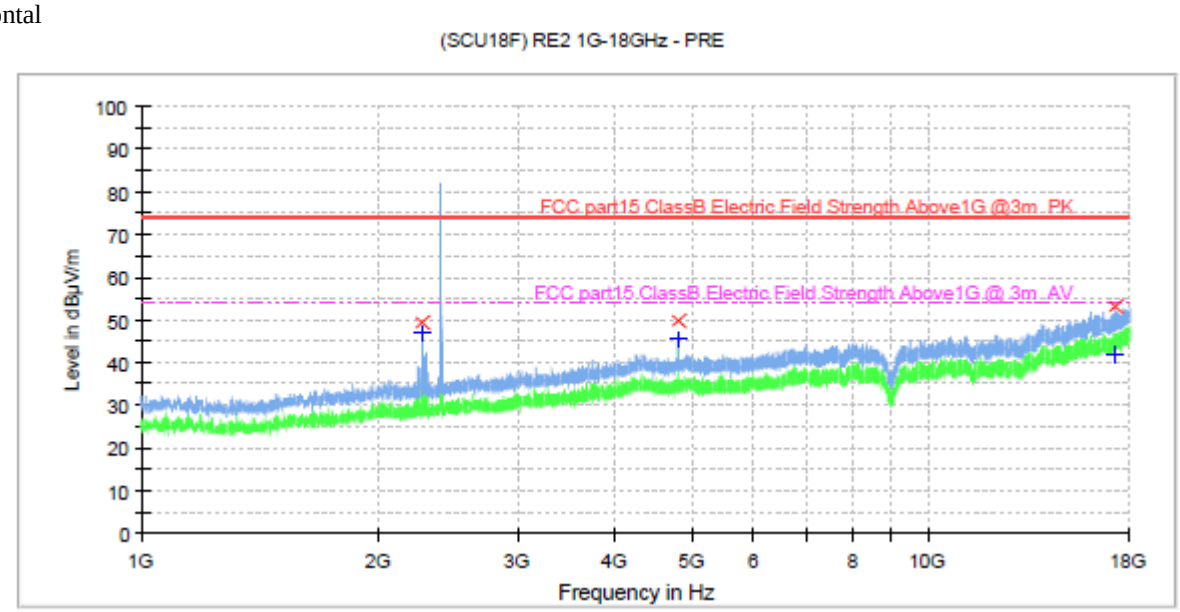


Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.640556	25.34	40.00	14.66	1000.0	120.000	313.0	V	39.0	25.0
132.325556	18.28	43.50	25.22	1000.0	120.000	354.0	V	127.0	18.8
845.089444	29.08	46.00	16.92	1000.0	120.000	196.0	V	274.0	29.4

Above 1GHz_BLE 1-18GHz Test Mode

Low Channel: 2402MHz
Horizontal



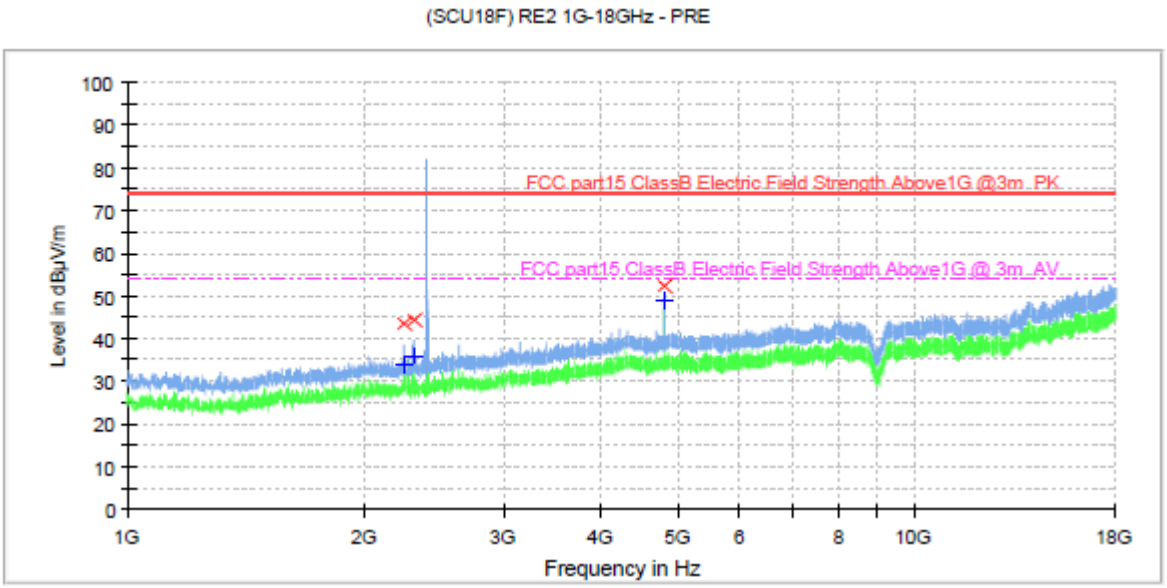
Limit and Margin-PK

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - PK+ (dB)	Limit - PK+ (dBµV/m)
2273.935000	49.3	1000.0	1000.000	150.0	H	0.0	-8.0	24.7	74.0
4803.750000	50.0	1000.0	1000.000	150.0	H	0.0	1.1	24.0	74.0
17310.970000	53.3	1000.0	1000.000	150.0	H	0.0	15.6	20.7	74.0

Limit and Margin-AV

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - AVG (dB)	Limit - AVG (dBµV/m)
2273.935000	46.7	1000.0	1000.000	150.0	H	0.0	-8.0	7.3	54.0
4803.750000	45.6	1000.0	1000.000	150.0	H	0.0	1.1	8.4	54.0
17310.970000	42.0	1000.0	1000.000	150.0	H	0.0	15.6	12.0	54.0

Vertical



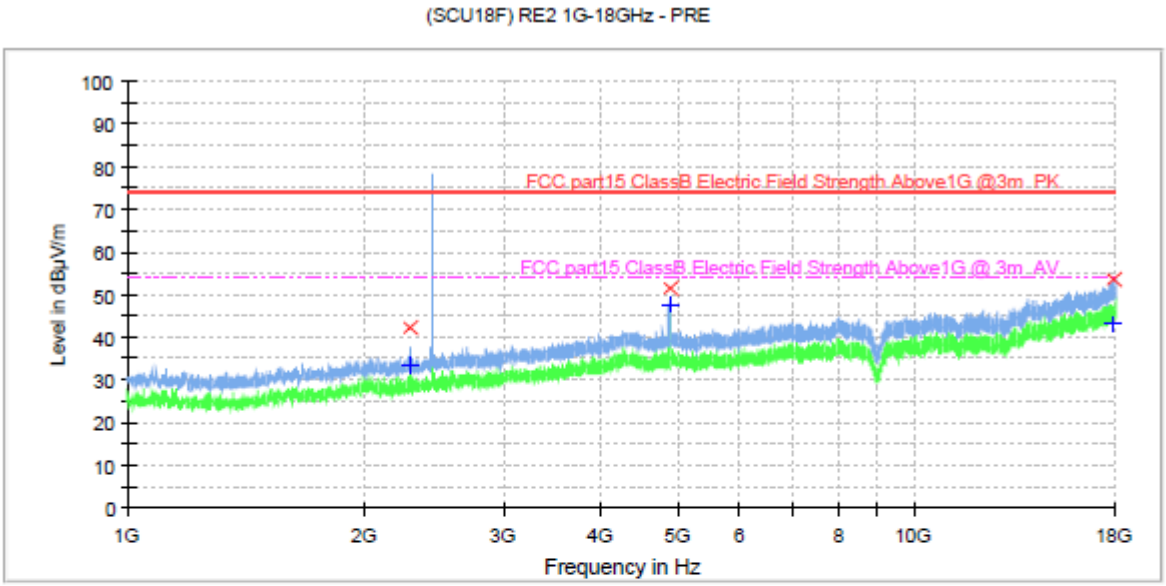
Limit and Margin-PK

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - PK+ (dB)	Limit - PK+ (dBµV/m)
2241.530000	43.6	1000.0	1000.000	300.0	V	0.0	-8.1	30.4	74.0
2314.845000	44.5	1000.0	1000.000	200.0	V	0.0	-7.8	29.5	74.0
4803.750000	52.5	1000.0	1000.000	200.0	V	0.0	1.1	21.5	74.0

Limit and Margin-AV

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - AVG (dB)	Limit - AVG (dBµV/m)
2241.530000	33.8	1000.0	1000.000	300.0	V	0.0	-8.1	20.2	54.0
2314.845000	36.1	1000.0	1000.000	200.0	V	0.0	-7.8	18.0	54.0
4803.750000	49.0	1000.0	1000.000	200.0	V	0.0	1.1	5.0	54.0

Mid Channel: 2440MHz
Horizontal



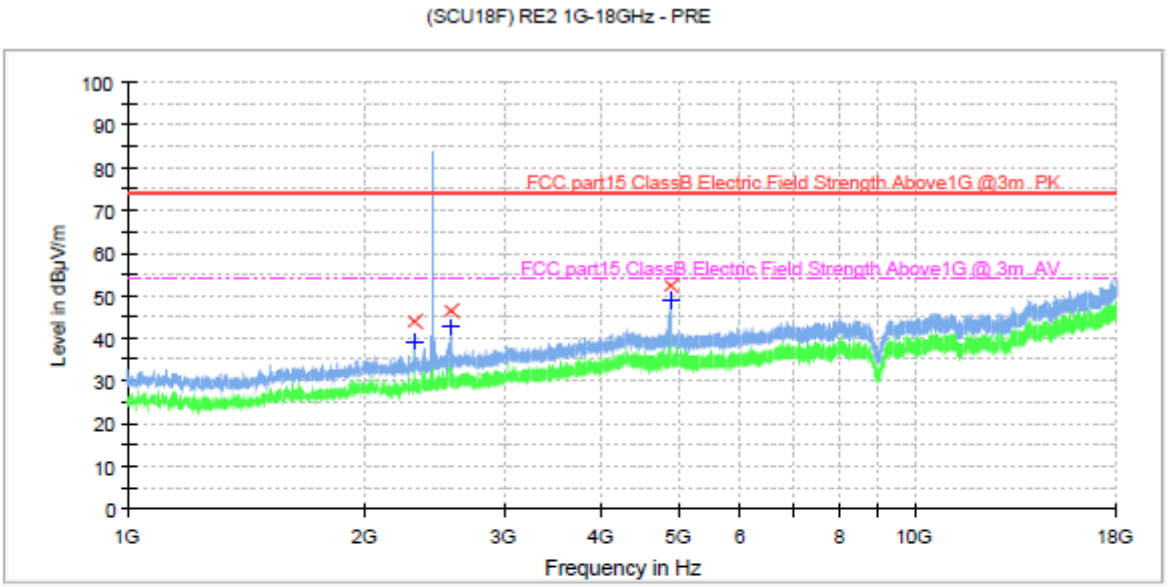
Limit and Margin-PK

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - PK+ (dB)	Limit - PK+ (dBµV/m)
2285.095000	42.2	1000.0	1000.000	150.0	H	0.0	-8.0	31.8	74.0
4879.720000	51.3	1000.0	1000.000	150.0	H	0.0	1.5	22.7	74.0
17895.875000	53.5	1000.0	1000.000	150.0	H	0.0	17.7	20.5	74.0

Limit and Margin-AV

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - AVG (dB)	Limit - AVG (dBµV/m)
2285.095000	33.7	1000.0	1000.000	150.0	H	0.0	-8.0	40.3	74.0
4879.720000	47.7	1000.0	1000.000	150.0	H	0.0	1.5	26.3	74.0
17895.875000	43.0	1000.0	1000.000	150.0	H	0.0	17.7	31.0	74.0

Vertical



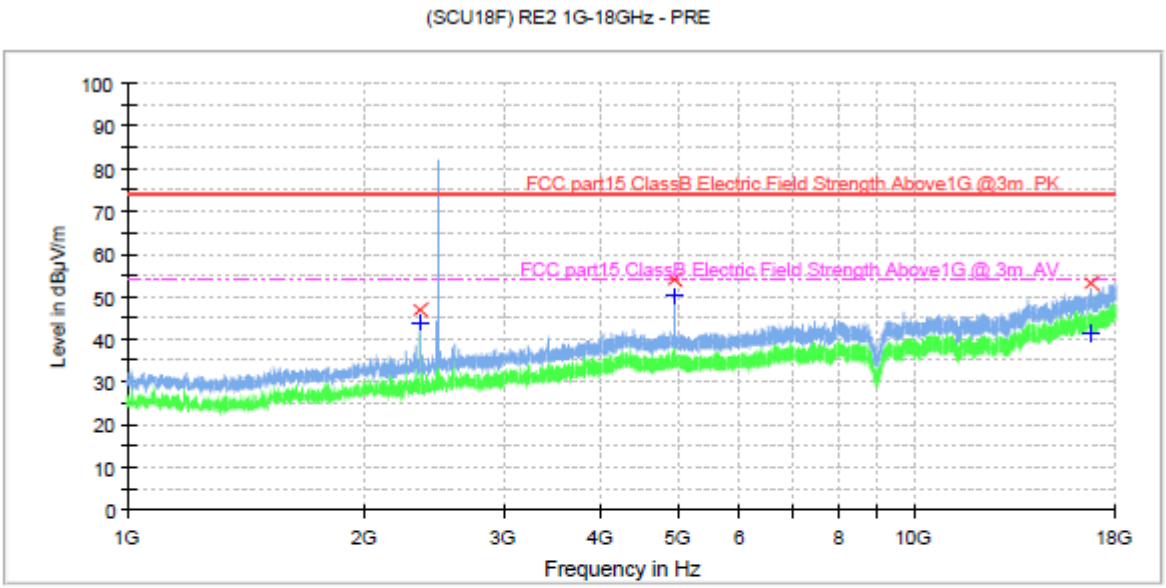
Limit and Margin-PK

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - PK+ (dB)	Limit - PK+ (dBµV/m)
2311.655000	44.0	1000.0	1000.000	150.0	V	0.0	-7.9	30.0	74.0
2567.720000	46.5	1000.0	1000.000	150.0	V	0.0	-6.2	27.5	74.0
4879.720000	52.2	1000.0	1000.000	150.0	V	0.0	1.5	21.8	74.0

Limit and Margin-AV

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - AVG (dB)	Limit - AVG (dBµV/m)
2311.655000	39.5	1000.0	1000.000	150.0	V	0.0	-7.9	14.6	54.0
2567.720000	42.8	1000.0	1000.000	150.0	V	0.0	-6.2	11.3	54.0
4879.720000	49.0	1000.0	1000.000	150.0	V	0.0	1.5	5.0	54.0

High Channel: 2480MHz
Horizontal



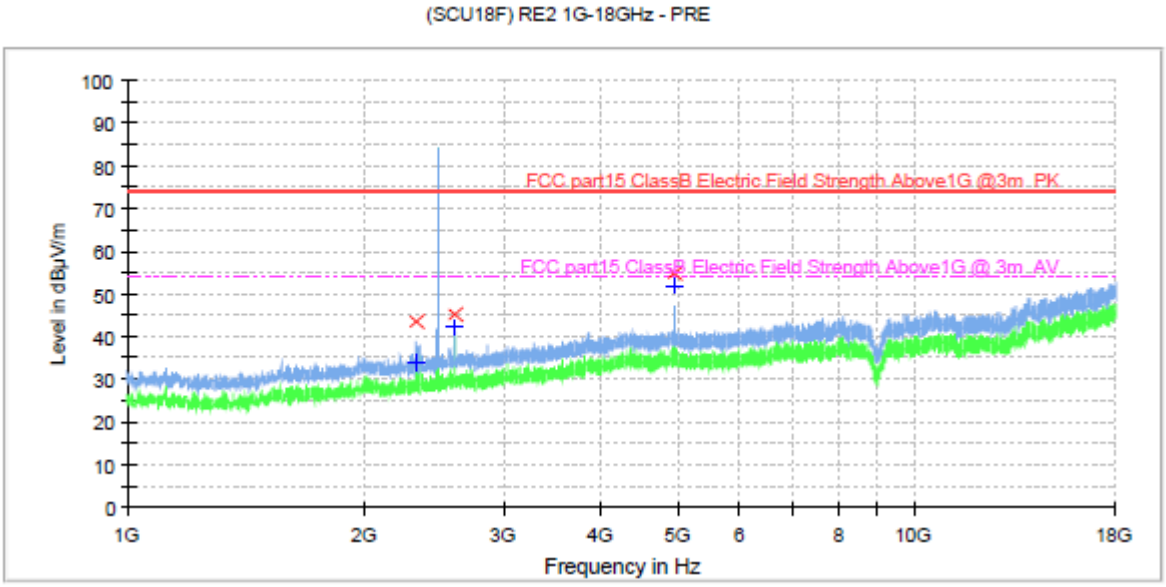
Limit and Margin-PK

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - PK+ (dB)	Limit - PK+ (dBµV/m)
2352.030000	47.0	1000.0	1000.000	200.0	H	0.0	-7.7	27.0	74.0
4959.405000	53.9	1000.0	1000.000	200.0	H	0.0	1.7	20.1	74.0
16755.810000	53.2	1000.0	1000.000	200.0	H	0.0	14.5	20.8	74.0

Limit and Margin-AV

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - AVG (dB)	Limit - AVG (dBµV/m)
2352.030000	43.9	1000.0	1000.000	200.0	H	0.0	-7.7	10.1	54.0
4959.405000	50.0	1000.0	1000.000	200.0	H	0.0	1.7	4.0	54.0
16755.810000	41.4	1000.0	1000.000	200.0	H	0.0	14.5	12.6	54.0

Vertical



Limit and Margin-PK

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - PK+ (dB)	Limit - PK+ (dBµV/m)
2323.345000	43.5	1000.0	1000.000	200.0	V	0.0	-7.7	30.5	74.0
2608.095000	45.4	1000.0	1000.000	200.0	V	0.0	-5.8	28.6	74.0
4959.935000	54.7	1000.0	1000.000	200.0	V	0.0	1.7	19.3	74.0

Limit and Margin-AV

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - AVG (dB)	Limit - AVG (dBµV/m)
2323.345000	34.0	1000.0	1000.000	200.0	V	0.0	-7.7	20.0	54.0
2608.095000	42.3	1000.0	1000.000	200.0	V	0.0	-5.8	11.7	54.0
4959.935000	51.8	1000.0	1000.000	200.0	V	0.0	1.7	2.2	54.0

Above 1GHz_LoRa DTS Test Mode

Low Channel: 902.5MHz
Horizontal

Limit and Margin-PK

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Corr. (dB)	Margin - PK+ (dB)	Limit - PK+ (dBµV/m)
1466.970000	57.0	1000.0	1000.000	H	28.7	17.0	74.0
1602.435000	59.0	1000.0	1000.000	H	30.2	15.0	74.0
1804.310000	61.2	1000.0	1000.000	H	31.0	12.8	74.0

Limit and Margin-AV

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Corr. (dB)	Margin - PK+ (dB)	Limit - PK+ (dBµV/m)
1466.970000	46.4	1000.0	1000.000	H	28.7	7.6	54.0
1602.435000	47.8	1000.0	1000.000	H	30.2	6.2	54.0
1804.310000	51.1	1000.0	1000.000	H	31.0	3.0	54.0

Vertical

Limit and Margin-PK

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Corr. (dB)	Margin - PK+ (dB)	Limit - PK+ (dBµV/m)
1607.750000	59.6	1000.0	1000.000	V	30.1	14.4	74.0
1719.845000	59.1	1000.0	1000.000	V	30.7	14.9	74.0
1804.310000	59.7	1000.0	1000.000	V	31.0	14.3	74.0

Limit and Margin-AV

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Corr. (dB)	Margin - PK+ (dB)	Limit - PK+ (dBµV/m)
1607.750000	47.9	1000.0	1000.000	V	30.1	6.1	54.0
1719.845000	48.9	1000.0	1000.000	V	30.7	5.1	54.0
1804.310000	49.3	1000.0	1000.000	V	31.0	4.7	54.0

Mid Channel: 914.5MHz
Horizontal

Limit and Margin-PK

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Corr. (dB)	Margin - PK+ (dB)	Limit - PK+ (dBµV/m)
1354.875000	56.4	1000.0	1000.000	H	27.9	17.7	74.0
1676.280000	59.6	1000.0	1000.000	H	30.6	14.4	74.0
1828.750000	60.9	1000.0	1000.000	H	31.1	13.2	74.0

Limit and Margin-AV

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Corr. (dB)	Margin - PK+ (dB)	Limit - PK+ (dBµV/m)
1354.875000	45.2	1000.0	1000.000	H	27.9	8.8	54.0
1676.280000	48.6	1000.0	1000.000	H	30.6	5.4	54.0
1828.750000	49.4	1000.0	1000.000	H	31.1	4.6	54.0

Vertical

Limit and Margin-PK

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Corr. (dB)	Margin - PK+ (dB)	Limit - PK+ (dBµV/m)
1420.750000	56.4	1000.0	1000.000	V	28.1	17.6	74.0
1616.780000	58.6	1000.0	1000.000	V	30.1	15.4	74.0
1828.220000	60.1	1000.0	1000.000	V	31.1	13.9	74.0

Limit and Margin-AV

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Corr. (dB)	Margin - PK+ (dB)	Limit - PK+ (dBµV/m)
1420.750000	45.6	1000.0	1000.000	V	28.1	8.4	54.0
1616.780000	47.8	1000.0	1000.000	V	30.1	6.2	54.0
1828.220000	49.5	1000.0	1000.000	V	31.1	4.5	54.0

High Channel: 927.3MHz

Horizontal

Limit and Margin-PK

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Corr. (dB)	Margin - PK+ (dB)	Limit - PK+ (dBµV/m)
1471.750000	57.3	1000.0	1000.000	H	28.8	16.7	74.0
1641.750000	59.6	1000.0	1000.000	H	30.4	14.4	74.0
1854.250000	60.6	1000.0	1000.000	H	31.2	13.4	74.0

Limit and Margin-AV

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Corr. (dB)	Margin - PK+ (dB)	Limit - PK+ (dBµV/m)
1471.750000	46.2	1000.0	1000.000	H	28.8	7.8	54.0
1641.750000	48.2	1000.0	1000.000	H	30.4	5.8	54.0
1854.250000	50.2	1000.0	1000.000	H	31.2	3.9	54.0

Vertical

Limit and Margin-PK

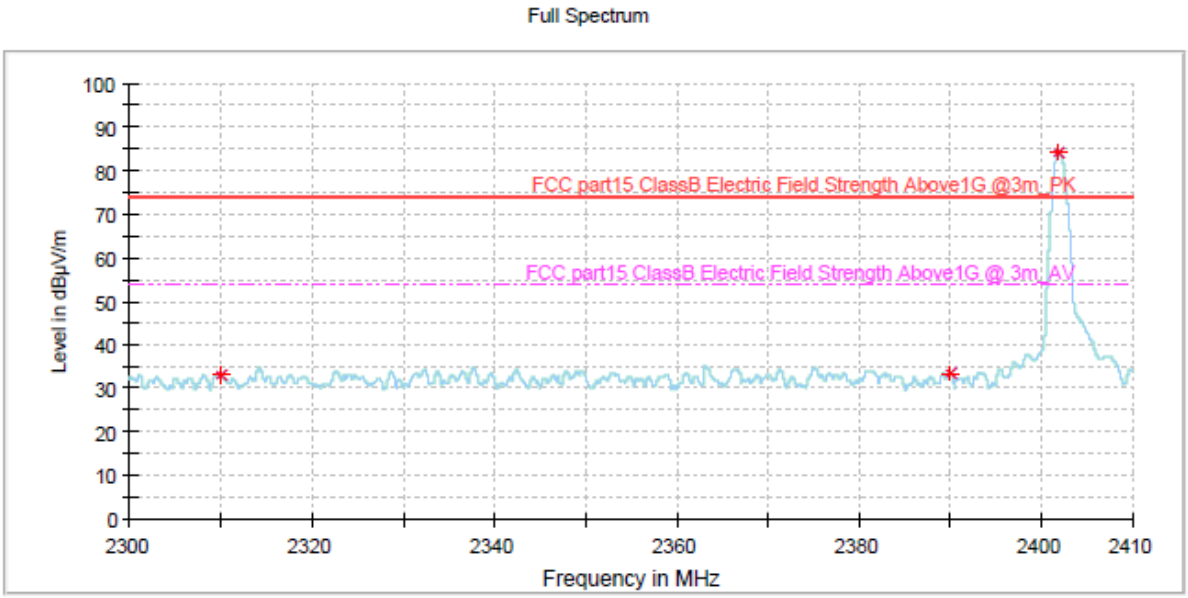
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Corr. (dB)	Margin - PK+ (dB)	Limit - PK+ (dBµV/m)
1512.655000	57.5	1000.0	1000.000	V	29.4	16.5	74.0
1693.810000	59.2	1000.0	1000.000	V	30.3	14.8	74.0
1854.250000	61.8	1000.0	1000.000	V	31.2	12.2	74.0

Limit and Margin-AV

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Corr. (dB)	Margin - PK+ (dB)	Limit - PK+ (dBµV/m)
1512.655000	46.7	1000.0	1000.000	V	29.4	7.3	54.0
1693.810000	48.3	1000.0	1000.000	V	30.3	5.7	54.0
1854.250000	52.3	1000.0	1000.000	V	31.2	1.7	54.0

BLE_2402MHz_2310MHz_2390MHz

Full Spectrum



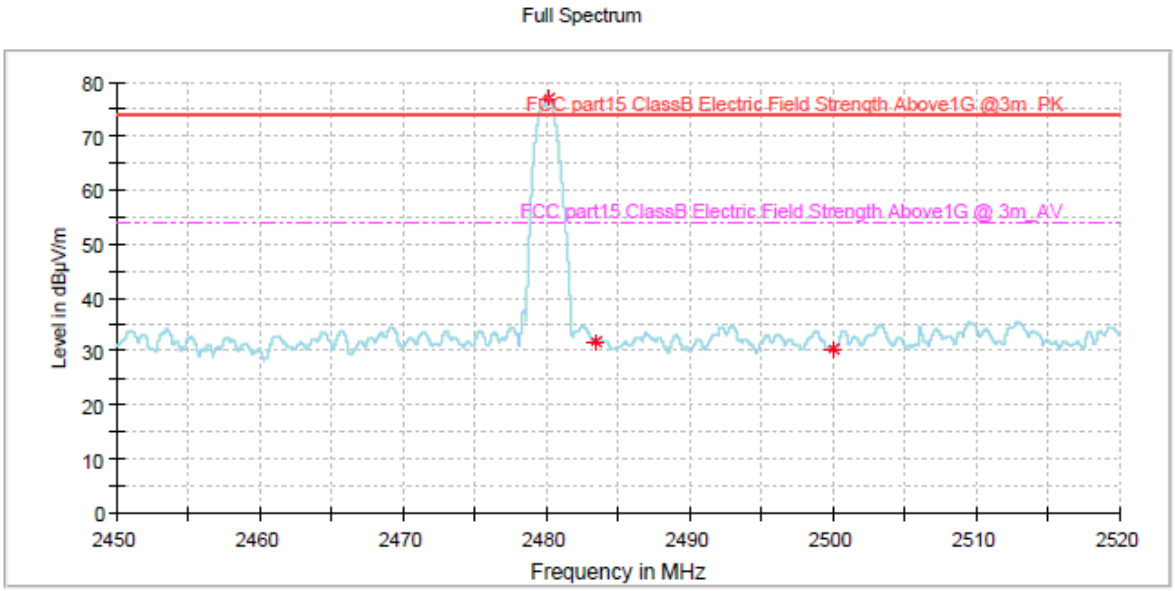
Critical Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2310.000000	33.17	74.00	40.83	---	---	100.0	H	61.0	-7.1
2390.000000	33.34	74.00	40.66	---	---	100.0	H	39.0	-6.7
2401.827000	84.10	74.00	-10.10	---	---	100.0	H	61.0	-6.6

Remark: Above is the worse data of the two polarizations after check by pre-testing.

BLE_2480MHz_2483.5MHz_2500MHz

Full Spectrum



Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2480.177000	76.98	74.00	-2.98	---	---	100.0	H	155.0	-5.9
2483.500000	31.82	74.00	42.18	---	---	100.0	H	67.0	-5.9
2500.000000	30.47	74.00	43.53	---	---	100.0	H	0.0	-5.9

Remark: Above is the worse data of the two polarizations after check by pre-testing.

5 Photographs of the Test Set-Up

Photograph 1: Set-up for Radiated Spurious Emission, 30MHz - 1GHz

Photograph 2: Set-up for Radiated Spurious Emission, 1GHz - 18GHz

Photograph 3: Overview of the EUT

Photographs 4: PCBs of the EUT

6 List of Tables

7 List of Figures

8 List of Photographs