FCC Part 15.247

TEST REPORT

For

PROTECH SYSTEMS Co., Ltd

NO.24, Lane 365, Yang Guang Street, Nei Hu District, Taipei 114, Taiwan R.O.C.

FCC ID: 2AMRAMH5100

Report Type:	**Product Type:**
Original Report	10.1" Integrated Pad

Report Producer:	Jane Lee
Report Number:	RTWL170619001-00A
Report Date:	2017-10-23
Reviewed By:	Jerry Chang

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REVISION HISTORY

Revision	Issue Date	Description
1.0	2017.10.23	Original

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1 General Information

1.1 Product Description for Equipment Under Test (EUT)

Applicant:	PROTECH SYSTEMS Co., Ltd NO.24, Lane 365, Yang Guang Street, Nei Hu District, Taipei 114, Taiwan R.O.C.
Manufacturer:	PROTECH SYSTEMS Co., Ltd NO.24, Lane 365, Yang Guang Street, Nei Hu District, Taipei 114, Taiwan R.O.C.
Product:	10.1" Integrated Pad
Main Model:	MH-5100
Trade Name:	PROTECH
Frequency Range:	BLE: 2402 ~ 2480 MHz IEEE 802.11b/g/n HT20 Mode: 2412 ~ 2462 MHz IEEE 802.11n HT40 Mode: 2422 ~ 2452 MHz
Transmit Power:	BLE Mode: 3.49dBm (0.00223W) IEEE 802.11b Mode: 12.51dBm (0.01782W) IEEE 802.11g Mode: 23.03dBm (0.2009W) IEEE 802.11n HT20 Mode: 25.63dBm (0.3656W) IEEE 802.11n HT40 Mode: 26.07dBm (0.4046W)
Modulation Technique:	BLE: GFSK IEEE 802.11b: DSSS IEEE 802.11g: OFDM IEEE 802.11n HT20 Mode: OFDM IEEE 802.11n HT40 Mode: OFDM
Transmit Data Rate:	BLE: 1Mbps IEEE 802.11b Mode: 11, 5.5, 2, 1 Mbps IEEE 802.11g Mode: 54, 48, 36, 24, 18, 12, 11 , 9, 6Mbps IEEE 802.11n HT 20 MHz mode: 6.5 – 144.4.Mbps IEEE 802.11n HT 40 MHz mode: 13.5 - 300 Mbps
Number of Channels:	BLE: 40 Channels IEEE 802.11b/g / IEEE 802.11n HT20 Mode: 11 Channels IEEE 802.11n HT40 Mode: 7 Channels
Antenna Specification:	Microstrip Antenna (Chain 0) / Gain: 2.26 dBi Microstrip Antenna (Chain 1) /Gain: 3.04 dBi
Voltage Range:	Adapter: I/P: 100-240Vac, 50/60Hz, 0.6A O/P: 12Vdc, 2.0A
Date of Test:	June 19, 2017 ~ Oct 23, 2017

**All measurement and test data in this report was gathered from production sample identifier: 170619001 (Assigned by BACL, Taiwan) The EUT supplied by the applicant was received on 2017-06-19.*

1.2 Objective

This report is prepared on behalf of *PROTECH SYSTEMS Co., Ltd* in accordance with Part 2, Subpart J, Part 15, Subparts A and C of the Federal Communication Commission's rules.

The objective is to determine compliance with FCC Part 15.247 rules for Output Power, Antenna Requirements, 6 dB Bandwidth, Power Spectral Density, 100 kHz Bandwidth of Band Edges Measurement, Conducted and Radiated Spurious Emissions.

1.3 Related Submittal(s)/Grant(s)

FCC Part 15.247 DSS submission with FCC ID: 2AMRAMH5100

1.4 Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

1.5 Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Taiwan) to collect test data is located on
☒70, Lane 169, Sec. 2, Datong Road, Xizhi Dist., New Taipei City 22183, Taiwan, R.O.C.
☒68-3, Lane 169, Sec. 2, Datong Road, Xizhi Dist., New Taipei City 22183, Taiwan, R.O.C.

Bay Area Compliance Laboratories Corp. (Taiwan) Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code: 3180) and the FCC designation No.TW3180 under the Mutual Recognition Agreement (MRA) in FCC Test. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.10.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 974454. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

2 System Test Configuration

2.1 Description of Test Configuration

For WIFI mode, there are totally 11 channels.

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2412	7	2442
2	2417	8	2447
3	2422	9	2452
4	2427	10	2457
5	2432	11	2462
6	2437		

For 802.11 b/g/n20 Modes were testd with channel 1, 6 and 11
For 802.11n40 Mode were testd with channel 3, 6 and 9

For BLE mode, there are totally 40 channels.

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2402	20	2440
2	2404	21	2442
3	2406	-	-
-	-	38	2476
-	-	39	2478
19	2438	40	2480

For BLE Modes were testd with channel 1, 20 and 40

2.2 Equipment Modifications

No modification was made to the EUT

2.3 EUT Exercise Software

Used "WIFI_TXRX_TEST" software.

Test Software Version		Engineering Mode		
Test Frequency		Low	Mid	High
Power Level Setting	B Mode	12	12	12
	G Mode	16	16	16
	N20 Mode	14	14	14
	N40 Mode	13	13	13

The EUT was configured for testing in an engineering mode which was provided by the manufacturer.
The worst-case data rates are determined to be as follows for each mode based upon investigations by measuring the average power and PSD across all data rates bandwidths, and modulations.

BLE: 1 Mbps
802.11b: 1Mbps
802.11g: 6Mbps
802.11n ht20: MCS8
802.11n ht40: MCS8

2.4 Support Equipment List and Details

Description	Manufacturer	Model Number	FCC ID / DOC	S/N
Adaptor	Top-Unum Electronics Co., Ltd.	KSASB0241200200D5	DOC	N/A

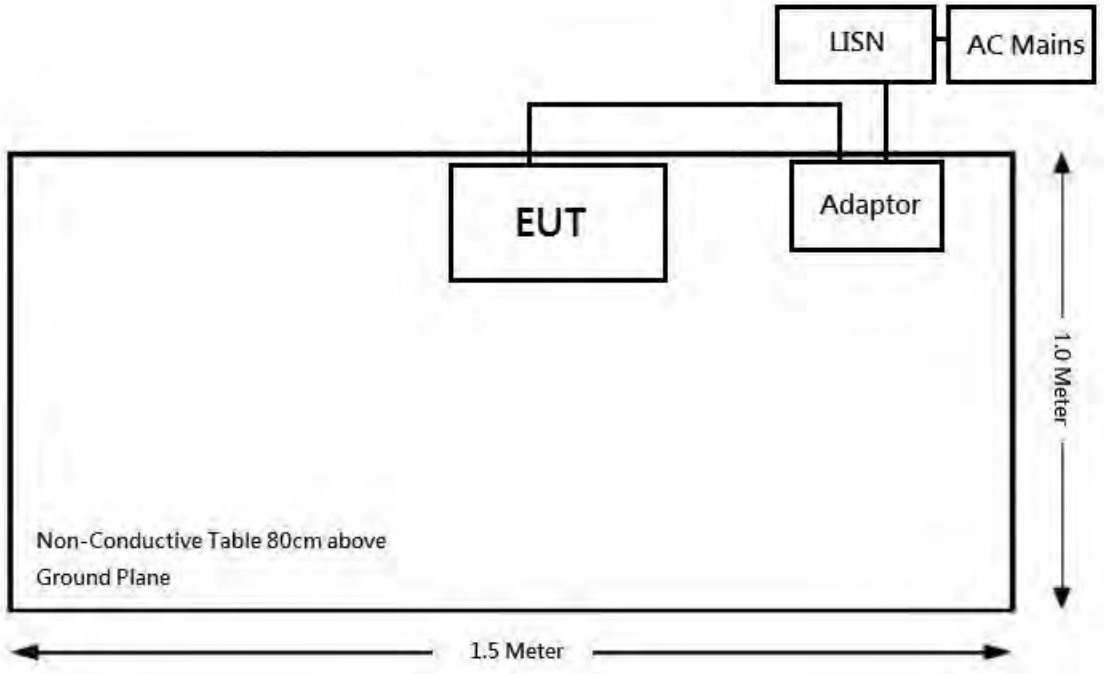
2.5 External Cable List and Details

Cable Description	Length (m)	From	To
N/A	N/A	N/A	N/A

2.6 Block Diagram of Test Setup

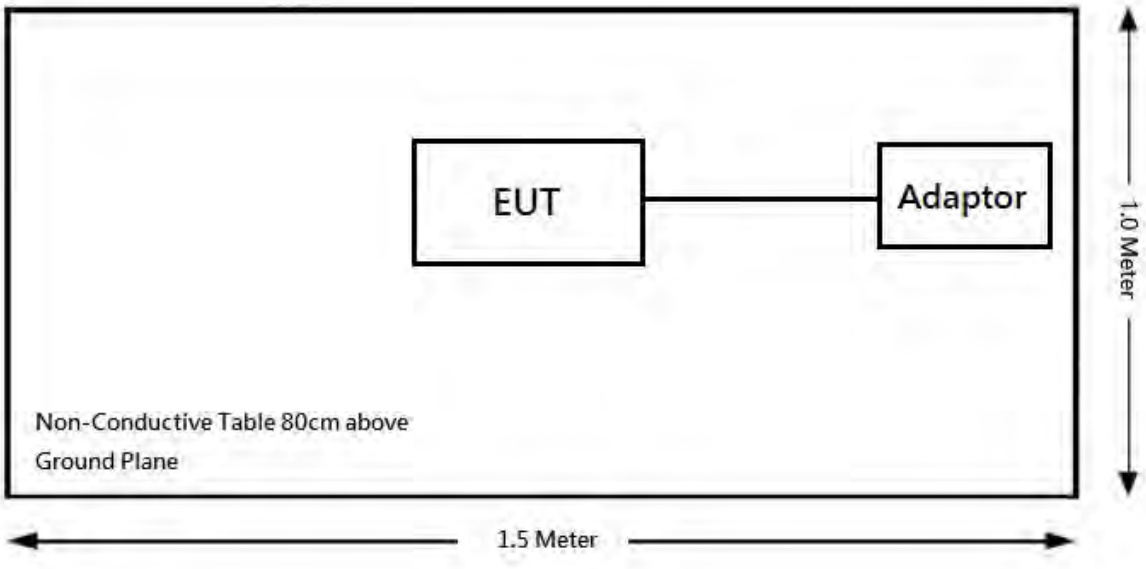
See test photographs attached in Exhibit A for the actual connections between EUT and support equipment.

Conduction:

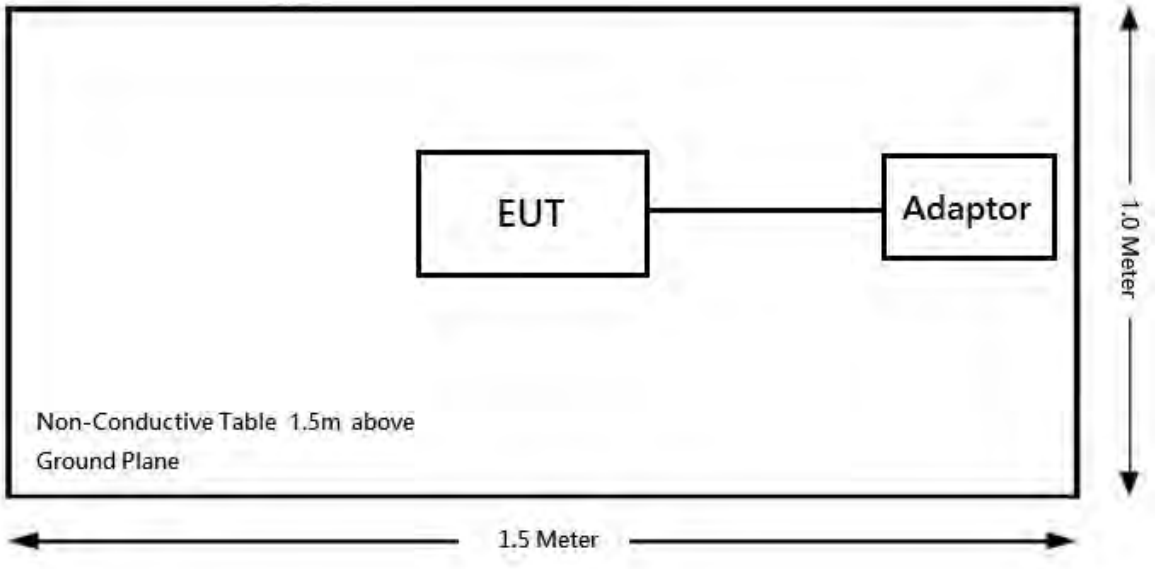


Radiation:

Below 1GHz:



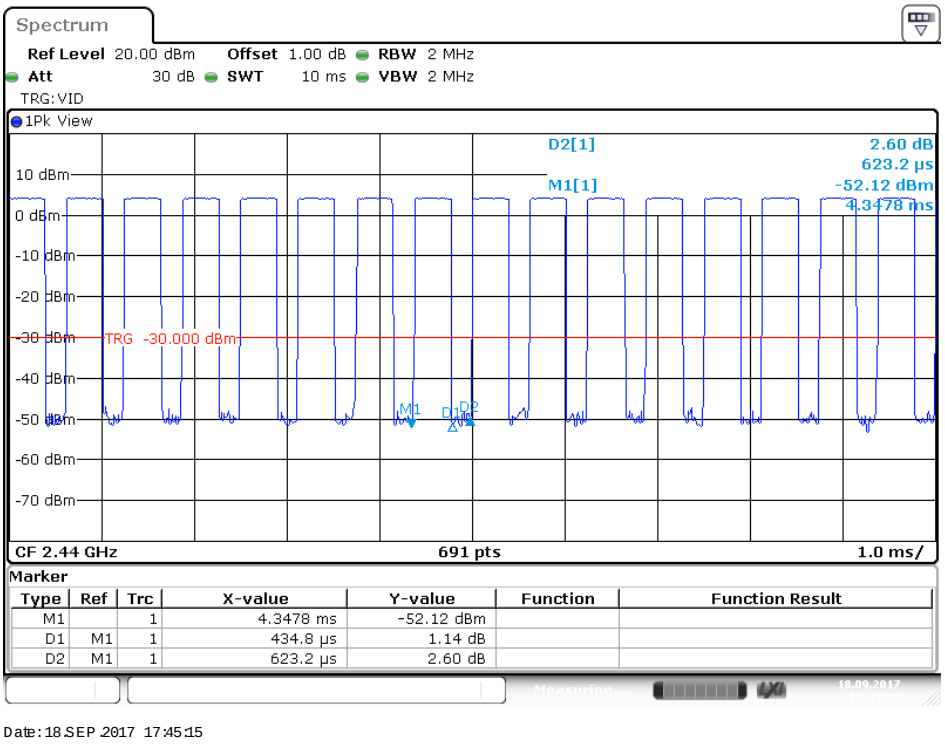
Above 1GHz:


EUT
Adaptor
1.0 Meter
Non-Conductive Table 1.5m above
Ground Plane
1.5 Meter

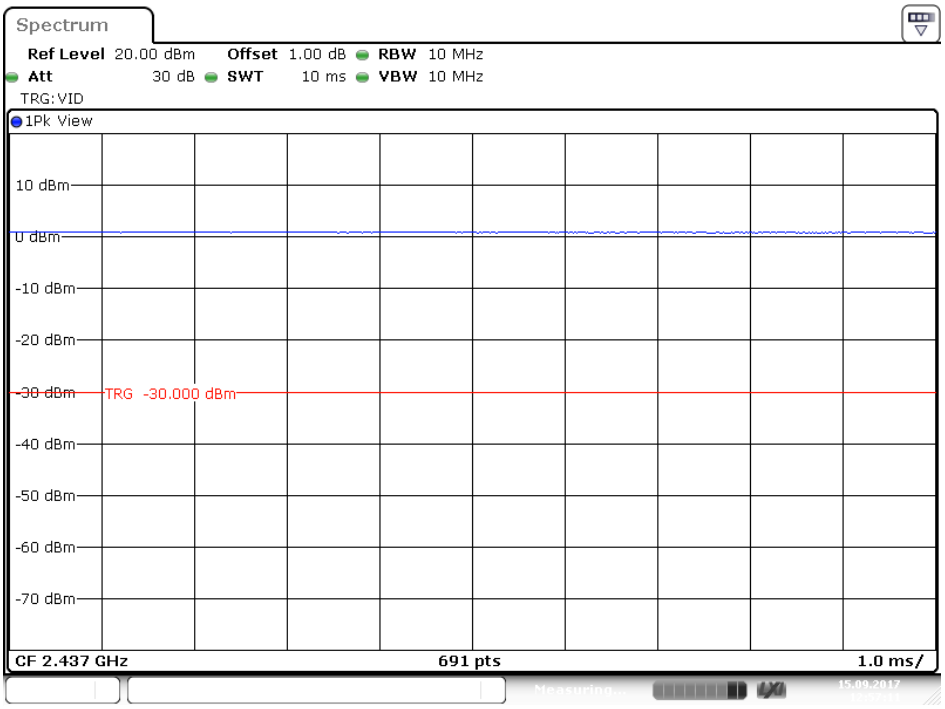
2.7 Duty Cycle

Radio Mode	On Time (ms)	Period (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
802.11b	10	10	100	0
802.11g	2.1014	2.1739	97	0.13
802.11n20	1.0145	1.0870	93	0.32
802.11n40	0.5362	0.5942	90	0.46
BLE	0.4348	0.6232	70	1.55

BLE Mode



B Mode



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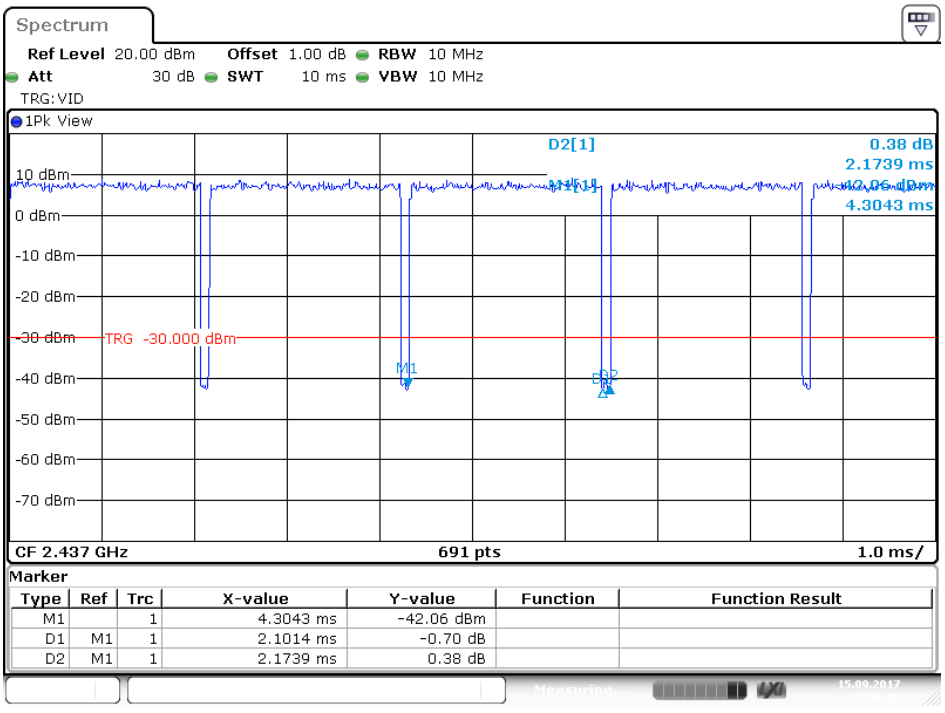
G Mode



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	4.3043 ms	-42.06 dBm		
D1	M1	1	2.1014 ms	-0.70 dB		
D2	M1	1	2.1739 ms	0.38 dB		

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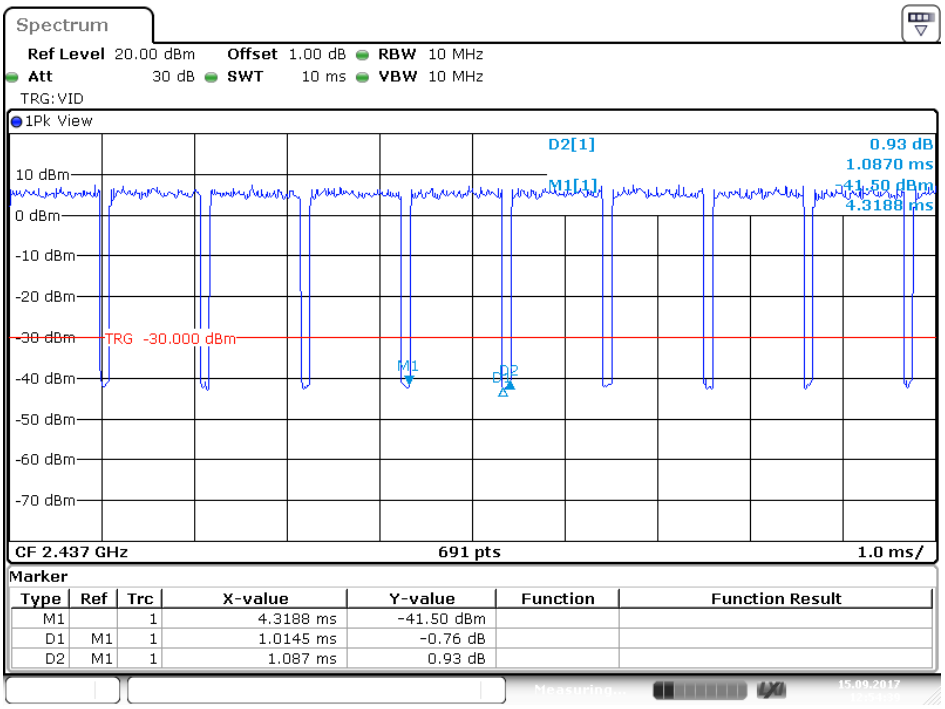
N20 Mode



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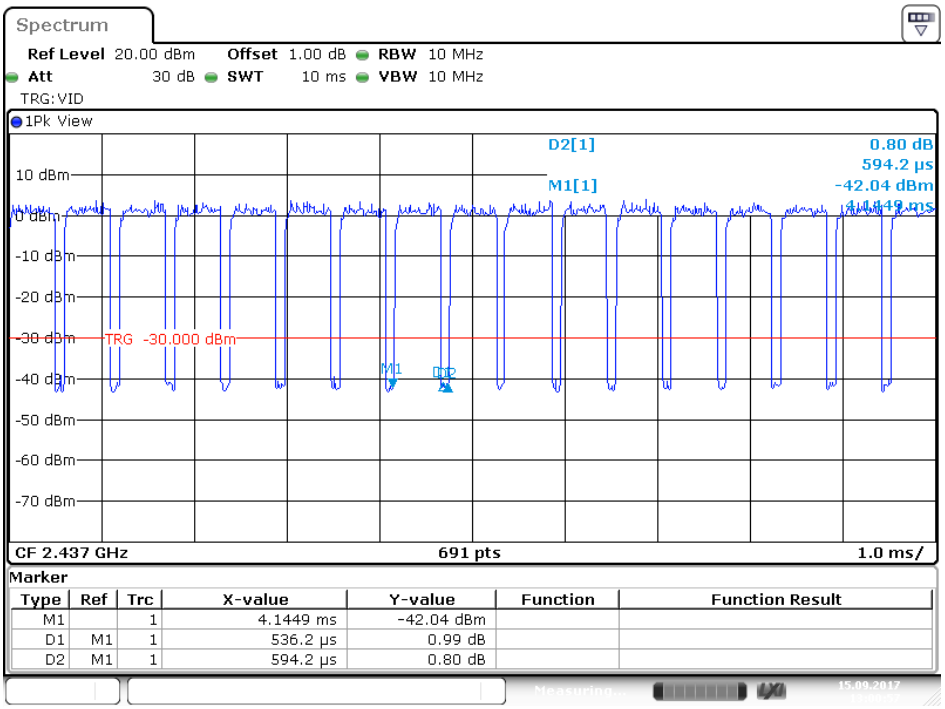
N40 Mode



Date: 15.SEP.2017 13:00:58

3 Summary of Test Results

FCC Rules	Description of Test	Result
§15.247(i), §2.1093	RF Exposure	Compliance
§15.203	Antenna Requirement	Compliance
§15.207(a)	AC Line Conducted Emissions	Compliance
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliance
§15.247(a)(2)	6 dB Emission Bandwidth	Compliance
§15.247(b)(3)	Maximum Peak Output Power	Compliance
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliance
§15.247(e)	Power Spectral Density	Compliance

4 FCC §15.247(i), §2.1093 - RF EXPOSURE

4.1 Applicable Standard

According to FCC §2.1093 and §1.1307(b) (1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

According to KDB 447498 D01 General RF Exposure Guidance v06
The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] ·
[√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where
1. f(GHz) is the RF channel transmit frequency in GHz.
2. Power and distance are rounded to the nearest mW and mm before calculation.
3. The result is rounded to one decimal place for comparison.
4. 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

The test exclusions are applicable only when the minimum *test separation distance* is ≤ 50 mm, and for transmission frequencies between 100 MHz and 6 GHz. When the minimum *test separation distance* is < 5 mm, a distance of 5 mm according to 4.1 f) is applied to determine SAR test exclusion.

4.2 Measurement Result

For WiFi and Mode:

Please refer to the SAR report, report No.: RTWL170619001-23

For BLE Mode:

Frequency (MHz)	Tunp-up Power		Evaluation Distrance (mm)	SAR Excluion Result	Extremity SAR Exclusion Limit (1g SAR)
	(dBm)	(mW)			
2480	2	1.585	5	0.5	3

So the stand-alone SAR evaluation for BLE is not necessary.

5 FCC §15.203 – Antenna Requirements

5.1 Applicable Standard

According to § 15.203,

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited.

And according to FCC 47 CFR section 15.247 (b), if the transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna does not exceed 6 dBi.

5.2 Antenna List and Details

Manufacturer	Model	Type	Antenna Gain	Result
Gaobotech Technology Co., Ltd.	GA16-25201235B1-101-1	Microstrip Antenna	2.26 dBi	Compliance
Gaobotech Technology Co., Ltd.	GA16-25201235B1-101-2	Microstrip Antenna	3.04 dBi	Compliance

*Remark :
1. GA16-25201235B1-101-1 for Bluetooth and Wifi
2. GA16-25201235B1-101-2 for Wifi

6 FCC §15.207 - AC Line Conducted Emissions

6.1 Applicable Standard

According to FCC §15.207 Conducted limits:

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequencies ranges.

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56 Note 1	56 to 46 Note 2
0.5-5	56	46
5-30	60	50

Note 1: Decreases with the logarithm of the frequency.
Note 2: A linear average detector is required

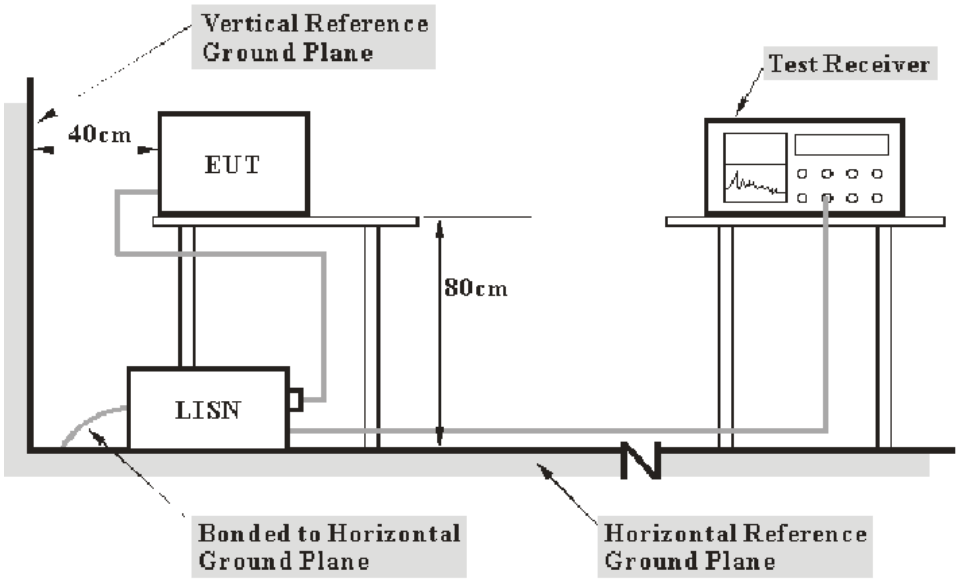
6.2 Measurement Uncertainty

Input quantities to be considered for conducted disturbance measurements maybe receiver reading, attenuation of the connection between LISN/ISN and receiver, LISN/ISN voltage division factor, LISN/ISN VDF frequency interpolation and receiver related input quantities, etc.

Based on CISPR 16-4-2:2011, the expended combined standard uncertainty of conducted disturbance test at Bay Area Compliance Laboratories Corp. (Taiwan) is shown as below. And the uncertainty will not be taken into consideration for the test data recorded in the report

Port	Expanded Measurement uncertainty
AC Mains	4.64 dB (k=2, 95% level of confidence)

6.3 EUT Setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 limits.

6.4 EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz. During the conducted emission test, the EMI test receiver was set with the following configurations

Frequency Range	IF B/W
150 kHz - 30 MHz	9 kHz

6.5 Test Procedure

During the conducted emission test, the adapter was connected to the outlet of the LISN. Maximizing procedure was performed on the six (6) highest emissions of the EUT. All data was recorded in the Quasi-peak and average detection mode.

6.6 Corrected Factor & Margin Calculation

The factor is calculated by adding LISN/ISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

Factor = LISN VDF + Cable Loss + Transient Limiter Attenuation

The "Over Limit" column of the following data tables indicates the degree of compliance with the applicable limit. For example, an over limit of -7 dB means the emission is 7 dB below the limit. The equation for Over Limit calculation is as follows:

Over Limit = Level – Limit Line

6.7 Test Equipment List and Details

Manufacturers	Descriptions	Models	Serial Numbers	Calibration Date	Calibration Due Date
LISN	Rohde & Schwarz	ENV216	101248	2017/07/20	2018/07/19
LISN	EMCO	3816/2	00075848	2017/08/02	2018/08/01
EMI Test Receiver	Rohde & Schwarz	ESR7	101419	2016/11/03	2017/11/02
Pulse Limiter	Rohde & Schwarz	ESH3Z2	TXZEM025	2017/08/11	2018/08/10
RF Cable	EMEC	EM-CB5D	001	2017/07/24	2018/07/23
Software	AUDIX	E3	V9.150826k	N.C.R	N.C.R

**** Statement of Traceability:*** BACL Corp. attests that all calibrations have been performed according to TAF requirements, traceable to the ETC.

6.8 Test Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	58 %
ATM Pressure:	1020 hPa

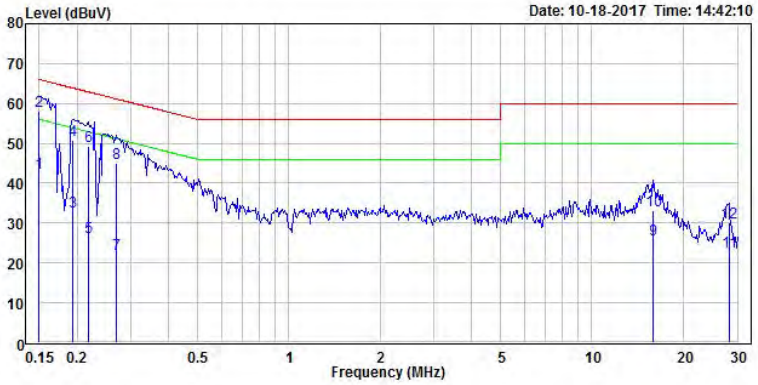
The testing was performed by Andy Shih from 2017-10-17 to 2017-10-18.

6.9 Test Results

Please refer to the following plots and tables.

Mode: Charge + Transmitting Mode

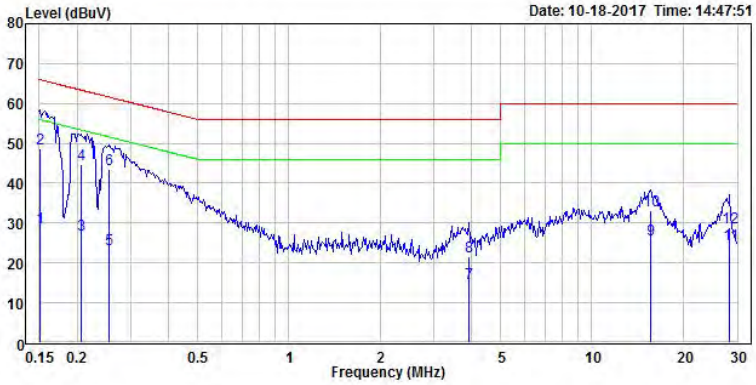
Main: AC 120V/60 Hz, Line



Condition: Line
EUT :
Mode :
Note :

	Freq	Level	Limit Line	Over Limit	Factor	Read Level	Remark	Pol/Phase
	MHz	dBuV	dBuV	dB	dB	dBuV		
1	0.150	42.46	56.00	-13.54	19.50	22.96	Average	Line
2	0.150	58.03	66.00	-7.97	19.50	38.53	QP	Line
3	0.194	32.72	53.88	-21.16	19.50	13.22	Average	Line
4	0.194	50.95	63.88	-12.93	19.50	31.45	QP	Line
5	0.218	26.60	52.89	-26.29	19.50	7.10	Average	Line
6	0.218	49.21	62.89	-13.68	19.50	29.71	QP	Line
7	0.268	22.09	51.17	-29.08	19.50	2.59	Average	Line
8	0.268	45.16	61.17	-16.01	19.50	25.66	QP	Line
9	15.860	25.87	50.00	-24.13	19.80	6.07	Average	Line
10	15.860	33.25	60.00	-26.75	19.80	13.45	QP	Line
11	28.147	22.90	50.00	-27.10	19.89	3.01	Average	Line
12	28.147	30.18	60.00	-29.82	19.89	10.29	QP	Line

Main: AC 120V/60 Hz, Neutral

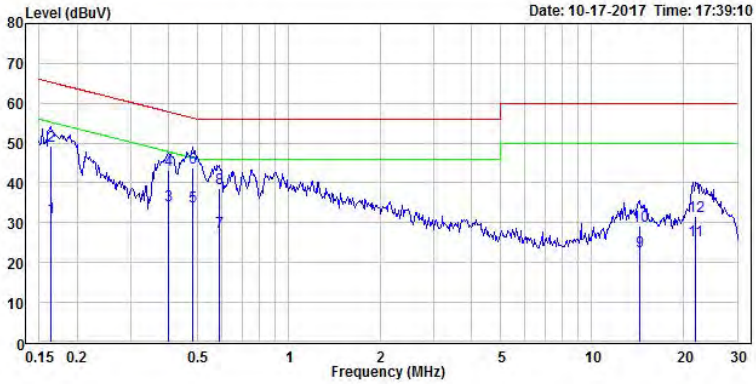


Condition: Neutral
EUT :
Mode :
Note :

	Freq	Level	Limit Line	Over Limit	Factor	Read Level	Remark	Pol/Phase
	MHz	dBuV	dBuV	dB	dB	dBuV		
1	0.151	28.89	55.93	-27.04	19.63	9.26	Average	Neutral
2	0.151	48.72	65.93	-17.21	19.63	29.09	QP	Neutral
3	0.206	27.09	53.35	-26.26	19.63	7.46	Average	Neutral
4	0.206	44.78	63.35	-18.57	19.63	25.15	QP	Neutral
5	0.254	23.45	51.63	-28.18	19.63	3.82	Average	Neutral
6	0.254	43.38	61.63	-18.25	19.63	23.75	QP	Neutral
7	3.933	14.85	46.00	-31.15	19.78	-4.93	Average	Neutral
8	3.933	21.72	56.00	-34.28	19.78	1.94	QP	Neutral
9	15.485	25.90	50.00	-24.10	19.98	5.92	Average	Neutral
10	15.485	33.08	60.00	-26.92	19.98	13.10	QP	Neutral
11	28.373	24.51	50.00	-25.49	20.14	4.37	Average	Neutral
12	28.373	28.93	60.00	-31.07	20.14	8.79	QP	Neutral

Mode: Charge + Transmitting with white cradle Mode

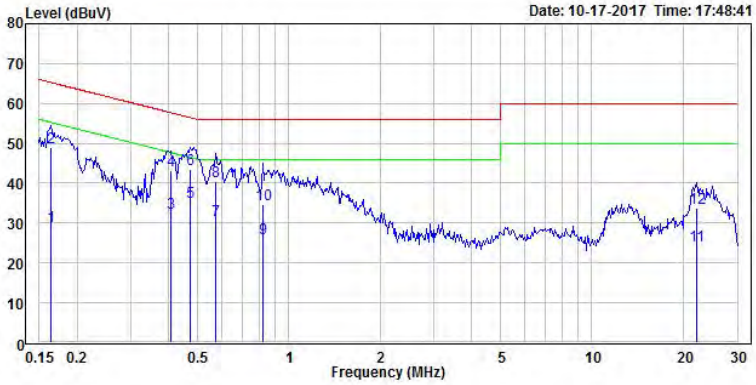
Main: AC 120V/60 Hz, Line



Condition: Line
EUT :
Mode :
Note :

	Freq	Level	Limit Line	Over Limit	Factor	Read Level	Remark	Pol/Phase
	MHz	dBuV	dBuV	dB	dB	dBuV		
1	0.164	31.30	55.27	-23.97	19.50	11.80	Average	Line
2	0.164	49.25	65.27	-16.02	19.50	29.75	QP	Line
3	0.400	34.44	47.86	-13.42	19.51	14.93	Average	Line
4	0.400	43.28	57.86	-14.58	19.51	23.77	QP	Line
5	0.480	34.19	46.34	-12.15	19.51	14.68	Average	Line
6	0.480	43.66	56.34	-12.68	19.51	24.15	QP	Line
7	0.591	27.75	46.00	-18.25	19.51	8.24	Average	Line
8	0.591	38.75	56.00	-17.25	19.51	19.24	QP	Line
9	14.300	22.83	50.00	-27.17	19.79	3.04	Average	Line
10	14.300	29.24	60.00	-30.76	19.79	9.45	QP	Line
11	21.813	25.62	50.00	-24.38	19.86	5.76	Average	Line
12	21.813	31.77	60.00	-28.23	19.86	11.91	QP	Line

Main: AC 120V/60 Hz, Neutral

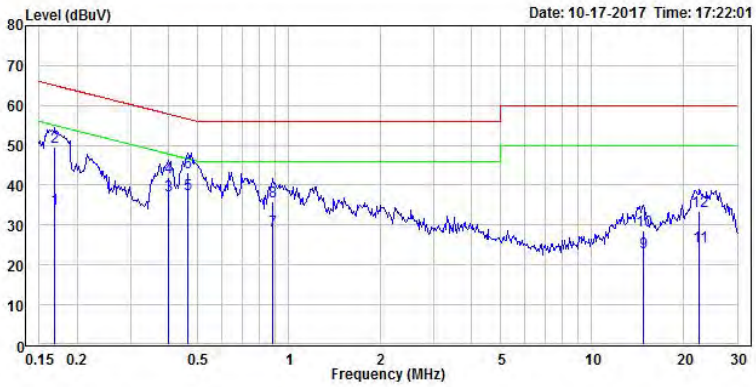


Condition: Neutral
EUT :
Mode :
Note :

	Freq	Level	Limit Line	Over Limit	Factor	Read Level	Remark	Pol/Phase
	MHz	dBuV	dBuV	dB	dB	dBuV		
1	0.164	29.21	55.27	-26.06	19.63	9.58	Average	Neutral
2	0.164	49.02	65.27	-16.25	19.63	29.39	QP	Neutral
3	0.409	32.47	47.66	-15.19	19.64	12.83	Average	Neutral
4	0.409	43.08	57.66	-14.58	19.64	23.44	QP	Neutral
5	0.472	35.34	46.47	-11.13	19.64	15.70	Average	Neutral
6	0.472	43.55	56.47	-12.92	19.64	23.91	QP	Neutral
7	0.572	30.78	46.00	-15.22	19.64	11.14	Average	Neutral
8	0.572	40.37	56.00	-15.63	19.64	20.73	QP	Neutral
9	0.819	26.05	46.00	-19.95	19.66	6.39	Average	Neutral
10	0.819	34.55	56.00	-21.45	19.66	14.89	QP	Neutral
11	21.987	24.41	50.00	-25.59	20.07	4.34	Average	Neutral
12	21.987	33.85	60.00	-26.15	20.07	13.78	QP	Neutral

Mode: Charge + Transmitting with black cradle Mode

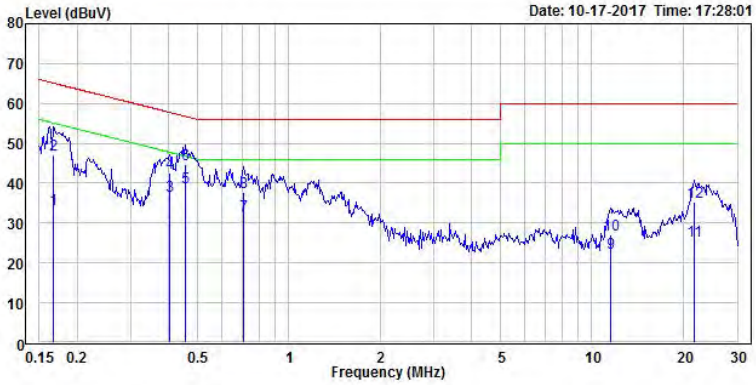
Main: AC 120V/60 Hz, Line



Condition: Line
EUT :
Mode :
Note :

		l	Limit Line	Over Limit	Factor	Read Level	Remark	Pol/Phase
	MHz	dBuV	dBuV	dB	dB	dBuV		
1	0.169	33.95	55.01	-21.06	19.50	14.45	Average	Line
2	0.169	49.70	65.01	-15.31	19.50	30.20	QP	Line
3	0.400	37.48	47.86	-10.38	19.51	17.97	Average	Line
4	0.400	41.88	57.86	-15.98	19.51	22.37	QP	Line
5	0.465	37.61	46.60	-8.99	19.51	18.10	Average	Line
6	0.465	43.15	56.60	-13.45	19.51	23.64	QP	Line
7	0.887	28.73	46.00	-17.27	19.53	9.20	Average	Line
8	0.887	35.93	56.00	-20.07	19.53	16.40	QP	Line
9	14.645	22.97	50.00	-27.03	19.79	3.18	Average	Line
10	14.645	28.58	60.00	-31.42	19.79	8.79	QP	Line
11	22.519	24.62	50.00	-25.38	19.85	4.77	Average	Line
12	22.519	33.41	60.00	-26.59	19.85	13.56	QP	Line

Main: AC 120V/60 Hz, Neutral



Condition: Neutral
EUT :
Mode :
Note :

	Freq	Level	Limit Line	Over Limit	Factor	Read Level	Remark	Pol/Phase
	MHz	dBuV	dBuV	dB	dB	dBuV		
1	0.166	33.34	55.14	-21.80	19.63	13.71	Average	Neutral
2	0.166	47.20	65.14	-17.94	19.63	27.57	QP	Neutral
3	0.403	36.77	47.79	-11.02	19.64	17.13	Average	Neutral
4	0.403	42.47	57.79	-15.32	19.64	22.83	QP	Neutral
5	0.454	38.90	46.80	-7.90	19.64	19.26	Average	Neutral
6	0.454	44.59	56.80	-12.21	19.64	24.95	QP	Neutral
7	0.709	32.00	46.00	-14.00	19.66	12.34	Average	Neutral
8	0.709	37.68	56.00	-18.32	19.66	18.02	QP	Neutral
9	11.532	22.37	50.00	-27.63	19.93	2.44	Average	Neutral
10	11.532	27.13	60.00	-32.87	19.93	7.20	QP	Neutral
11	21.640	25.61	50.00	-24.39	20.06	5.55	Average	Neutral
12	21.640	35.38	60.00	-24.62	20.06	15.32	QP	Neutral

7 FCC §15.209, §15.205, §15.247(d) – Spurious Emissions

7.1 Applicable Standard

As per FCC §15.35(d): Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1 MHz.

As Per FCC §15.205(a) and RSS-Gen except as show in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 – 0.110 0.495 – 0.505 2.1735 – 2.1905 4.125 – 4.128 4.17725 – 4.17775 4.20725 – 4.20775 6.215 – 6.218 6.26775 – 6.26825 6.31175 – 6.31225 8.291 – 8.294 8.362 – 8.366 8.37625 – 8.38675 8.41425 – 8.41475 12.29 – 12.293 12.51975 – 12.52025 12.57675 – 12.57725 13.36 – 13.41	16.42 – 16.423 16.69475 – 16.69525 25.5 – 25.67 37.5 – 38.25 73 – 74.6 74.8 – 75.2 108 – 121.94 123 – 138 149.9 – 150.05 156.52475 – 156.52525 156.7 – 156.9 162.0125 –167.17 167.72 – 173.2 240 – 285 322 – 335.4 399.9 – 410 608 – 614	960 – 1240 1300 – 1427 1435 – 1626.5 1645.5 – 1646.5 1660 – 1710 1718.8 – 1722.2 2200 – 2300 2310 – 2390 2483.5 – 2500 2690 – 2900 3260 – 3267 3.332 – 3.339 3 3458 – 3 358 3.600 – 4.400	4. 5 – 5. 15 5. 35 – 5. 46 7.25 – 7.75 8.025 – 8.5 9.0 – 9.2 9.3 – 9.5 10.6 – 12.7 13.25 – 13.4 14.47 – 14.5 15.35 – 16.2 17.7 – 21.4 22.01 – 23.12 23.6 – 24.0 31.2 – 31.8 36.43 – 36.5 Above 38.6

As per FCC §15.209(a): Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (micro volts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

As per FCC §15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the

intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c).

7.2 Measurement Uncertainty

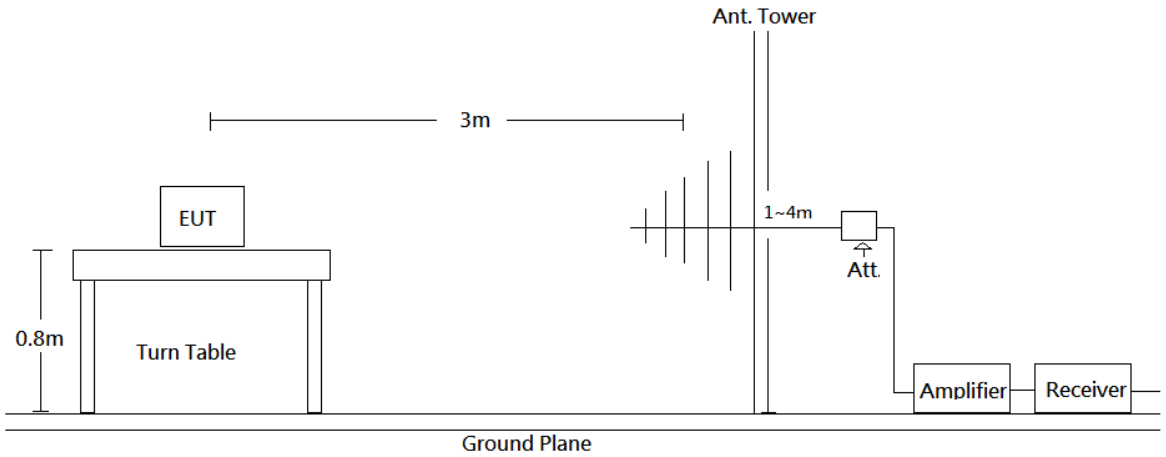
All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on CISPR 16-4-2:2011, the expended combined standard uncertainty of radiation emissions at Bay Area Compliance Laboratories Corp. (Taiwan) is shown in below table. And the uncertainty will not be taken into consideration for the test data recorded in the report.

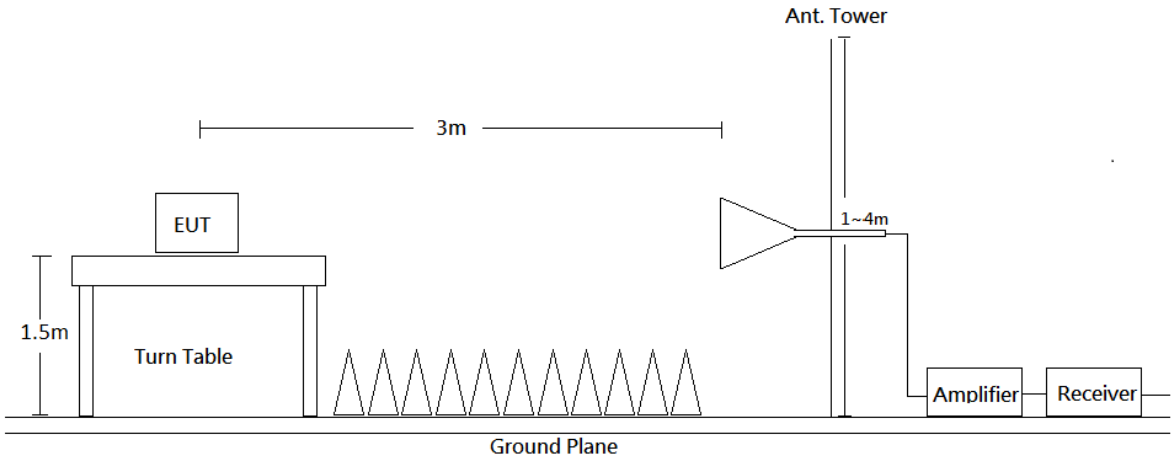
Frequency	Measurement uncertainty
30 MHz~200 MHz	3.76 dB (k=2, 95% level of confidence)
200 MHz~1 GHz	4.12 dB (k=2, 95% level of confidence)
1 GHz~6 GHz	4.84 dB (k=2, 95% level of confidence)
6 GHz~18 GHz	5.16 dB (k=2, 95% level of confidence)
18 GHz~26 GHz	4.84 dB (k=2, 95% level of confidence)
26 GHz~40 GHz	4.30 dB (k=2, 95% level of confidence)

7.3 EUT Setup

Blow 1 GHz:



Above 1 GHz:



Radiated emission tests were performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC Part 15.209 and FCC 15.247 Limits.

7.4 EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 26.5 GHz. During the radiated emission test, the EMI test receiver was set with the following configurations measurement method 6.3 in ANSI C63.10.

Frequency Range	RBW	VBW	IF BW	Detector	Duty cycle
30-1000 MHz	100 kHz	300 kHz	120 kHz	QP	
Above 1 GHz	1 MHz	3 MHz	/	PK	
	1 MHz	10 Hz	/	Ave	>98%
	1 MHz	1/T	/	Ave	<98%

7.5 Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

All data was recorded in the Quasi-peak detector mode from 30 MHz to 1 GHz and PK and average detector modes for frequencies above 1 GHz.

7.6 Corrected Factor & Margin Calculation

The Correct Factor is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain + Attenuator

The "Margin" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the limit. The equation for margin calculation is as follows:

Margin = Result –Limit

7.7 Test Results Summary

According to the data in the following table, the EUT complied with the FCC §15.209 Limit. Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level complies with the limit if

$$Lm + U(Lm) \leq Llim + Ucispr$$

In BACL, U(Lm) is less than Ucispr, if Lm is less than Llim, it implies that the EUT complies with the limit.

7.8 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due Date
966-A Room					
Bilog Antenna	Sunol & Mini-Circuits	JB6/ UNAT-6+	A050115 / 15542_01	2016/11/16	2017/11/15
Horn Antenna	EMCO	3115	9311-4158	2017/05/31	2018/05/30
Horn Antenna	ETS-Lindgren	3116	00062638	2017/09/04	2018/09/03
Preamplifier	Sonoma	310N	130602	2017/07/03	2018/07/02
Preamplifier	EMEC	EM01G18G	060697	2017/04/14	2018/04/16
Preamplifier	EMEC	EM18G40G	060656	2016/12/13	2017/12/12
EMI Test Receiver	R & S	ESR7	101419	2016/11/03	2017/11/03
Spectrum Analyzer	Rohde & Schwarz	FSV40	101203	2017/07/13	2018/07/12
Microflex Cable	UTIFLEX	UFB311A-Q-1440-300300	220490-006	2016/11/02	2017/11/01
Microflex Cable	UTIFLEX	UFA210A-1-3149-300300	MFR64639 226389-001	2016/11/29	2017/11/28
Microflex Cable	ROSNOL	K1K50-UP0264-K1K50-450CM	160309-1	2017/03/24	2018/03/23
Microflex Cable	ROSNOL	K1K50-UP0264-K1K50-80CM	160309-2	2017/01/20	2018/01/19
Turn Table	Champro	TT-2000	060772-T	N.C.R	N.C.R
Antenna Tower	Champro	AM-BS-4500-B	060772-A	N.C.R	N.C.R
Controller	Champro	EM1000	060772	N.C.R	N.C.R
Software	Farad	EZ_EMC	BACL-03A1	N.C.R	N.C.R
Conducted Room					
Spectrum Analyzer	Rohde & Schwarz	FSV40	101140	2016/11/10	2017/11/09
Cable	WOKEN	SFL402	S02-160323-07	2017/02/22	2018/02/21

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

7.9 Test Environmental Conditions

Temperature:	24 ° C
Relative Humidity:	57 %
ATM Pressure:	1020 hPa

The Radiated Spurious emission testing was performed by Ian Tu on 2017-09-08.

The Conducted Spurious Emissions testing was performed by Ian Tu from 2017-09-18 to 2017-10-23.

7.10 Test Results

(Pre-scan with three orthogonal axis, and worse case as X axis.)

Mode: BLE Mode

Horizontal

Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
BLE, Low channel								
224.9700	46.76	-12.54	34.22	46.00	-11.78	100	87	QP
322.9400	44.56	-9.35	35.21	46.00	-10.79	100	360	QP
480.0800	41.11	-6.05	35.06	46.00	-10.94	100	201	QP
2350.185	53.45	-4.98	48.47	74.00	-25.53	152	183	peak
2350.185	41.01	-4.98	36.03	54.00	-17.97	152	183	AVG
2402.000	101.97	-4.86	97.11	N/A	N/A	152	99	peak
2402.000	101.22	-4.86	96.36	N/A	N/A	152	99	AVG
4804.000	47.60	0.93	48.53	74.00	-25.47	121	154	peak
4804.000	44.70	0.93	45.63	54.00	-8.37	121	154	AVG
BLE, Middle channel								
195.8700	44.21	-11.56	32.65	43.50	-10.85	100	84	QP
337.4900	43.70	-9.04	34.66	46.00	-11.34	100	53	QP
480.0800	41.42	-6.05	35.37	46.00	-10.63	100	197	QP
2440.000	101.22	-4.78	96.44	N/A	N/A	155	100	peak
2440.000	100.02	-4.78	95.24	N/A	N/A	155	100	AVG
4880.000	47.23	1.23	48.46	74.00	-25.54	123	184	peak
4880.000	44.77	1.23	46.00	54.00	-8.00	123	184	AVG
BLE, High channel								
221.0900	46.30	-12.71	33.59	46.00	-12.41	100	77	QP
324.8800	45.01	-9.31	35.70	46.00	-10.30	100	24	QP
480.0800	41.46	-6.05	35.41	46.00	-10.59	100	206	QP
2480.000	101.70	-4.68	97.02	N/A	N/A	149	104	peak
2480.000	100.19	-4.68	95.51	N/A	N/A	149	104	AVG
2493.490	53.49	-4.66	48.83	74.00	-25.17	149	247	peak
2493.490	40.32	-4.66	35.66	54.00	-18.34	149	247	AVG
4960.000	45.73	1.52	47.25	74.00	-26.75	127	227	peak
4960.000	43.54	1.52	45.06	54.00	-8.94	127	227	AVG

Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Spurious emissions more than 20 dB below the limit were not reported.

Vertical

Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dB μV/m)	Limit (dB μV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
BLE, Low channel								
101.7800	44.01	-14.05	29.96	43.50	-13.54	100	304	QP
166.7700	38.43	-11.98	26.45	43.50	-17.05	100	2	QP
480.0800	41.07	-6.05	35.02	46.00	-10.98	100	268	QP
2386.855	53.34	-4.89	48.45	74.00	-25.55	182	232	peak
2386.855	40.31	-4.89	35.42	54.00	-18.58	182	232	AVG
2402.000	95.54	-4.86	90.68	N/A	N/A	182	55	peak
2402.000	94.86	-4.86	90.00	N/A	N/A	182	55	AVG
4804.000	48.89	0.93	49.82	74.00	-24.18	109	57	peak
4804.000	46.57	0.93	47.50	54.00	-6.50	109	57	AVG
BLE, Middle channel								
127.0000	38.69	-10.60	28.09	43.50	-15.41	100	314	QP
202.6600	38.10	-11.31	26.79	43.50	-16.71	100	322	QP
480.0800	40.74	-6.05	34.69	46.00	-11.31	100	278	QP
2440.000	98.27	-4.78	93.49	N/A	N/A	185	124	peak
2440.000	97.32	-4.78	92.54	N/A	N/A	185	124	AVG
4880.000	47.18	1.23	48.41	74.00	-25.59	101	44	peak
4880.000	45.25	1.23	46.48	54.00	-7.52	101	44	AVG
BLE, High channel								
205.5700	39.96	-11.98	27.98	43.50	-15.52	100	308	QP
480.0800	40.87	-6.05	34.82	46.00	-11.18	100	277	QP
600.3600	38.54	-3.97	34.57	46.00	-11.43	100	70	QP
2480.000	96.84	-4.68	92.16	N/A	N/A	187	123	peak
2480.000	95.79	-4.68	91.11	N/A	N/A	187	123	AVG
2494.780	53.34	-4.65	48.69	74.00	-25.31	187	137	peak
2494.780	40.27	-4.65	35.62	54.00	-18.38	187	137	AVG
4960.000	47.47	1.52	48.99	74.00	-25.01	104	249	peak
4960.000	43.07	1.52	44.59	54.00	-9.41	104	249	AVG

Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Spurious emissions more than 20 dB below the limit were not reported.

Mode: B Mode

Horizontal

Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Height (cm)	Degree (˚)	Remark
B Mode, Low channel								
176.4700	49.76	-12.82	36.94	43.50	-6.56	100	174	QP
334.5800	44.66	-9.10	35.56	46.00	-10.44	100	190	QP
480.0800	45.77	-6.05	39.72	46.00	-6.28	100	218	QP
2390.000	62.63	-4.89	57.74	74.00	-16.26	153	184	peak
2390.000	48.89	-4.89	44.00	54.00	-10.00	153	184	AVG
2412.000	105.13	-4.84	100.29	N/A	N/A	153	184	peak
2412.000	102.49	-4.84	97.65	N/A	N/A	153	184	AVG
4824.000	54.21	1.05	55.26	74.00	-18.74	121	188	peak
4824.000	52.07	1.05	53.12	54.00	-0.88	121	188	AVG
B Mode, Middle channel								
173.5600	50.27	-12.59	37.68	43.50	-5.82	100	165	QP
334.5800	44.19	-9.10	35.09	46.00	-10.91	100	199	QP
480.0800	46.05	-6.05	40.00	46.00	-6.00	100	215	QP
2437.000	105.99	-4.78	101.21	N/A	N/A	158	189	peak
2437.000	103.31	-4.78	98.53	N/A	N/A	158	189	AVG
4874.000	53.37	1.23	54.60	74.00	-19.40	117	189	peak
4874.000	51.3	1.23	52.53	54.00	-1.47	117	189	AVG
B Mode, High channel								
175.5000	49.86	-12.75	37.11	43.50	-6.39	100	155	QP
205.5700	47.84	-11.98	35.86	43.50	-7.64	100	201	QP
480.0800	46.03	-6.05	39.98	46.00	-6.02	100	223	QP
2462.000	105.30	-4.72	100.58	N/A	N/A	151	173	peak
2462.000	102.65	-4.72	97.93	N/A	N/A	151	173	AVG
2483.500	63.09	-4.69	58.40	74.00	-15.60	151	173	peak
2483.500	48.31	-4.69	43.62	54.00	-10.38	151	173	AVG
4924.000	53.78	1.40	55.18	74.00	-18.82	123	190	peak
4924.000	51.62	1.40	53.02	54.00	-0.98	123	190	AVG

Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Spurious emissions more than 20 dB below the limit were not reported.

Vertical

Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dB μV/m)	Limit (dB μV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
B Mode, Low channel								
198.7800	42.79	-10.96	31.83	43.50	-11.67	100	30	QP
480.0800	39.50	-6.05	33.45	46.00	-12.55	100	52	QP
600.3600	34.12	-3.97	30.15	46.00	-15.85	100	294	QP
2390.000	63.34	-4.89	58.45	74.00	-15.55	181	300	peak
2390.000	48.36	-4.89	43.47	54.00	-10.53	181	300	AVG
2412.000	101.20	-4.84	96.36	N/A	N/A	181	300	peak
2412.000	98.26	-4.84	93.42	N/A	N/A	181	300	AVG
4824.000	49.64	1.05	50.69	74.00	-23.31	103	33	peak
4824.000	45.92	1.05	46.97	54.00	-7.03	103	33	AVG
B Mode, Middle channel								
101.7800	45.52	-14.05	31.47	43.50	-12.03	100	321	QP
208.4800	42.51	-12.64	29.87	43.50	-13.63	100	13	QP
480.0800	39.76	-6.05	33.71	46.00	-12.29	100	66	QP
2437.000	98.97	-4.78	94.19	N/A	N/A	183	69	peak
2437.000	96.08	-4.78	91.30	N/A	N/A	183	69	AVG
4874.000	48.03	1.23	49.26	74.00	-24.74	107	59	peak
4874.000	44.44	1.23	45.67	54.00	-8.33	107	59	AVG
B Mode, High channel								
74.6200	46.81	-16.79	30.02	40.00	-9.98	100	5	QP
207.5100	42.24	-12.42	29.82	43.50	-13.68	100	36	QP
480.0800	39.70	-6.05	33.65	46.00	-12.35	100	57	QP
2462.000	99.06	-4.72	94.34	N/A	N/A	180	68	peak
2462.000	96.34	-4.72	91.62	N/A	N/A	180	68	AVG
2483.500	63.14	-4.69	58.45	74.00	-15.55	180	68	peak
2483.500	48.04	-4.69	43.35	54.00	-10.65	180	68	AVG
4924.000	48.62	1.40	50.02	74.00	-23.98	101	33	peak
4924.000	44.91	1.40	46.31	54.00	-7.69	101	33	AVG

Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Spurious emissions more than 20 dB below the limit were not reported.

Mode: G Mode

Horizontal

Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Height (cm)	Degree (˚)	Remark
G Mode, Low channel								
175.5000	50.15	-12.75	37.40	43.50	-6.10	100	147	QP
340.4000	44.19	-8.97	35.22	46.00	-10.78	100	208	QP
480.0800	46.21	-6.05	40.16	46.00	-5.84	100	204	QP
2390.000	72.91	-4.89	68.02	74.00	-5.98	153	99	peak
2390.000	54.73	-4.89	49.84	54.00	-4.16	153	99	AVG
2412.000	109.04	-4.84	104.20	N/A	N/A	153	99	peak
2412.000	97.93	-4.84	93.09	N/A	N/A	153	99	AVG
4824.000	56.04	1.05	57.09	74.00	-16.91	126	194	peak
4824.000	41.65	1.05	42.70	54.00	-11.30	126	194	AVG
G Mode, Middle channel								
175.5000	50.09	-12.75	37.34	43.50	-6.16	100	179	QP
336.5200	44.37	-9.07	35.30	46.00	-10.70	100	206	QP
480.0800	46.38	-6.05	40.33	46.00	-5.67	100	206	QP
2437.000	109.3	-4.78	104.52	N/A	N/A	154	109	peak
2437.000	97.98	-4.78	93.20	N/A	N/A	154	109	AVG
4874.000	56.10	1.23	57.33	74.00	-16.67	122	190	peak
4874.000	41.25	1.23	42.48	54.00	-11.52	122	190	AVG
G Mode, High channel								
178.4100	50.80	-12.97	37.83	43.50	-5.67	100	149	QP
336.5200	44.27	-9.07	35.20	46.00	-10.80	100	197	QP
480.0800	46.05	-6.05	40.00	46.00	-6.00	100	209	QP
2462.000	109.64	-4.72	104.92	N/A	N/A	156	117	peak
2462.000	98.32	-4.72	93.60	N/A	N/A	156	117	AVG
2483.500	75.47	-4.69	70.78	74.00	-3.22	156	117	peak
2483.500	56.18	-4.69	51.49	54.00	-2.51	156	117	AVG
4924.000	53.21	1.40	54.61	74.00	-19.39	126	194	peak
4924.000	41.83	1.40	43.23	54.00	-10.77	126	194	AVG

Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Spurious emissions more than 20 dB below the limit were not reported.

Vertical

Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dB μV/m)	Limit (dB μV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
G Mode, Low channel								
63.9500	46.24	-17.27	28.97	40.00	-11.03	100	9	QP
198.7800	43.35	-10.96	32.39	43.50	-11.11	100	28	QP
480.0800	39.30	-6.05	33.25	46.00	-12.75	100	69	QP
2390.000	68.27	-4.89	63.38	74.00	-10.62	182	334	peak
2390.000	51.71	-4.89	46.82	54.00	-7.18	182	334	AVG
2412.000	105.38	-4.84	100.54	N/A	N/A	182	334	peak
2412.000	93.98	-4.84	89.14	N/A	N/A	182	334	AVG
7236.000	50.41	6.69	57.10	74.00	-16.90	101	225	peak
7236.000	28.00	6.69	34.69	54.00	-19.31	101	225	AVG
G Mode, Middle channel								
72.6800	45.05	-16.82	28.23	40.00	-11.77	100	315	QP
205.5700	42.01	-11.98	30.03	43.50	-13.47	100	15	QP
480.0800	39.95	-6.05	33.90	46.00	-12.10	100	63	QP
2437.000	104.13	-4.78	99.35	N/A	N/A	187	334	peak
2437.000	93.40	-4.78	88.62	N/A	N/A	187	334	AVG
7311.000	49.35	6.98	56.33	74.00	-17.67	103	70	peak
7311.000	34.50	6.98	41.48	54.00	-12.52	103	70	AVG
G Mode, High channel								
73.6500	45.20	-16.81	28.39	40.00	-11.61	100	321	QP
202.6600	43.80	-11.31	32.49	43.50	-11.01	100	359	QP
480.0800	39.66	-6.05	33.61	46.00	-12.39	100	61	QP
2462.000	104.00	-4.72	99.28	N/A	N/A	182	335	peak
2462.000	92.78	-4.72	88.06	N/A	N/A	182	335	AVG
2483.500	69.32	-4.69	64.63	74.00	-9.37	182	335	peak
2483.500	51.77	-4.69	47.08	54.00	-6.92	182	335	AVG
7386.000	43.83	7.23	51.06	74.00	-22.94	104	62	peak
7386.000	33.74	7.23	40.97	54.00	-13.03	104	62	AVG

Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Spurious emissions more than 20 dB below the limit were not reported.

Mode: N20 Mode

Horizontal

Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
N20 Mode, Low channel								
176.4700	50.53	-12.82	37.71	43.50	-5.79	100	168	QP
334.5800	44.38	-9.10	35.28	46.00	-10.72	100	193	QP
480.0800	45.91	-6.05	39.86	46.00	-6.14	100	227	QP
2390.000	70.03	-4.89	65.14	74.00	-8.86	155	347	peak
2390.000	49.65	-4.89	44.76	54.00	-9.24	155	347	AVG
2412.000	105.86	-4.84	101.02	N/A	N/A	155	347	peak
2412.000	94.84	-4.84	90.00	N/A	N/A	155	347	AVG
4824.000	51.93	1.05	52.98	74.00	-21.02	123	192	peak
4824.000	43.02	1.05	44.07	54.00	-9.93	123	192	AVG
N20 Mode, Middle channel								
179.3800	50.51	-13.04	37.47	43.50	-6.03	100	144	QP
339.4300	44.09	-9.00	35.09	46.00	-10.91	100	209	QP
480.0800	45.94	-6.05	39.89	46.00	-6.11	100	206	QP
2437.000	106.69	-4.78	101.91	N/A	N/A	158	320	peak
2437.000	95.85	-4.78	91.07	N/A	N/A	158	320	AVG
4874.000	52.31	1.23	53.54	74.00	-20.46	127	191	peak
4874.000	41.62	1.23	42.85	54.00	-11.15	127	191	AVG
N20 Mode, High channel								
176.4700	50.20	-12.82	37.38	43.50	-6.12	100	156	QP
339.4300	44.02	-9.00	35.02	46.00	-10.98	100	194	QP
480.0800	46.03	-6.05	39.98	46.00	-6.02	100	218	QP
2462.000	106.94	-4.72	102.22	N/A	N/A	156	127	peak
2462.000	95.81	-4.72	91.09	N/A	N/A	156	127	AVG
2483.500	71.26	-4.69	66.57	74.00	-7.43	156	127	peak
2483.500	51.43	-4.69	46.74	54.00	-7.26	156	127	AVG
4924.000	49.93	1.40	51.33	74.00	-22.67	122	193	peak
4924.000	41.44	1.40	42.84	54.00	-11.16	122	193	AVG

Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Spurious emissions more than 20 dB below the limit were not reported.

Vertical

Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
N20 Mode, Low channel								
74.6200	44.68	-16.79	27.89	40.00	-12.11	100	17	QP
205.5700	42.43	-11.98	30.45	43.50	-13.05	100	23	QP
480.0800	39.86	-6.05	33.81	46.00	-12.19	100	66	QP
2390.000	64.71	-4.89	59.82	74.00	-14.18	187	55	peak
2390.000	48.77	-4.89	43.88	54.00	-10.12	187	55	AVG
2412.000	99.55	-4.84	94.71	N/A	N/A	187	55	peak
2412.000	88.61	-4.84	83.77	N/A	N/A	187	55	AVG
4824.000	48.05	1.05	49.10	74.00	-24.90	101	187	peak
4824.000	36.14	1.05	37.19	54.00	-16.81	101	187	AVG
N20 Mode, Middle channel								
101.7800	45.68	-14.05	31.63	43.50	-11.87	100	263	QP
480.0800	39.85	-6.05	33.80	46.00	-12.20	100	63	QP
600.3600	35.22	-3.97	31.25	46.00	-14.75	100	125	QP
2437.000	100.78	-4.78	96.00	N/A	N/A	186	51	peak
2437.000	89.36	-4.78	84.58	N/A	N/A	186	51	AVG
4874.000	47.42	1.23	48.65	74.00	-25.35	107	193	peak
4874.000	36.24	1.23	37.47	54.00	-16.53	107	193	AVG
N20 Mode, High channel								
73.6500	45.41	-16.81	28.60	40.00	-11.40	100	360	QP
208.4800	43.04	-12.64	30.40	43.50	-13.10	100	13	QP
480.0800	39.72	-6.05	33.67	46.00	-12.33	100	66	QP
2462.000	101.66	-4.72	96.94	N/A	N/A	185	336	peak
2462.000	91.15	-4.72	86.43	N/A	N/A	185	336	AVG
2483.500	67.75	-4.69	63.06	74.00	-10.94	185	336	peak
2483.500	49.51	-4.69	44.82	54.00	-9.18	185	336	AVG
4924.000	46.91	1.40	48.31	74.00	-25.69	104	197	peak
4924.000	36.39	1.40	37.79	54.00	-16.21	104	197	AVG

Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Spurious emissions more than 20 dB below the limit were not reported.

Mode: N40 Mode

Horizontal

Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
N40 Mode, Low channel								
175.5000	49.62	-12.75	36.87	43.50	-6.63	100	144	QP
334.5800	44.22	-9.10	35.12	46.00	-10.88	100	196	QP
480.0800	45.98	-6.05	39.93	46.00	-6.07	100	206	QP
2390.000	75.04	-4.89	70.15	74.00	-3.85	154	352	peak
2390.000	54.46	-4.89	49.57	54.00	-4.43	154	352	AVG
2422.000	104.12	-4.81	99.31	N/A	N/A	154	352	peak
2422.000	92.20	-4.81	87.39	N/A	N/A	154	352	AVG
4844.000	47.99	1.11	49.10	74.00	-24.90	106	187	peak
4844.000	36.08	1.11	37.19	54.00	-16.81	106	187	AVG
N40 Mode, Middle channel								
176.4700	50.18	-12.82	37.36	43.50	-6.14	100	164	QP
339.4300	44.44	-9.00	35.44	46.00	-10.56	100	207	QP
480.0800	46.18	-6.05	40.13	46.00	-5.87	100	213	QP
2437.000	104.47	-4.78	99.69	N/A	N/A	155	129	peak
2437.000	93.67	-4.78	88.89	N/A	N/A	155	129	AVG
2483.500	69.95	-4.69	65.26	74.00	-8.74	155	129	peak
2483.500	52.68	-4.69	47.99	54.00	-6.01	155	129	AVG
4874.000	47.42	1.23	48.65	74.00	-25.35	108	193	peak
4874.000	36.24	1.23	37.47	54.00	-16.53	108	193	AVG
N40 Mode, High channel								
179.3800	50.83	-13.04	37.79	43.50	-5.71	100	153	QP
336.5200	45.35	-9.07	36.28	46.00	-9.72	100	214	QP
480.0800	39.07	-6.05	33.02	46.00	-12.98	100	226	QP
2452.000	106.28	-4.75	101.53	N/A	N/A	153	126	peak
2452.000	94.77	-4.75	90.02	N/A	N/A	153	126	AVG
2483.500	75.97	-4.69	71.28	74.00	-2.72	153	126	peak
2483.500	55.29	-4.69	50.60	54.00	-3.40	153	126	AVG
4904.000	47.02	1.29	48.31	74.00	-25.69	104	197	peak
4904.000	36.50	1.29	37.79	54.00	-16.21	104	197	AVG

Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Spurious emissions more than 20 dB below the limit were not reported.

Vertical

Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Height (cm)	Degree (˚)	Remark
N40 Mode, Low channel								
73.6500	44.86	-16.81	28.05	40.00	-11.95	100	318	QP
205.5700	41.95	-11.98	29.97	43.50	-13.53	100	24	QP
480.0800	39.50	-6.05	33.45	46.00	-12.55	100	60	QP
2390.000	66.78	-4.89	61.89	74.00	-12.11	188	327	peak
2390.000	51.75	-4.89	46.86	54.00	-7.14	188	327	AVG
2422.000	99.44	-4.81	94.63	N/A	N/A	188	327	peak
2422.000	88.54	-4.81	83.73	N/A	N/A	188	327	AVG
7266.000	41.58	6.76	48.34	74.00	-25.66	101	312	peak
7266.000	30.53	6.76	37.29	54.00	-16.71	101	312	AVG
N40 Mode, Middle channel								
101.7800	43.88	-14.05	29.83	43.50	-13.67	100	80	QP
208.4800	42.97	-12.64	30.33	43.50	-13.17	100	36	QP
480.0800	39.29	-6.05	33.24	46.00	-12.76	100	56	QP
2437.000	99.33	-4.78	94.55	N/A	N/A	182	52	peak
2437.000	87.72	-4.78	82.94	N/A	N/A	182	52	AVG
2483.500	69.70	-4.69	65.01	74.00	-8.99	182	52	peak
2483.500	50.07	-4.69	45.38	54.00	-8.62	182	52	AVG
7311.000	41.70	6.98	48.68	74.00	-25.32	107	316	peak
7311.000	28.71	6.98	35.69	54.00	-18.31	107	316	AVG
N40 Mode, High channel								
101.7800	43.11	-14.05	29.06	43.50	-14.44	100	337	QP
207.5100	42.65	-12.42	30.23	43.50	-13.27	100	34	QP
480.0800	38.78	-6.05	32.73	46.00	-13.27	100	337	QP
2452.000	100.82	-4.75	96.07	N/A	N/A	184	328	peak
2452.000	89.23	-4.75	84.48	N/A	N/A	184	328	AVG
2483.500	71.42	-4.69	66.73	74.00	-7.27	184	328	peak
2483.500	52.38	-4.69	47.69	54.00	-6.31	184	328	AVG
7356.000	40.69	7.16	47.85	74.00	-26.15	105	232	peak
7356.000	28.16	7.16	35.32	54.00	-18.68	105	232	AVG

Result = Reading + Correct Factor

Margin = Result – Limit

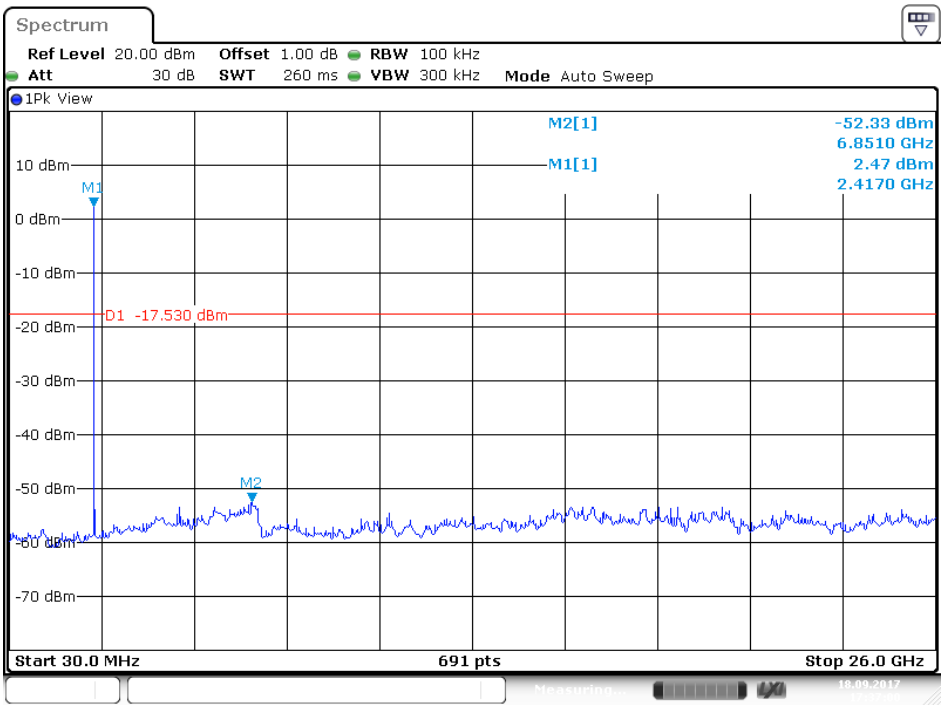
Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Spurious emissions more than 20 dB below the limit were not reported.

Conducted Spurious Emissions:

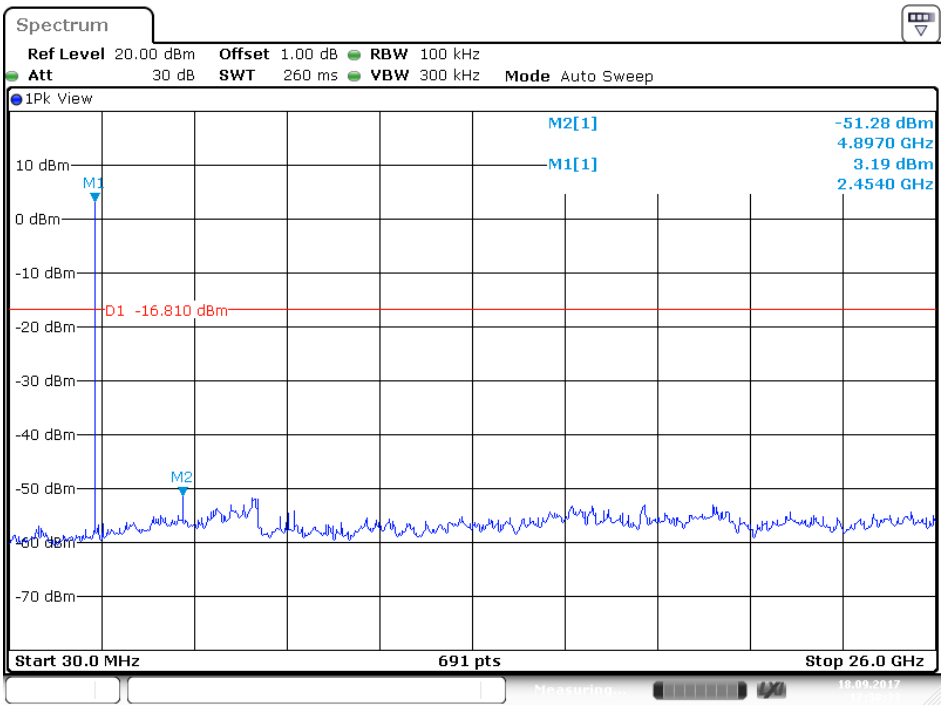
Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)		Limit (dBc)	RESULT
		Chain 0	Chain 1		
BLE Mode					
Low	2402	54.80	N/A	≥ 20	PASS
Mid	2440	54.47	N/A	≥ 20	PASS
High	2480	53.05	N/A	≥ 20	PASS
B Mode					
Low	2412	43.56	N/A	≥ 20	PASS
Mid	2437	45.15	N/A	≥ 20	PASS
High	2462	47.57	N/A	≥ 20	PASS
G Mode					
Low	2412	49.94	N/A	≥ 20	PASS
Mid	2437	50.85	N/A	≥ 20	PASS
High	2462	51.09	N/A	≥ 20	PASS
N20 Mode					
Low	2412	50.46	50.44	≥ 20	PASS
Mid	2437	51.58	51.21	≥ 20	PASS
High	2462	52.06	49.41	≥ 20	PASS
N40 Mode					
Low	2422	47.80	48.02	≥ 20	PASS
Mid	2437	47.73	47.48	≥ 20	PASS
High	2452	44.44	48.15	≥ 20	PASS

BLE Mode Low Channel



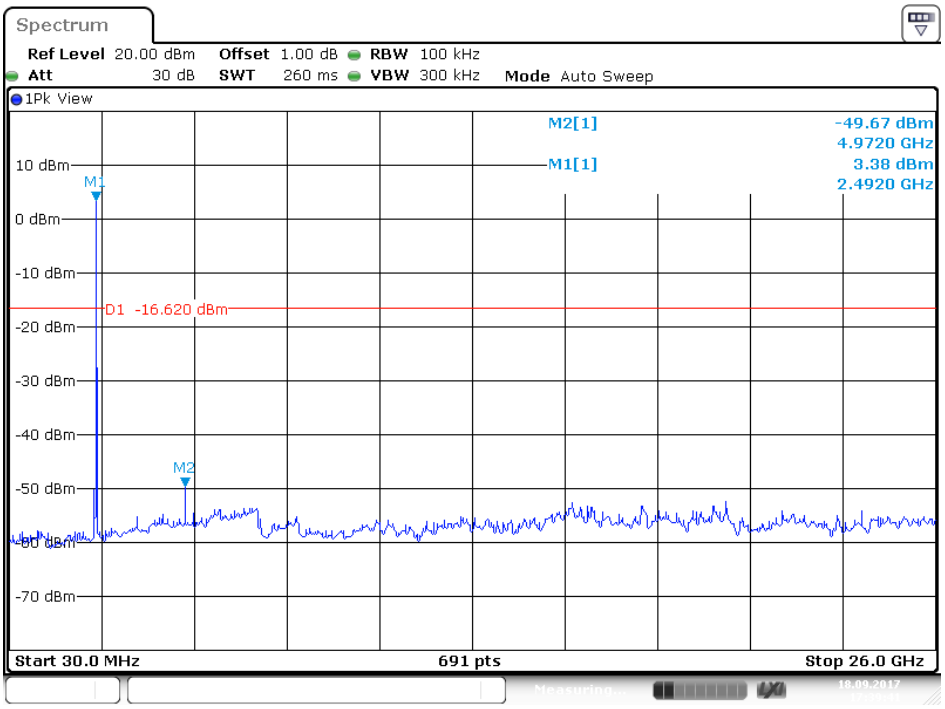
Date: 18.SEP.2017 17:37:00

BLE Mode Middle Channel



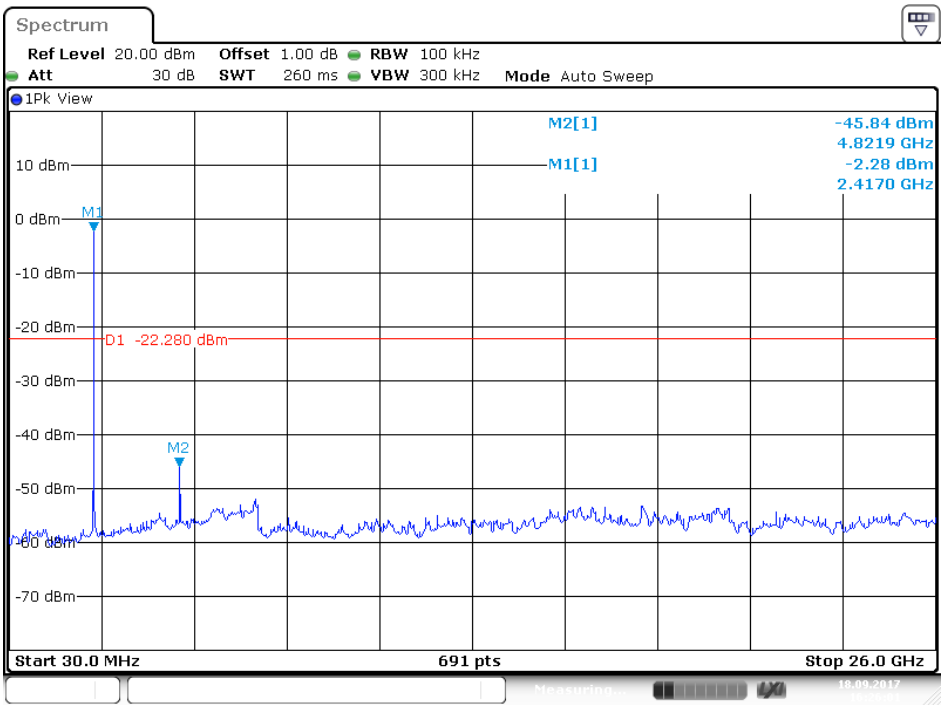
Date: 18.SEP.2017 17:38:33

BLE Mode High Channel



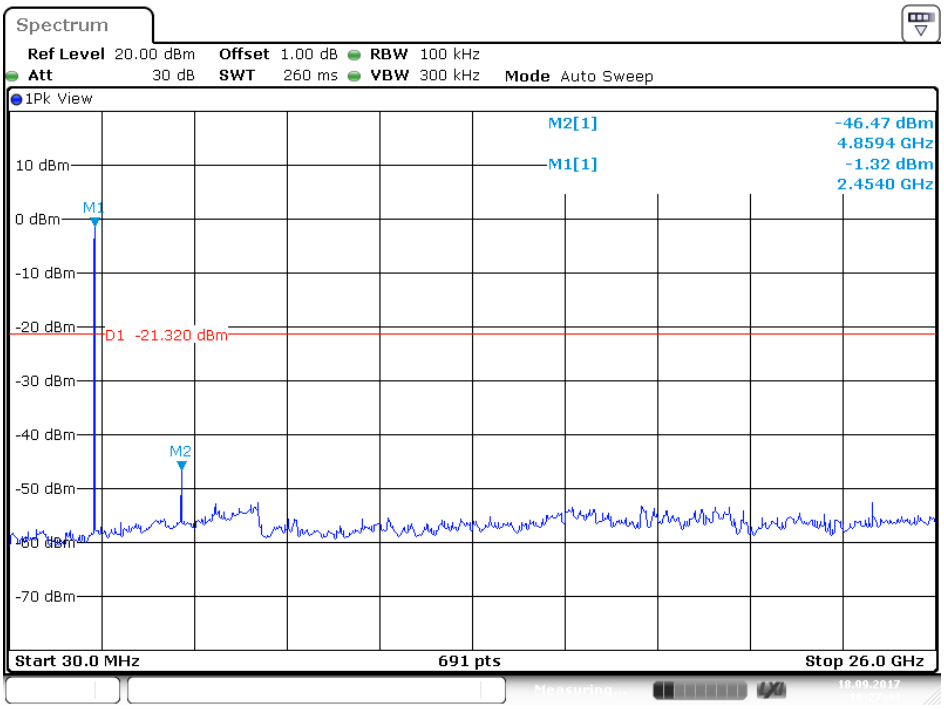
Date: 18.SEP.2017 17:39:42

B Mode Low Channel



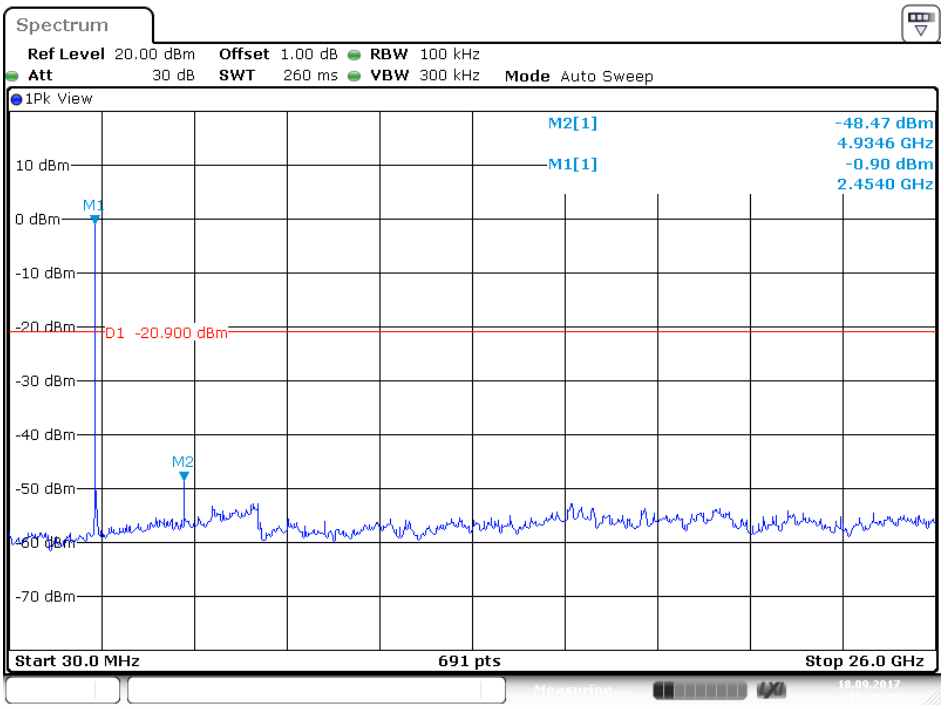
Date: 18.SEP.2017 16:26:01

B Mode Middle Channel



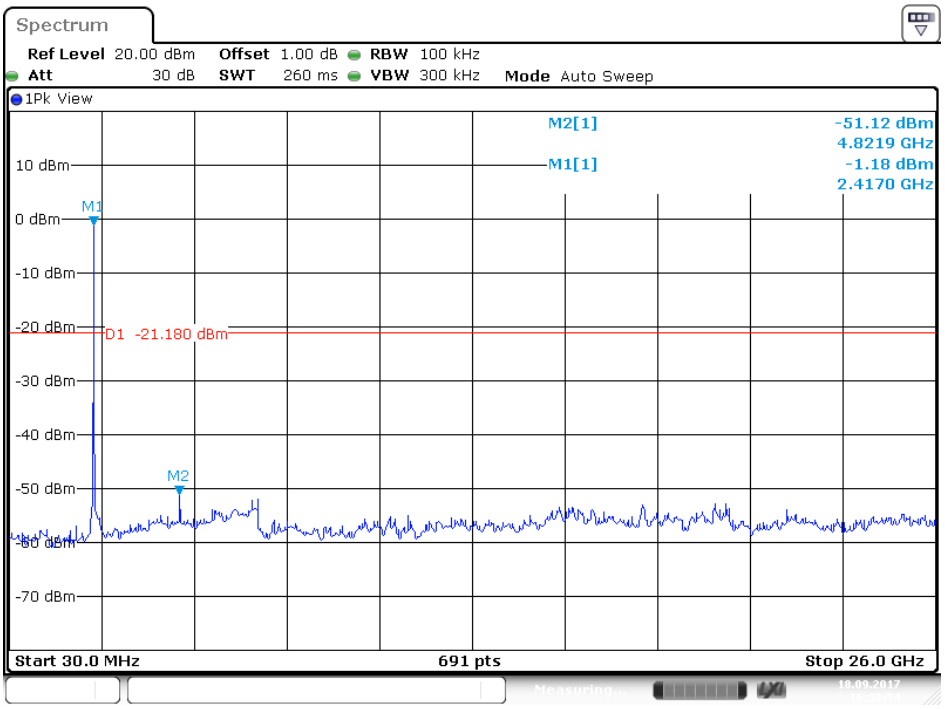
Date: 18.SEP.2017 16:27:43

B Mode High Channel



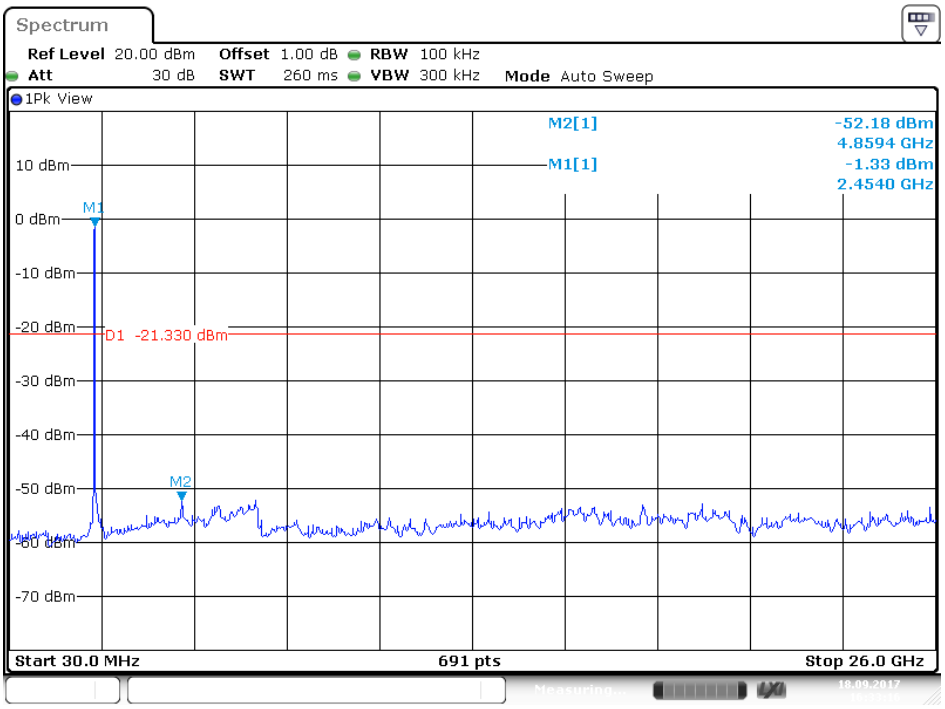
Date: 18.SEP.2017 16:29:02

G Mode Low Channel



Date: 18.SEP.2017 16:30:55

G Mode Middle Channel



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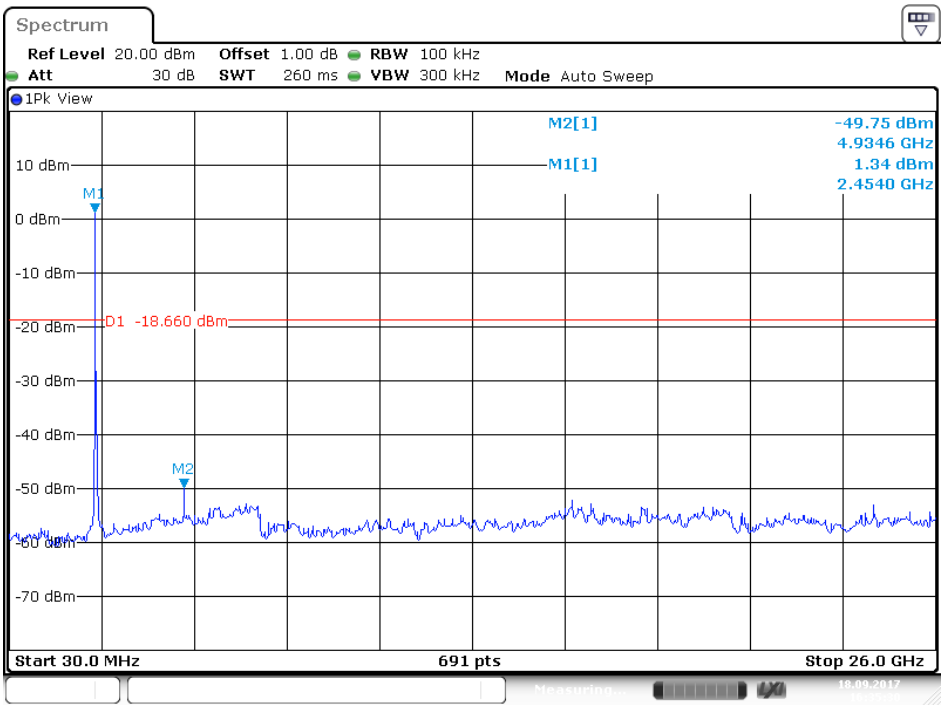
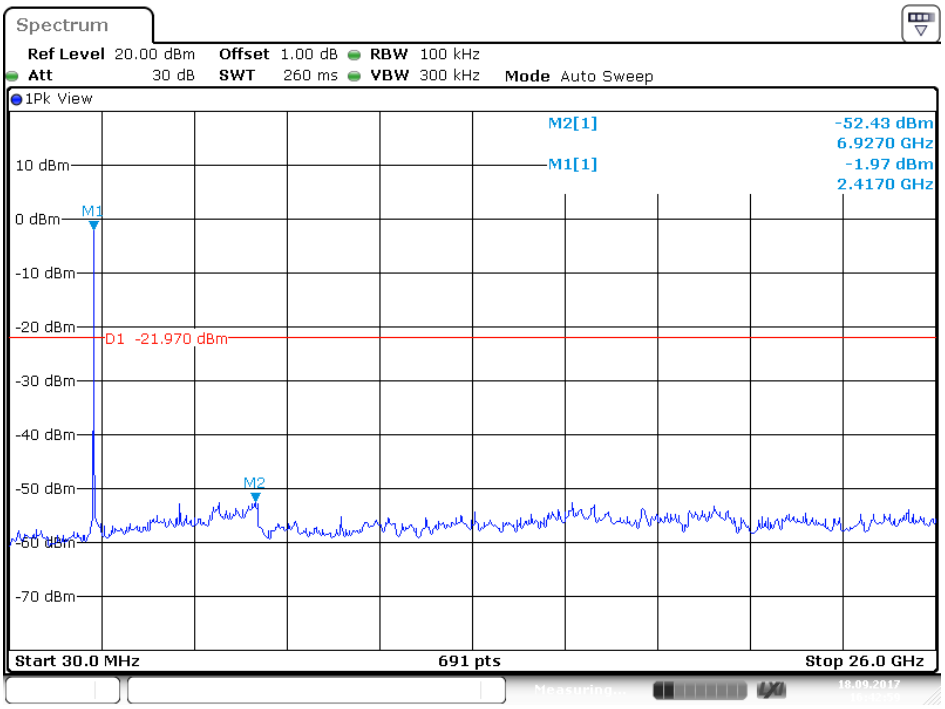
G Mode High Channel



Date: 18.SEP.2017 16:35:30

N20 Mode Low Channel (Chain 0)



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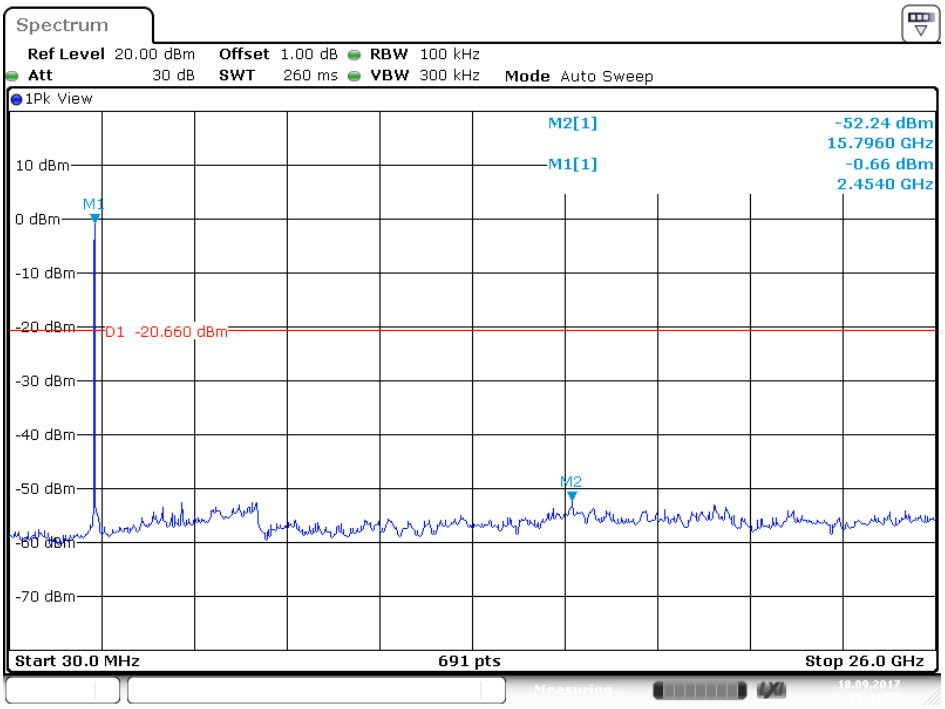
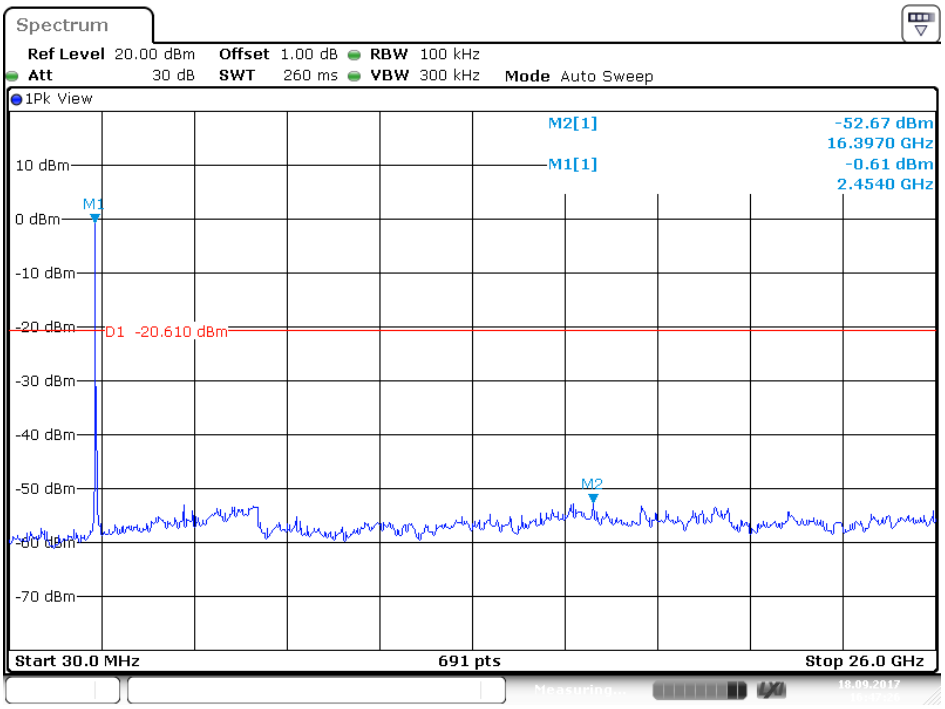
N20 Mode Middle Channel (Chain 0)



Date: 18.SEP.2017 16:41:52

N20 Mode High Channel (Chain 0)



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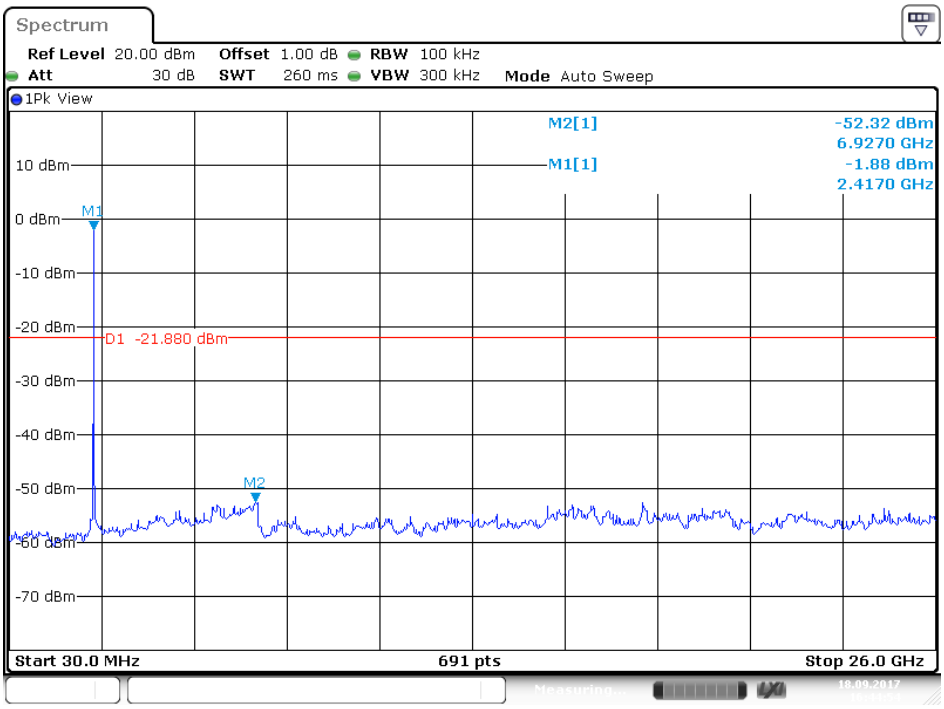
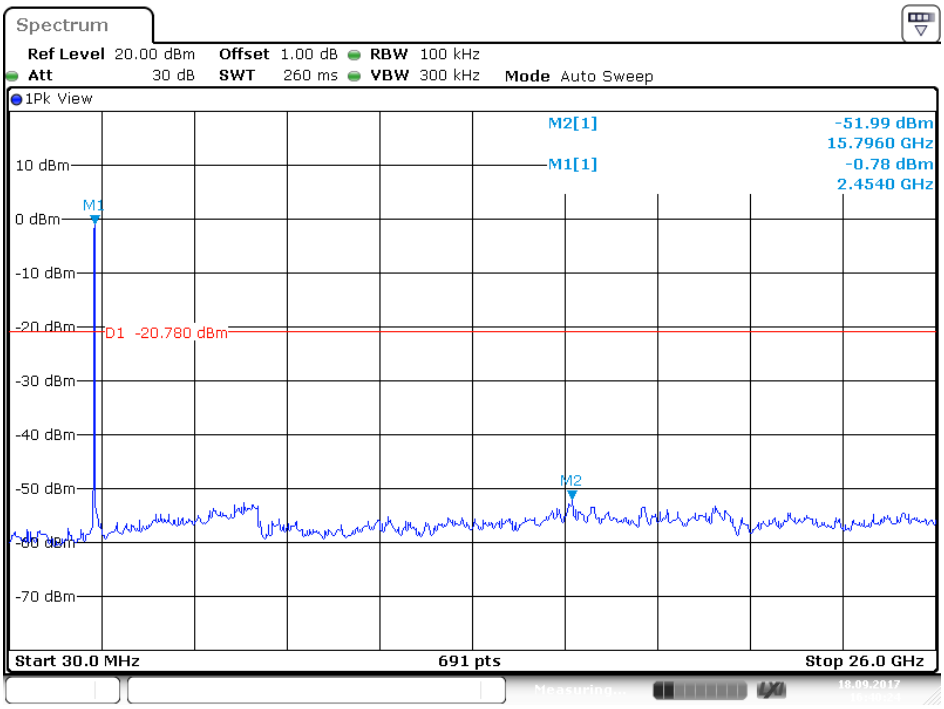
N20 Mode Low Channel (Chain 1)



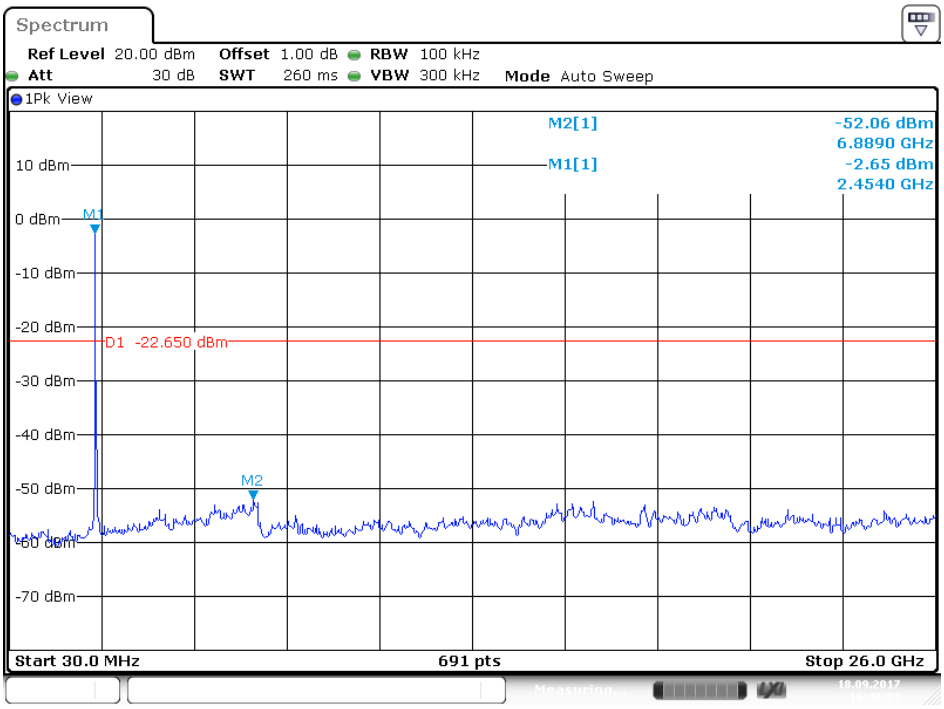
Date: 18.SEP.2017 16:44:54

N20 Mode Middle Channel (Chain 1)



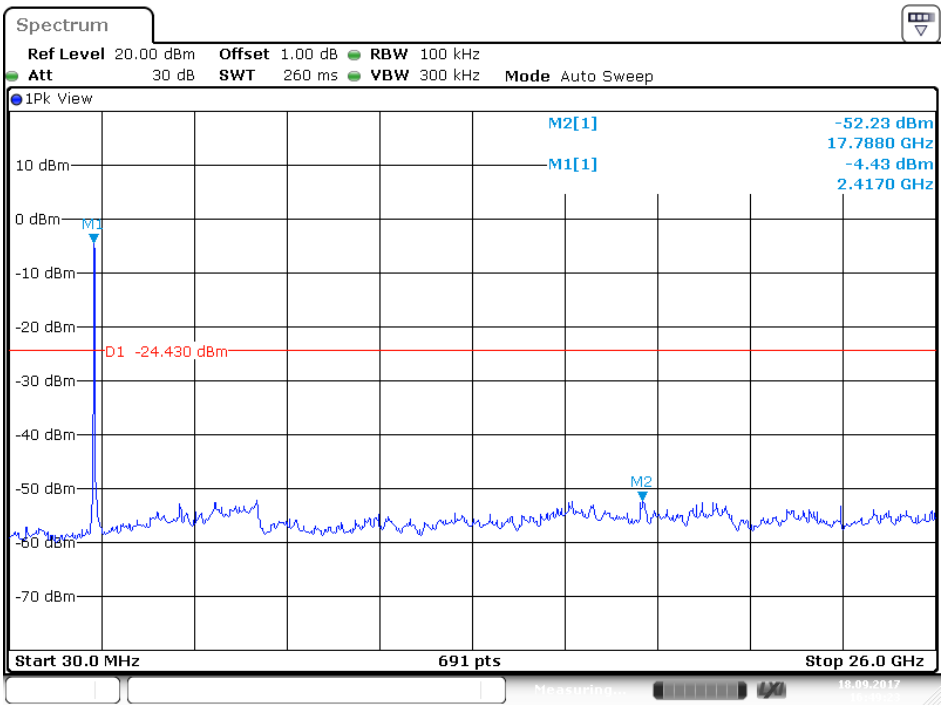
Date: 18.SEP.2017 16:40:25

N20 Mode High Channel (Chain 1)



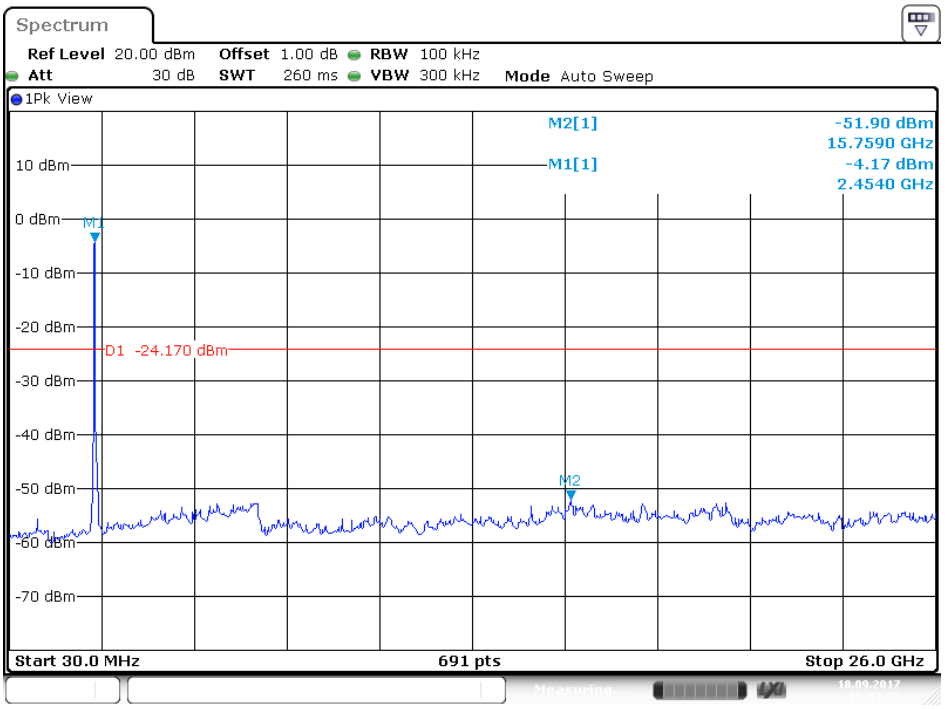
Date: 18.SEP.2017 16:46:21

N40 Mode Low Channel (Chain 0)



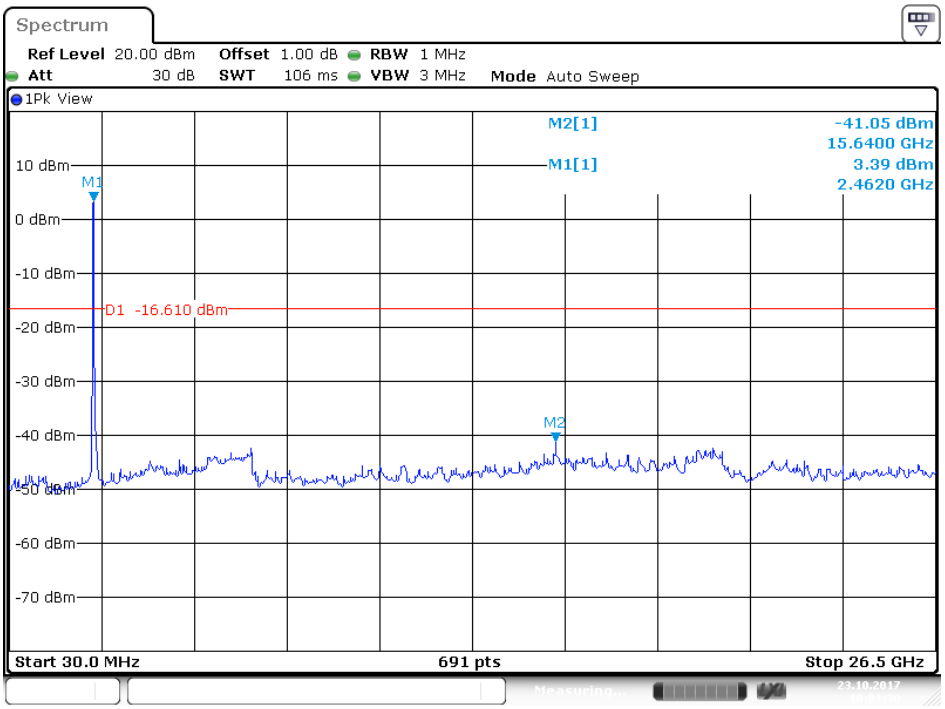
Date: 18.SEP.2017 16:49:23

N40 Mode Middle Channel (Chain 0)



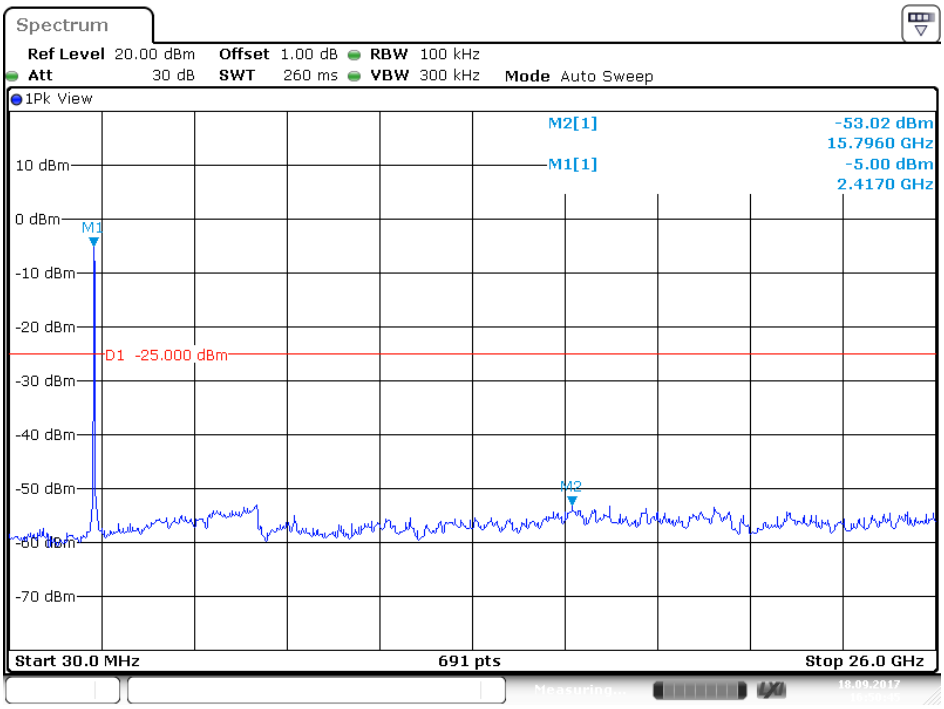
Date: 18.SEP.2017 16:53:58

N40 Mode High Channel (Chain 0)



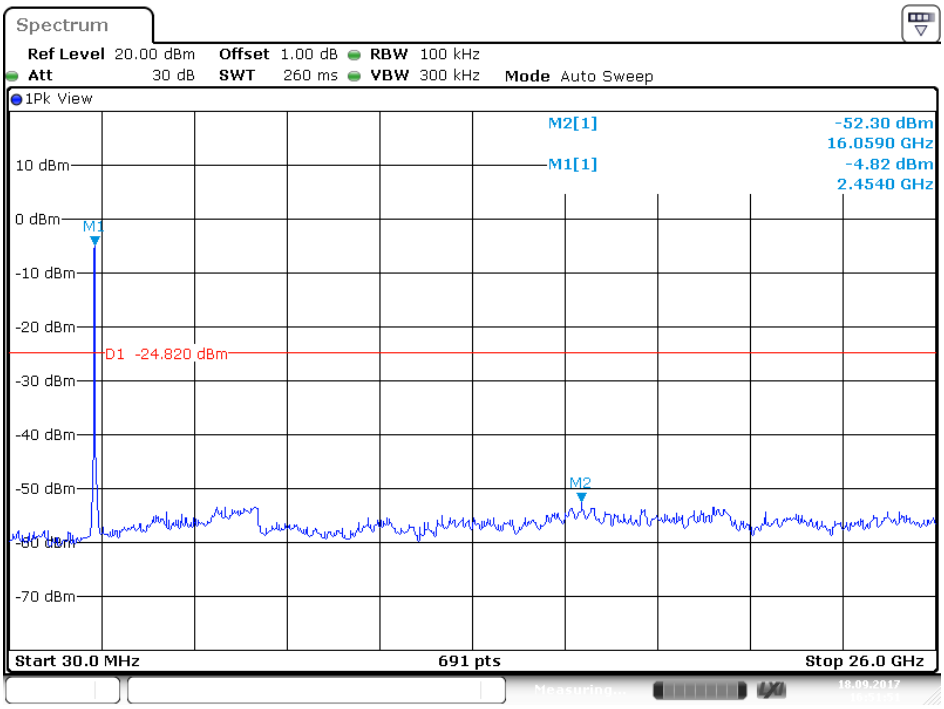
Date: 23.OCT.2017 10:01:30

N40 Mode Low Channel (Chain 1)



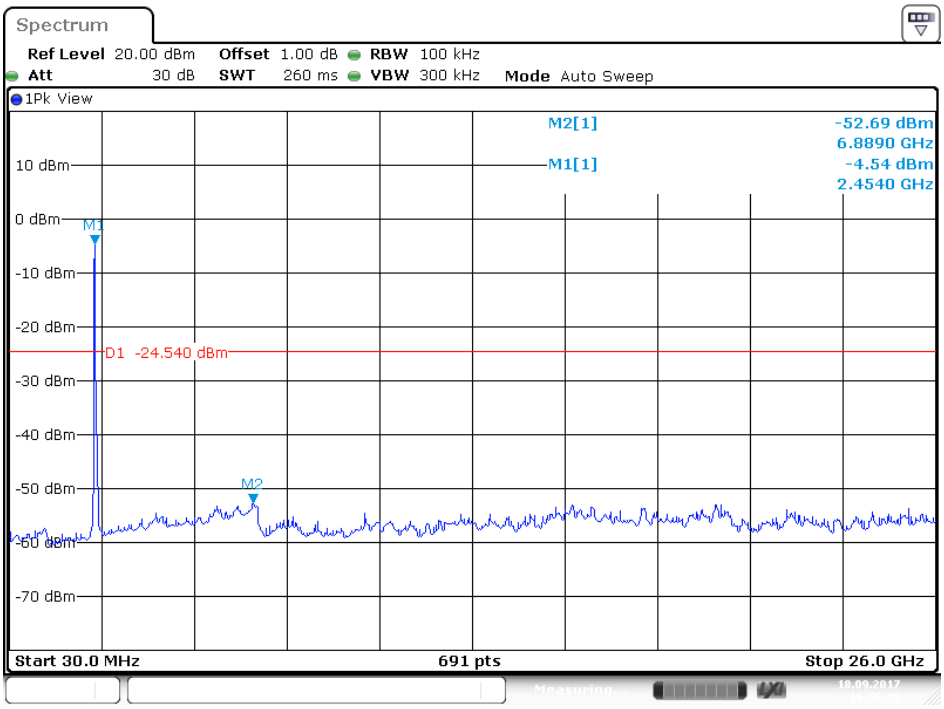
Date: 18.SEP.2017 16:50:45

N40 Mode Middle Channel (Chain 1)



Date: 18.SEP.2017 16:51:51

N40 Mode High Channel (Chain 1)



Date: 18.SEP.2017 16:56:26

8 FCC §15.247(a)(2) – 6 dB Emission Bandwidth

8.1 Applicable Standard

According to FCC §15.247(a) (2).

Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

8.2 Test Procedure

According to ANSI C63.10-2013

6 dB Emission Bandwidth
The steps for the first option are as follows:
a) Set RBW = 100 kHz.
b) Set the VBW ≥ [3 × RBW].
c) Detector = peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

8.3 Test Equipment List and Details

Descriptions	Manufacturers	Models	Serial Numbers	Calibration Date	Calibration Due Date
Spectrum Analyzer	Rohde & Schwarz	FSV40	101140	2016/11/10	2017/11/09
Cable	WOKEN	SFL402	S02-160323-07	2017/02/22	2018/02/21

**** Statement of Traceability:*** BACL Corp. attests that all calibrations have been performed according to TAF requirements, traceable to the ETC.

8.4 Test Environmental Conditions

Temperature:	26° C
Relative Humidity:	58 %
ATM Pressure:	1010 hPa

The testing was performed by Ian Tu on from 2017-08-18 to 2017-10-18.

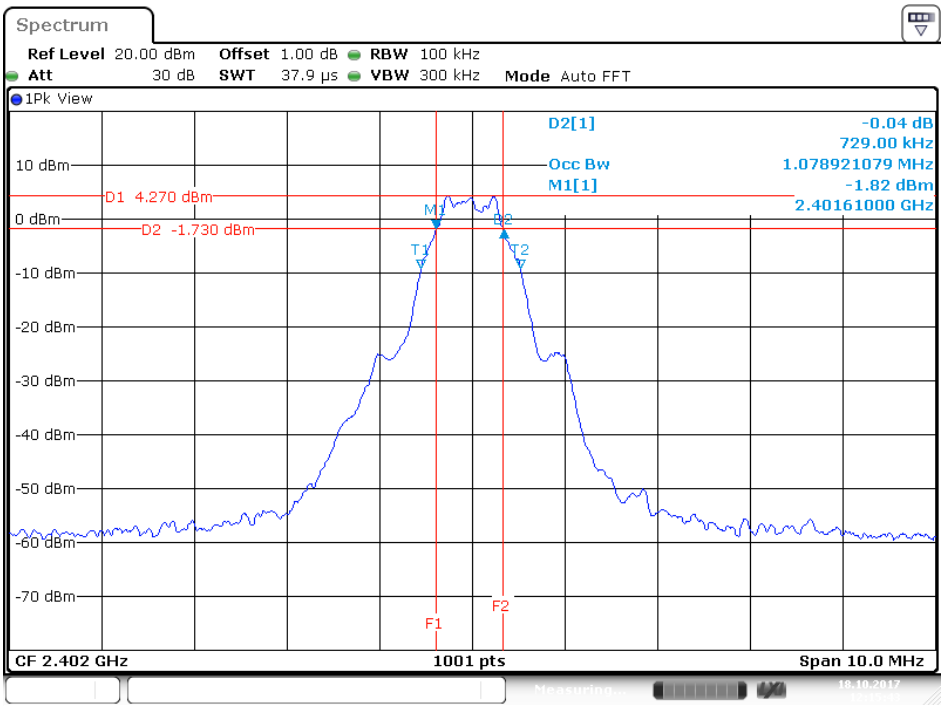
8.5 Test Results

Please refer to the following plots

Channel	Frequency (MHz)	6 dB OBW (MHz)		Limit (MHz)	RESULT
		Chain 0	Chain 1		
BLE Mode					
Low	2402	0.729	N/A	≥ 0.5	PASS
Mid	2440	0.709	N/A	≥ 0.5	PASS
High	2480	0.719	N/A	≥ 0.5	PASS
B Mode					
Low	2412	8.973	N/A	≥ 0.5	PASS
Mid	2437	8.104	N/A	≥ 0.5	PASS
High	2462	8.046	N/A	≥ 0.5	PASS
G Mode					
Low	2412	15.630	N/A	≥ 0.5	PASS
Mid	2437	15.803	N/A	≥ 0.5	PASS
High	2462	15.745	N/A	≥ 0.5	PASS
N20 Mode					
Low	2412	15.687	15.803	≥ 0.5	PASS
Mid	2437	15.745	15.687	≥ 0.5	PASS
High	2462	16.266	16.266	≥ 0.5	PASS
N40 Mode					
Low	2422	36.350	36.240	≥ 0.5	PASS
Mid	2437	36.350	36.240	≥ 0.5	PASS
High	2452	36.350	36.350	≥ 0.5	PASS

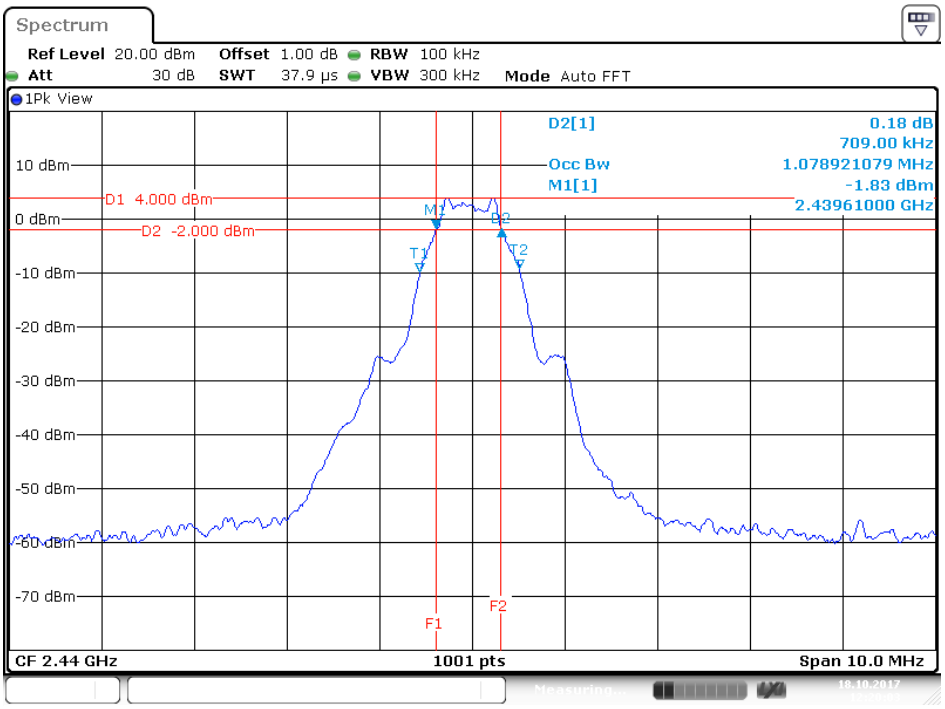
6 dB Emission Bandwidth

BLE Mode Low Channel



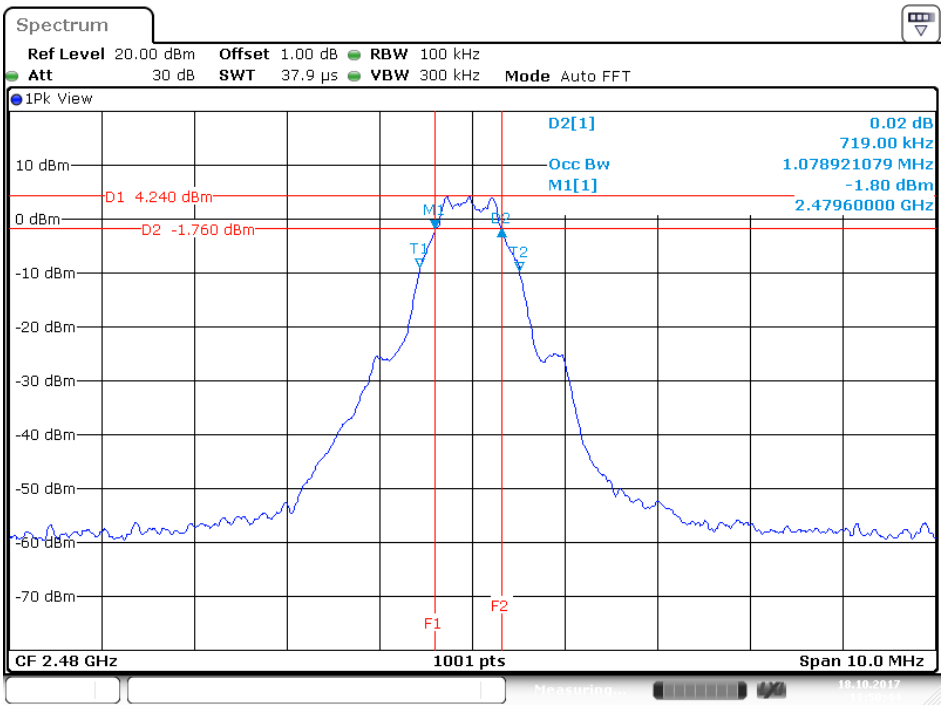
Date: 18.OCT.2017 12:15:43

BLE Mode Middle Channel



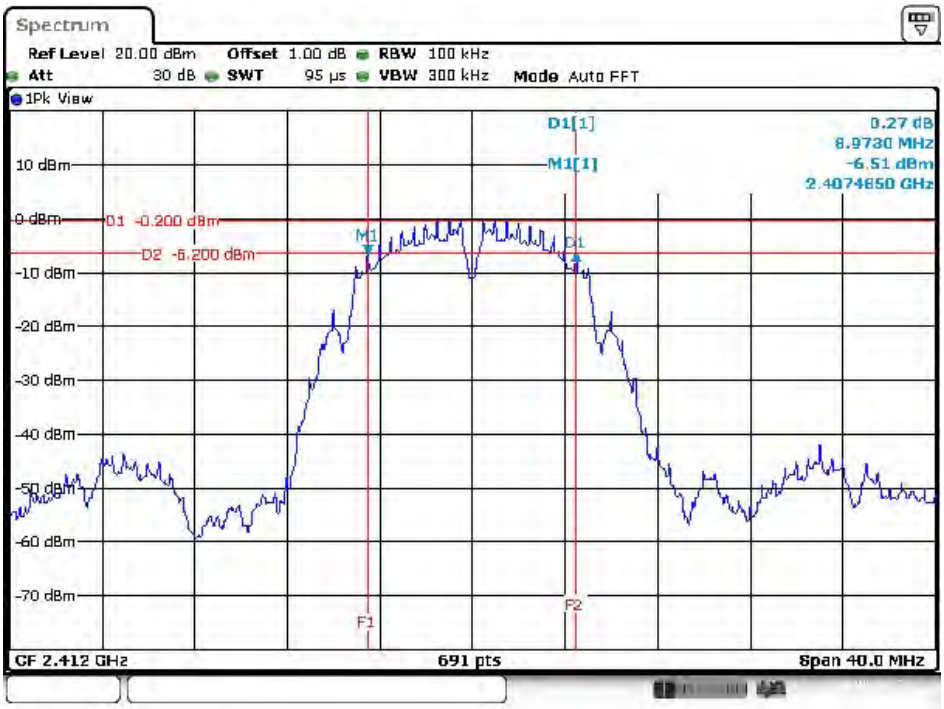
Date: 18.OCT.2017 12:20:04

BLE Mode High Channel



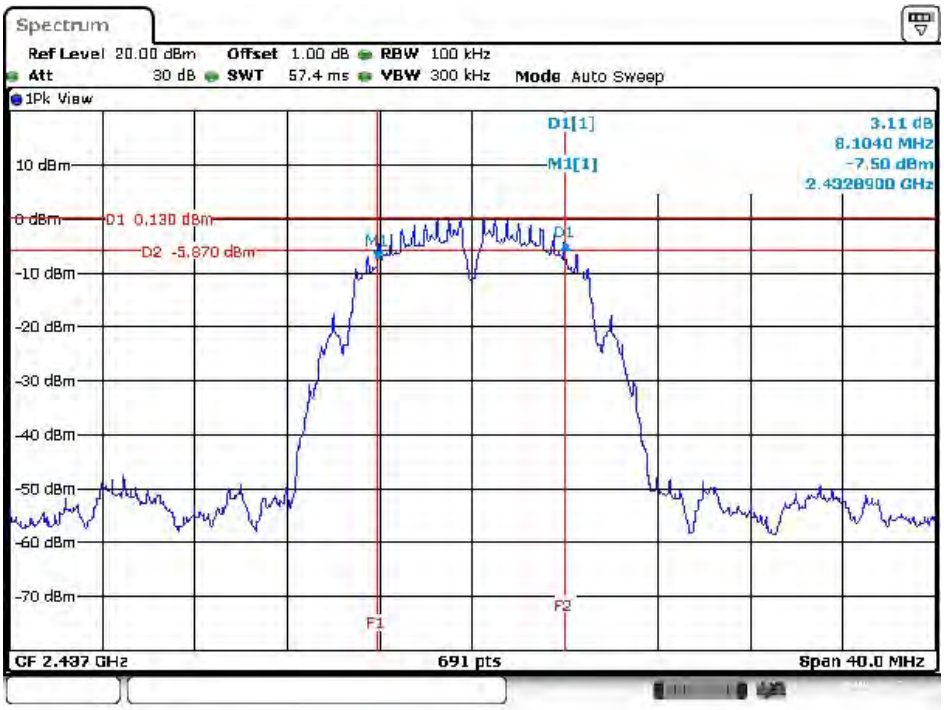
Date: 18.OCT.2017 11:50:44

B Mode Low Channel

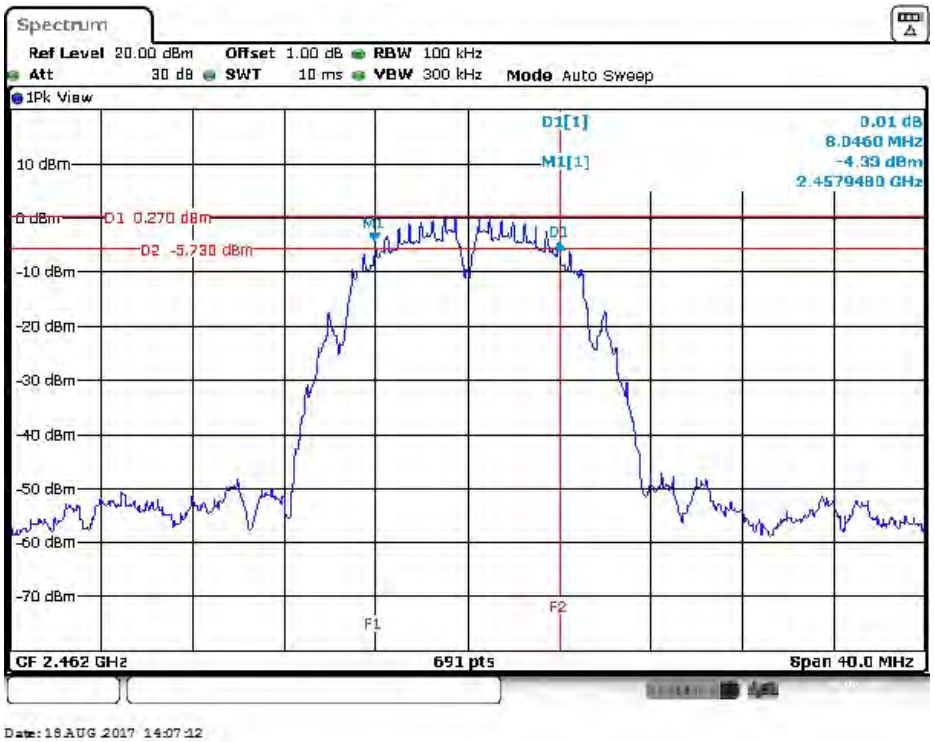


Date: 18.AUG.2017 13:15:15

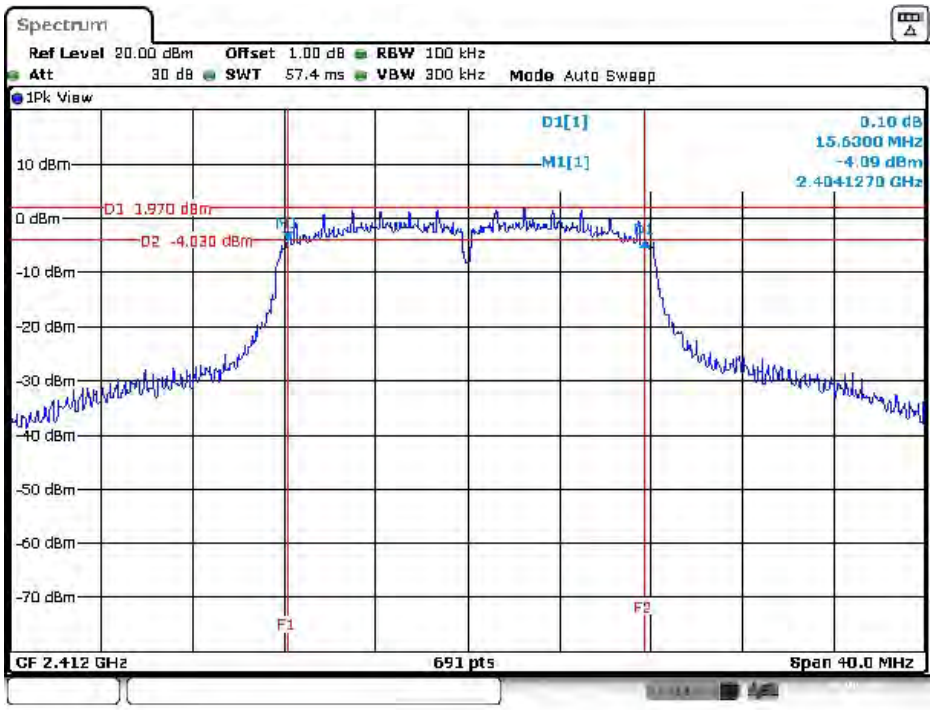
B Mode Middle Channel



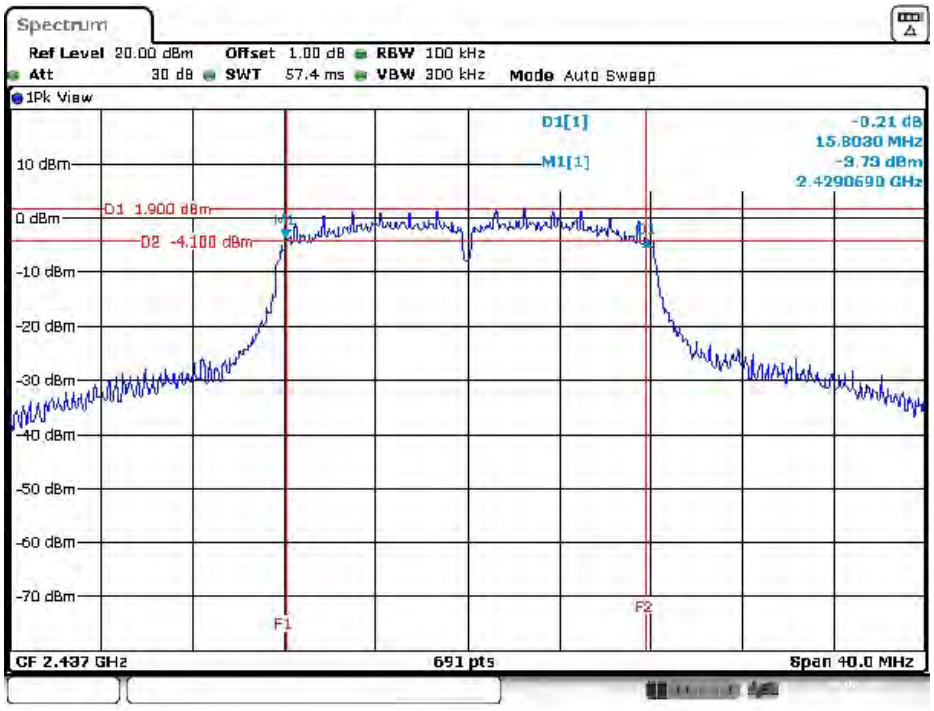
B Mode High Channel



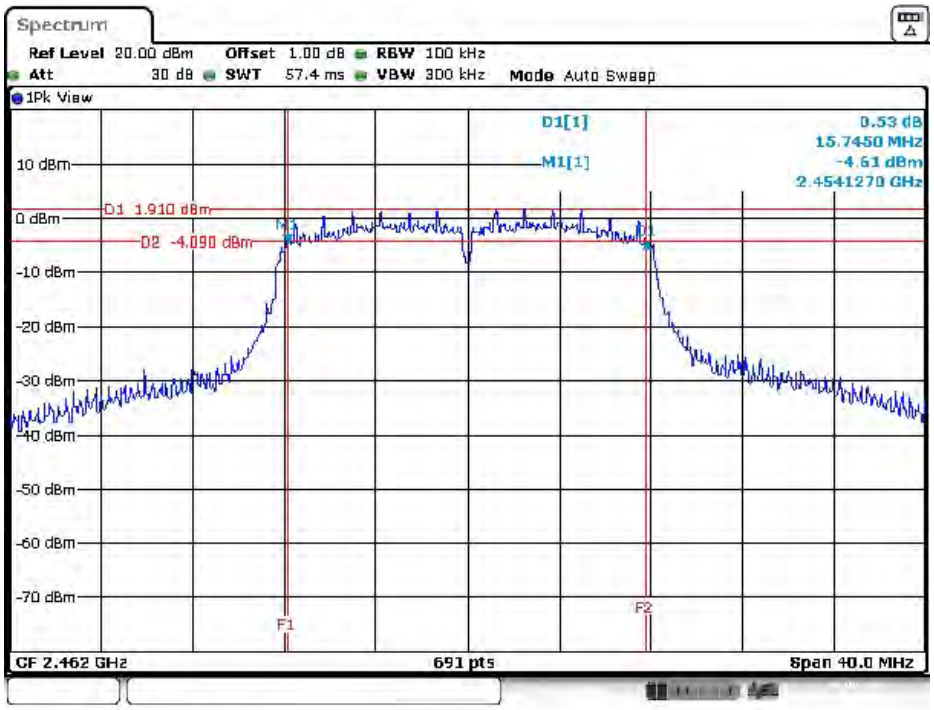
G Mode Low Channel



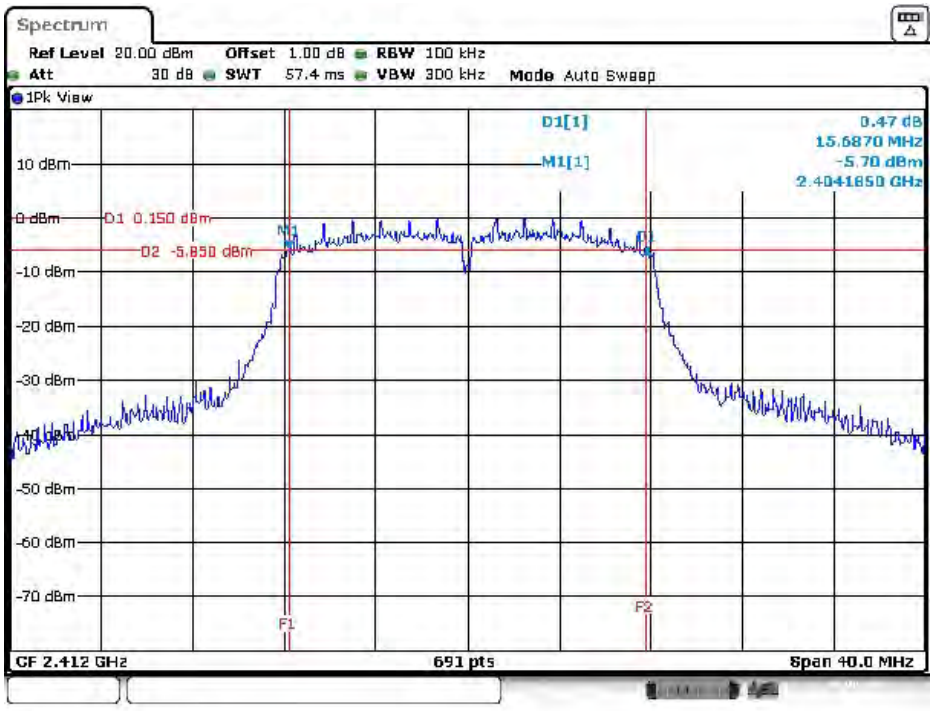
G Mode Middle Channel



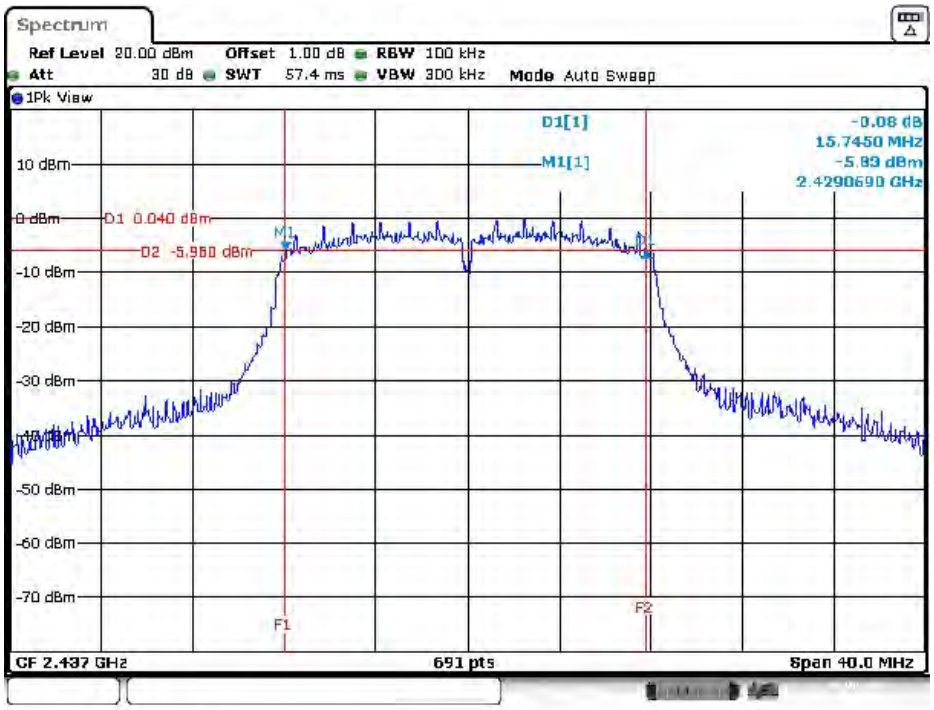
G Mode High Channel



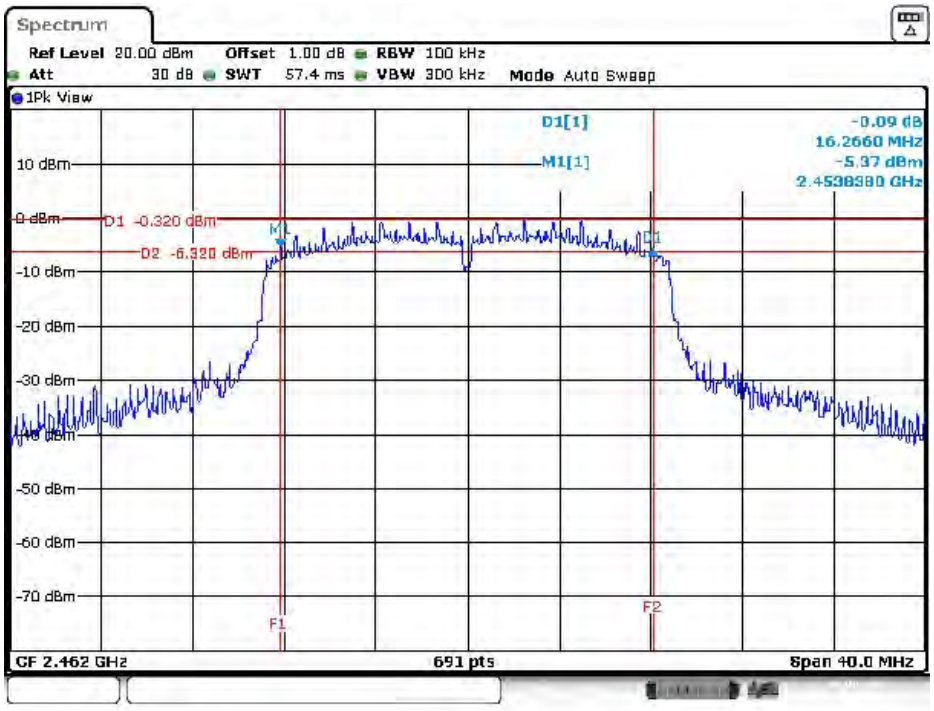
N20 Mode Low Channel (Chain 0)



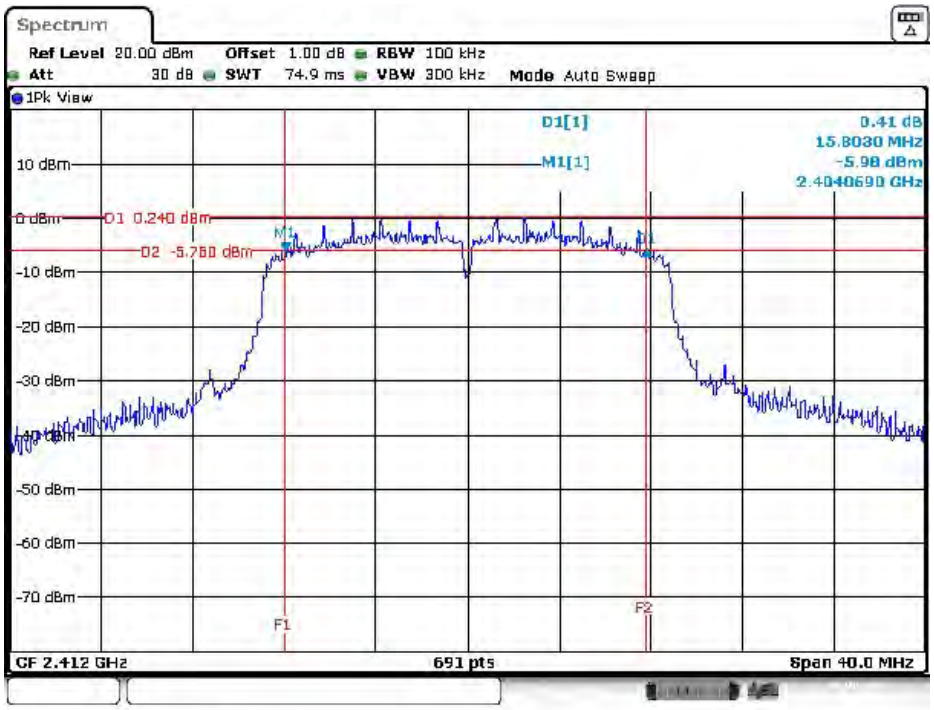
N20 Mode Middle Channel (Chain 0)



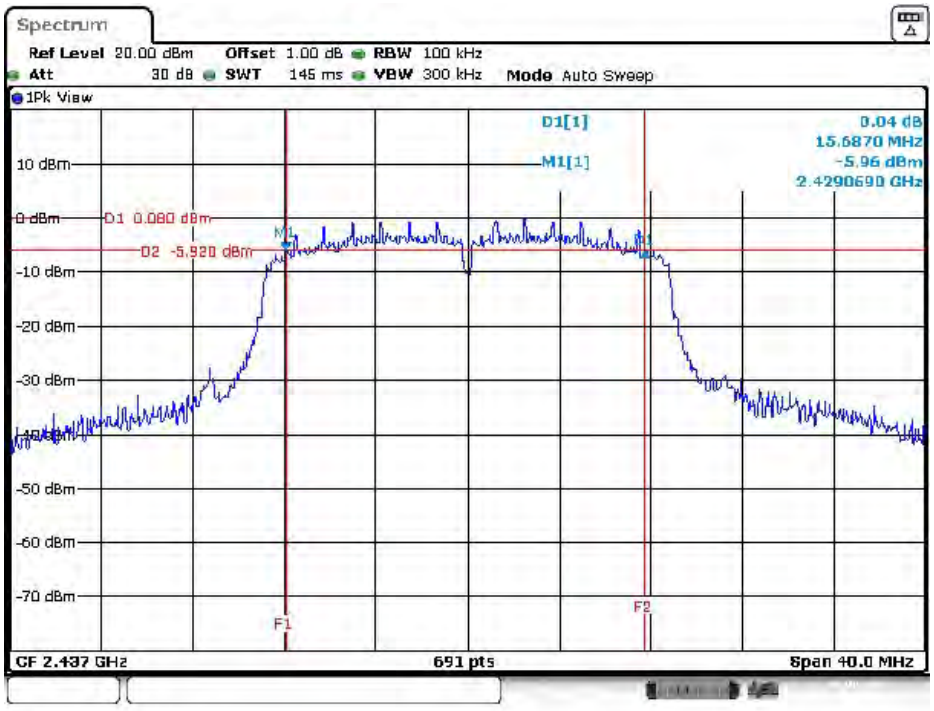
N20 Mode High Channel (Chain 0)



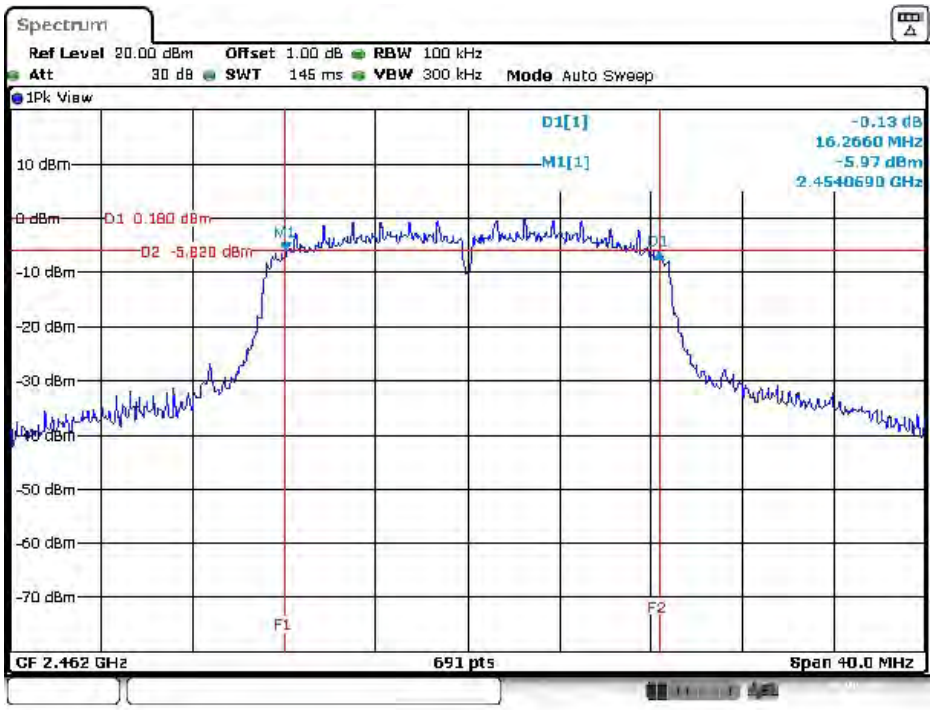
N20 Mode Low Channel (Chain 1)



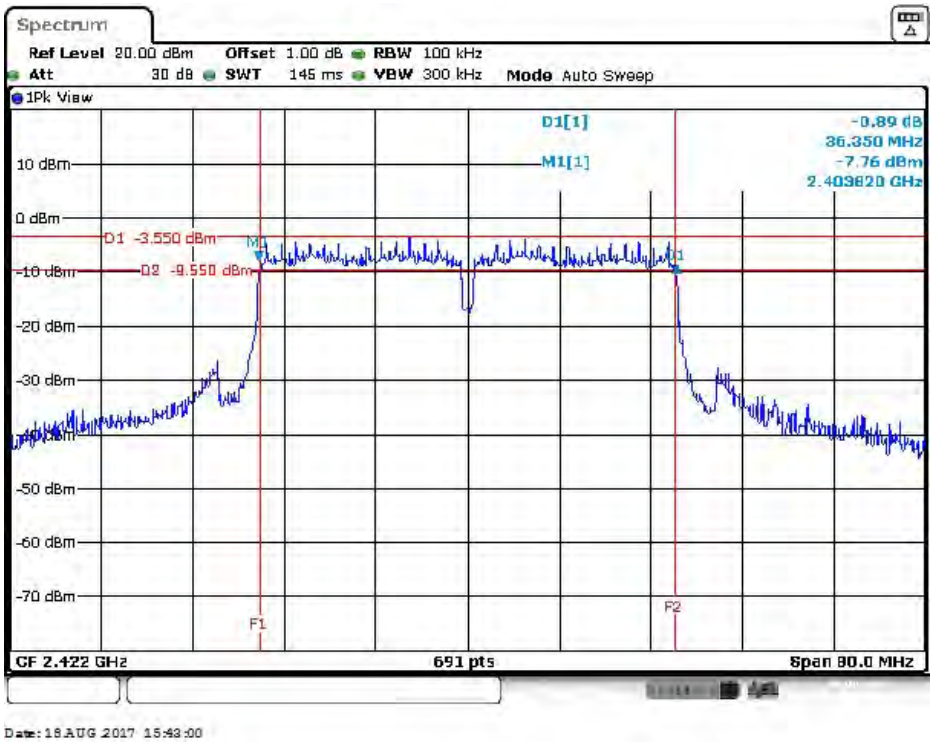
N20 Mode Middle Channel (Chain 1)



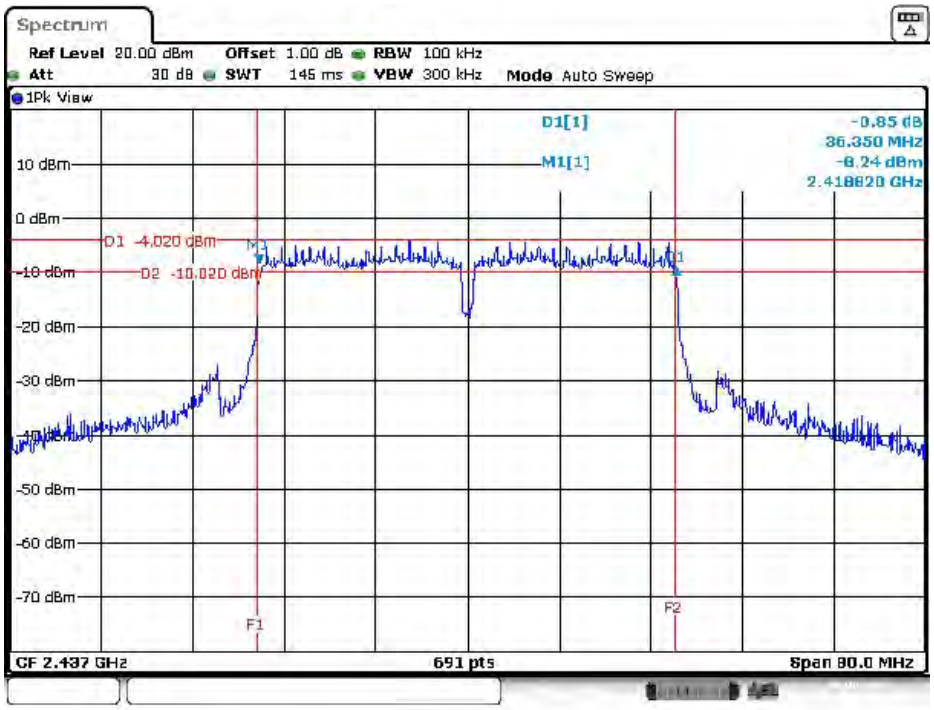
N20 Mode High Channel (Chain 1)



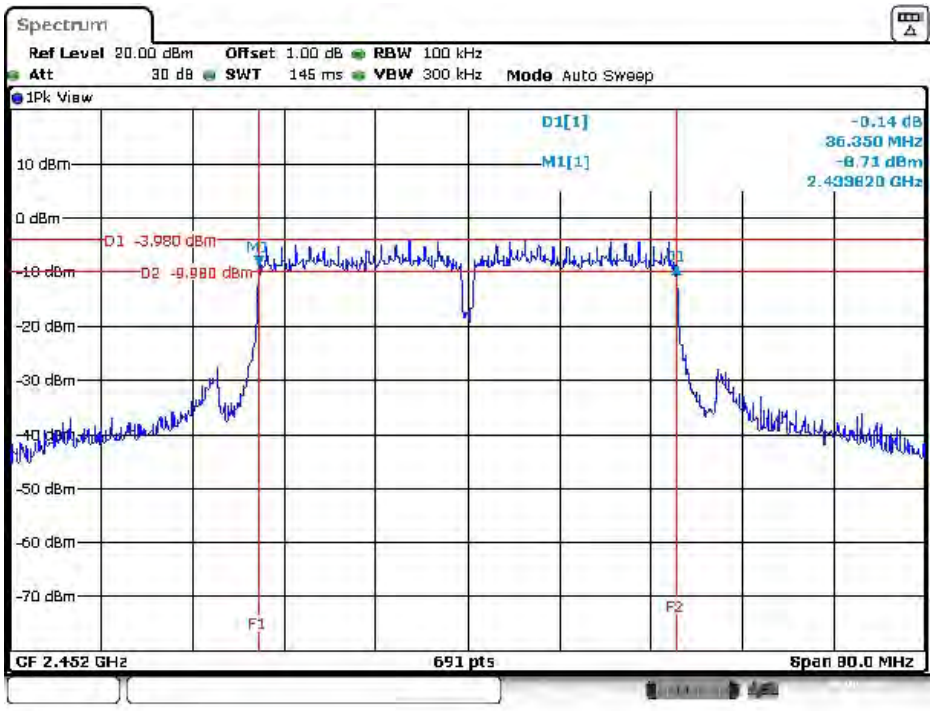
N40 Mode Low Channel (Chain 0)



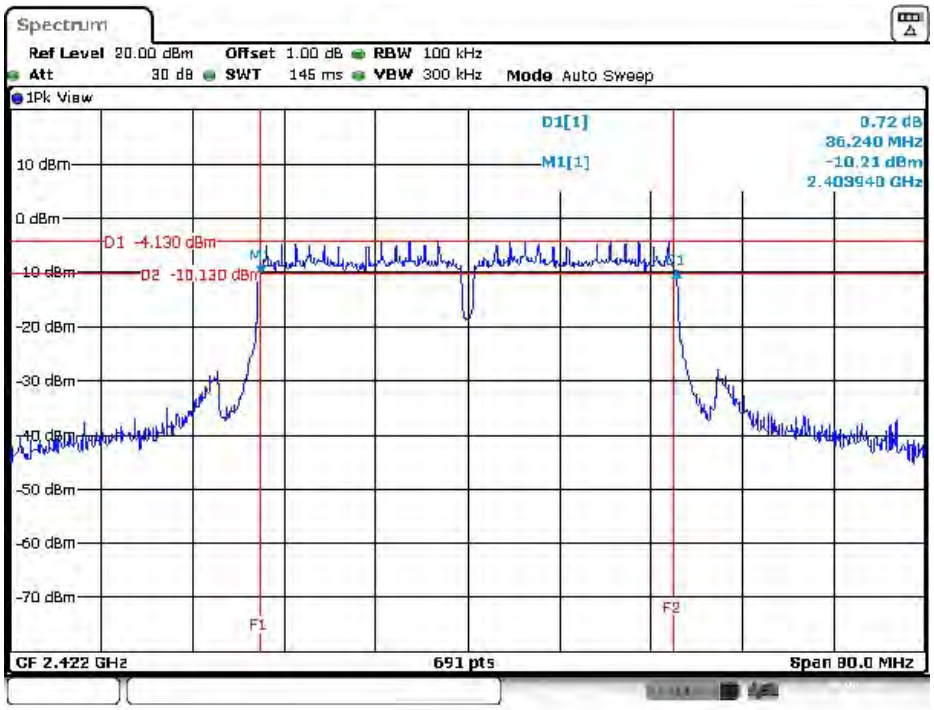
N40 Mode Middle Channel (Chain 0)



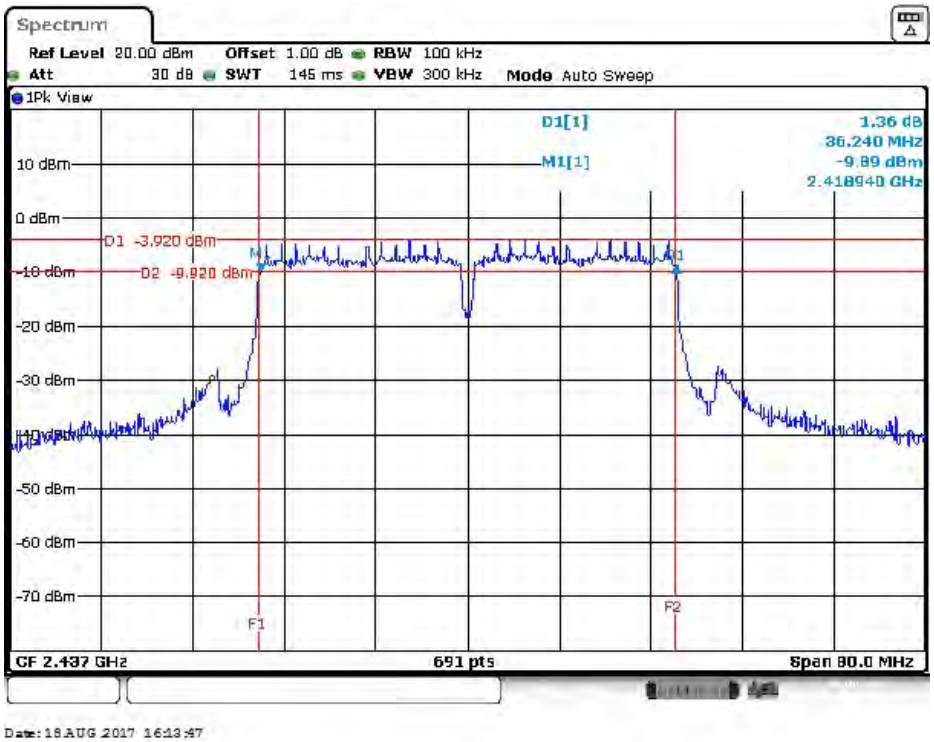
N40 Mode High Channel (Chain 0)



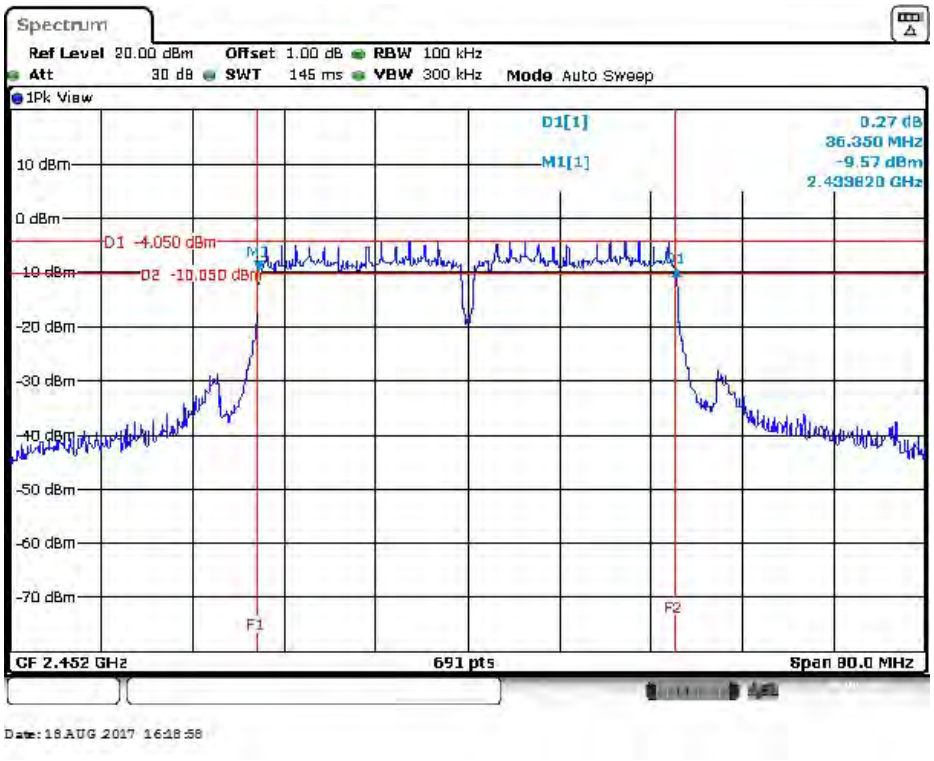
N40 Mode Low Channel (Chain 1)



N40 Mode Middle Channel (Chain 1)



N40 Mode High Channel (Chain 1)



9 FCC §15.247(b)(3) – Maximum Output Power

9.1 Applicable Standard

According to FCC §15.247(b) (3).

Systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

9.2 Test Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to an Power sensor.

9.3 Test Equipment List and Details

Descriptions	Manufacturers	Models	Serial Numbers	Calibration Date	Calibration Due Date
Power Sensor	KEYSIGHT	U2021XA	MY54080018	2017/3/21	2018/3/20
Cable	WOKEN	SFL402	S02-160323-07	2017/02/22	2018/02/21

**** Statement of Traceability:*** BACL Corp. attests that all calibrations have been performed according to TAF requirements, traceable to the ETC.

9.4 Test Environmental Conditions

Temperature:	26° C
Relative Humidity:	58 %
ATM Pressure:	1010 hPa

The testing was performed by Ian Tu on 2017-08-18.

9.5 Test Results

Channel	Frequency (MHz)	Conducted Peak Output Power (dBm)			Limit (dBm)	RESULT
		Chain 0	Chain 1	Total		
BLE Mode						
Low	2402	2.58	N/A	N/A	30	PASS
Mid	2440	3.49	N/A	N/A	30	PASS
High	2480	2.46	N/A	N/A	30	PASS
B Mode						
Low	2412	12.48	N/A	N/A	30	PASS
Mid	2437	12.51	N/A	N/A	30	PASS
High	2462	12.38	N/A	N/A	30	PASS
G Mode						
Low	2412	23.03	N/A	N/A	30	PASS
Mid	2437	22.89	N/A	N/A	30	PASS
High	2462	22.88	N/A	N/A	30	PASS
N20 Mode						
Low	2412	22.11	22.96	25.57	30	PASS
Mid	2437	22.42	22.82	25.63	30	PASS
High	2462	22.31	22.82	25.58	30	PASS
N40 Mode						
Low	2422	22.86	23.26	26.07	30	PASS
Mid	2437	22.64	22.71	25.69	30	PASS
High	2452	22.77	22.85	25.82	30	PASS

Channel	Frequency (MHz)	Conducted Average Output Power (dBm)			Duty Factor	Total Maximum Conducted Average Output Power With Duty Factor(dBm)	Limit (dBm)
		Chain 0	Chain 1	Total			
BLE Mode							
Low	2402	-0.50	N/A	N/A	1.55	1.05	30
Mid	2440	0.34	N/A	N/A	1.55	1.89	30
High	2480	-0.81	N/A	N/A	1.55	0.74	30
B Mode							
Low	2412	7.41	N/A	N/A	0	7.41	30
Mid	2437	8.12	N/A	N/A	0	8.12	30
High	2462	6.29	N/A	N/A	0	6.29	30
G Mode							
Low	2412	14.61	N/A	N/A	0.13	14.74	30
Mid	2437	14.5	N/A	N/A	0.13	14.63	30
High	2462	14.45	N/A	N/A	0.13	14.58	30
N20 Mode							
Low	2412	12.22	12.54	15.39	0.32	15.71	30
Mid	2437	12.33	14.2	16.38	0.32	16.70	30
High	2462	12.15	12.09	15.13	0.32	15.45	30
N40 Mode							
Low	2422	11.07	10.92	14.01	0.46	14.47	30
Mid	2437	10.91	10.95	13.94	0.46	14.40	30
High	2452	10.87	10.83	13.86	0.46	14.32	30

10 FCC §15.247(d) – 100 kHz Bandwidth of Frequency Band Edge

10.1 Applicable Standard

According to FCC §15.247(d).

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

10.2 Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

10.3 Test Equipment List and Details

Descriptions	Manufacturers	Models	Serial Numbers	Calibration Date	Calibration Due Date
Spectrum Analyzer	Rohde & Schwarz	FSV40	101140	2016/11/10	2017/11/09
Cable	WOKEN	SFL402	S02-160323-07	2017/02/22	2018/02/21

**** Statement of Traceability:*** BACL Corp. attests that all calibrations have been performed according to TAF requirements, traceable to the ETC.

10.4 Test Environmental Conditions

Temperature:	25° C
Relative Humidity:	56 %
ATM Pressure:	1010 hPa

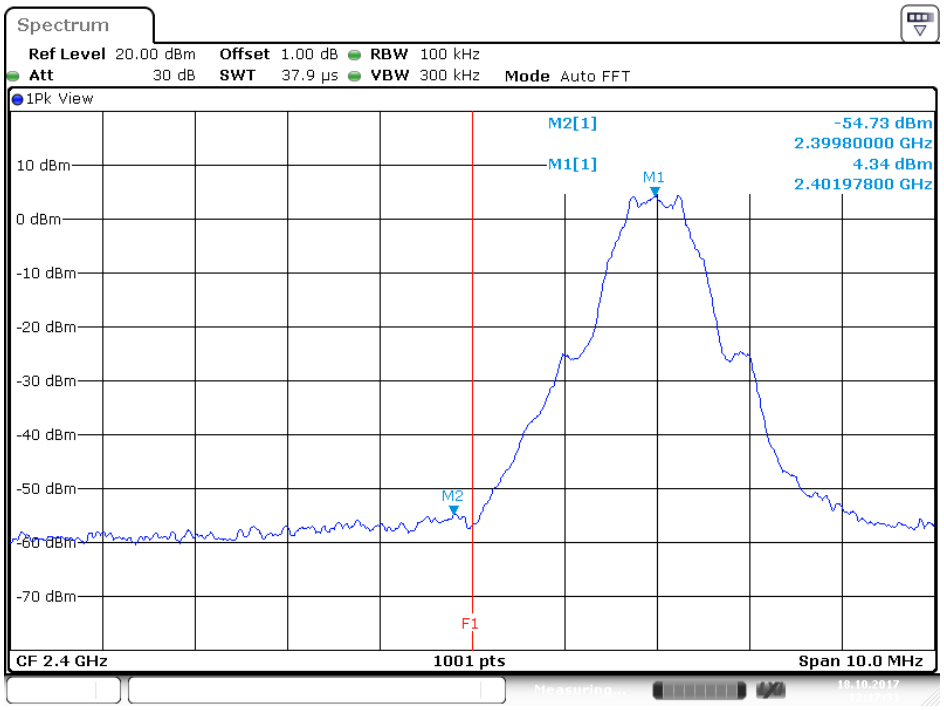
The testing was performed by Ian Tu from 2017-08-18 to 2017-10-18.

10.5 Test Results

Please refer to the following plots

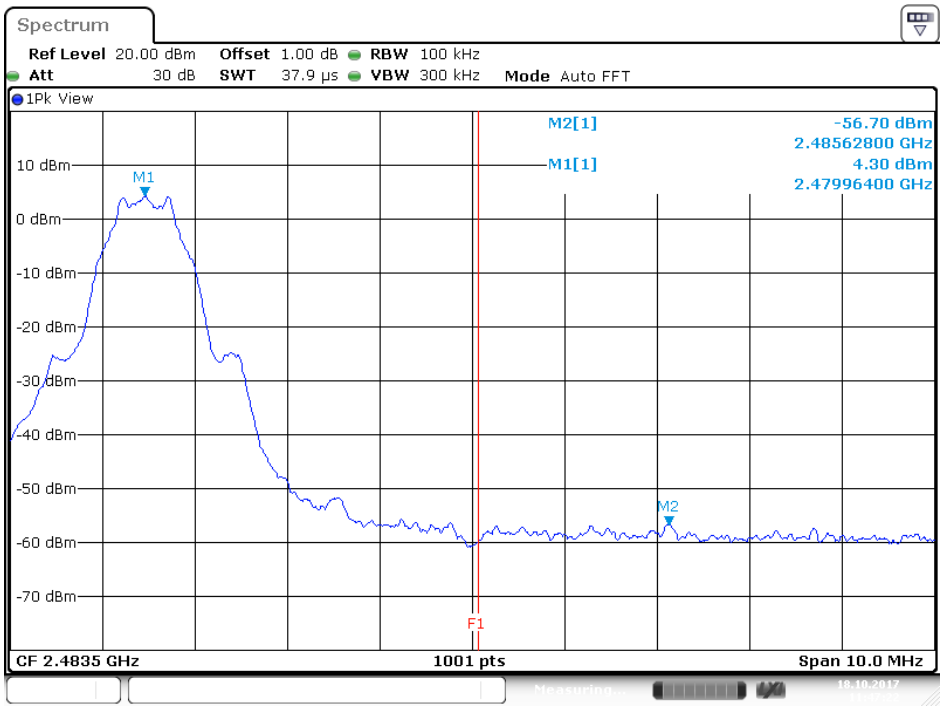
Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)		Limit (dBc)	RESULT
		Chain 0	Chain 1		
BLE Mode					
Low	2402	59.07	N/A	≥ 20	PASS
High	2480	61.00	N/A	≥ 20	PASS
B Mode					
Low	2412	42.88	N/A	≥ 20	PASS
High	2462	54.04	N/A	≥ 20	PASS
G Mode					
Low	2412	30.08	N/A	≥ 20	PASS
High	2462	38.85	N/A	≥ 20	PASS
N20 Mode					
Low	2412	33.57	31.09	≥ 20	PASS
High	2462	36.64	39.85	≥ 20	PASS
N40 Mode					
Low	2422	24.65	25.02	≥ 20	PASS
High	2452	33.55	33.23	≥ 20	PASS

Band Edge, Left Side (BLE mode / CH Low)



Date: 18.OCT.2017 12:17:34

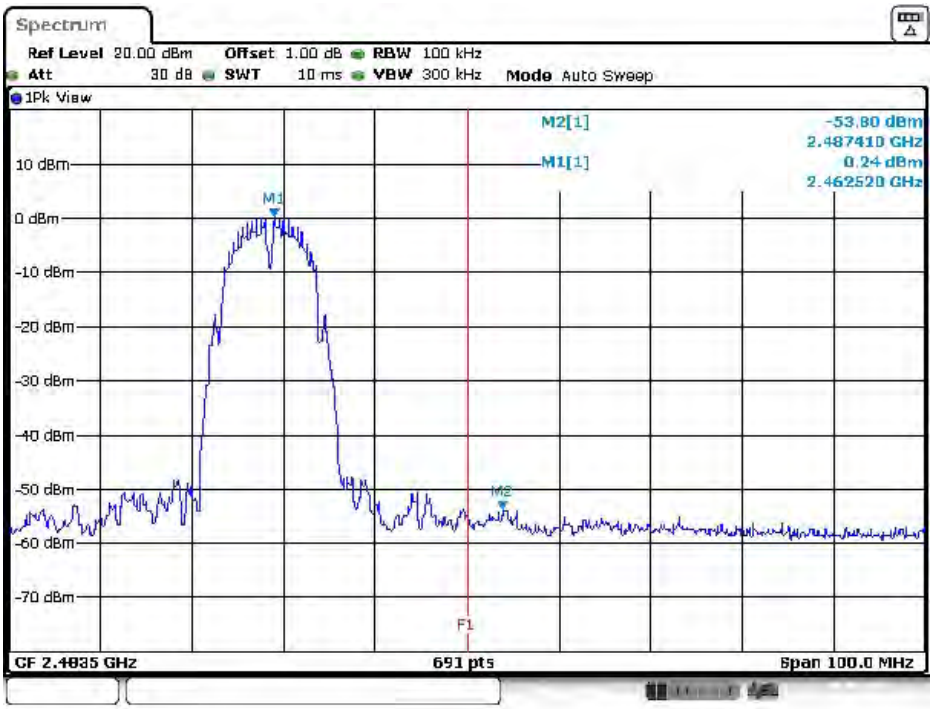
Band Edge, Right Side (BLE mode / CH High)



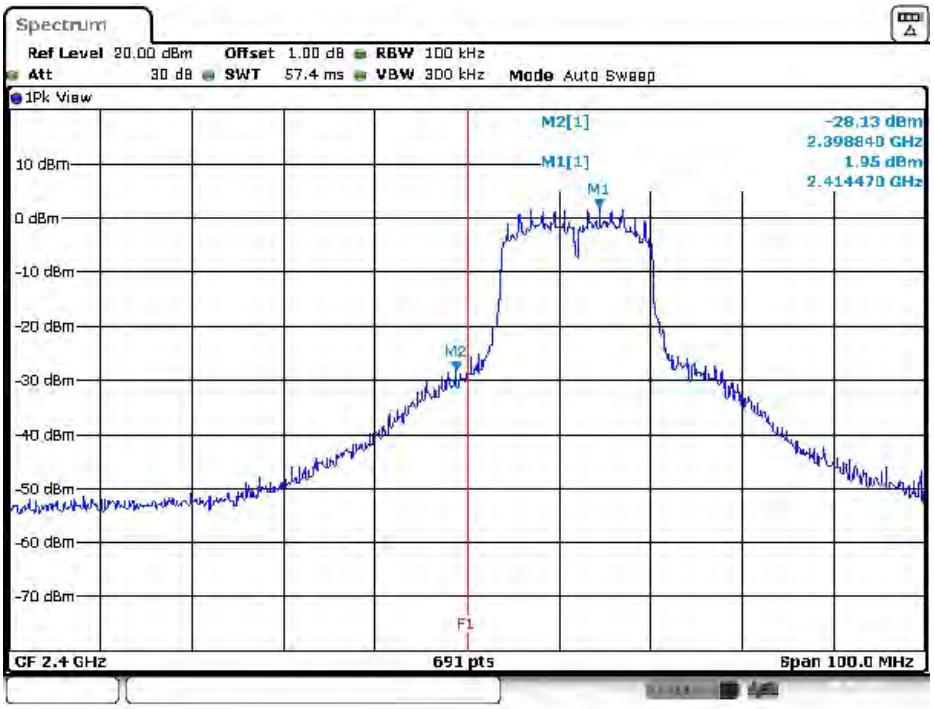
Date: 18.OCT.2017 11:47:23

Band Edge, Left Side (B mode / CH Low)

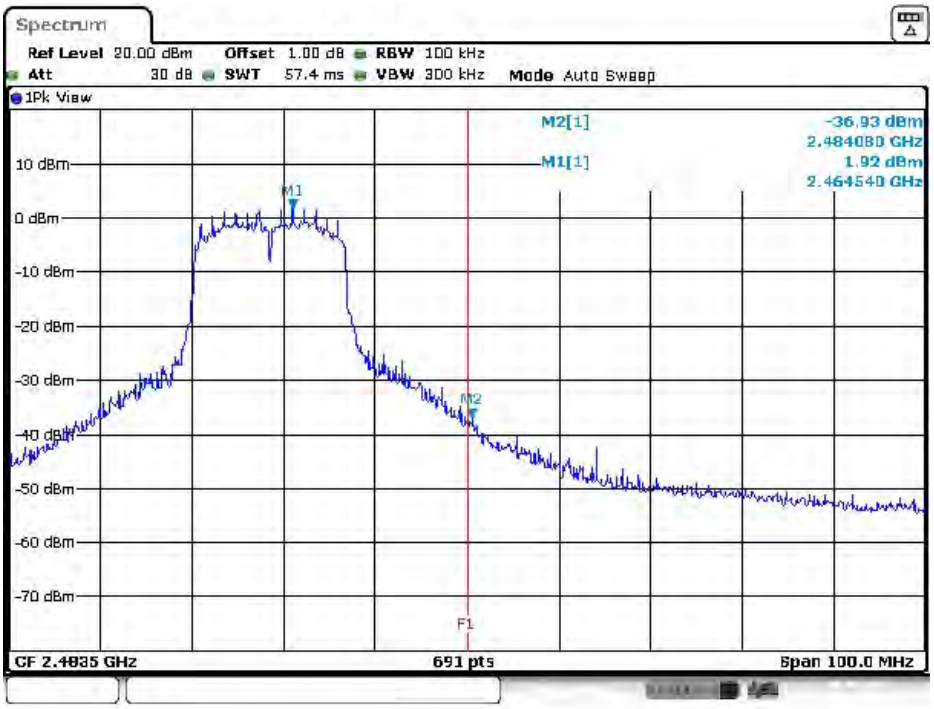
Band Edge, Right Side (B mode / CH High)



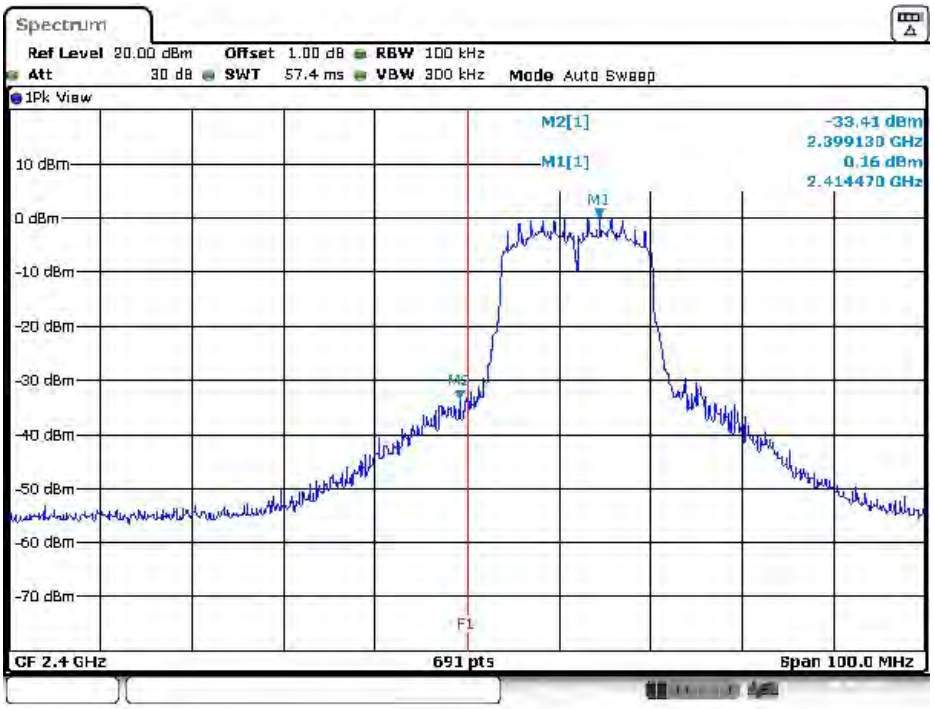
Band Edge, Left Side (G mode / CH Low)



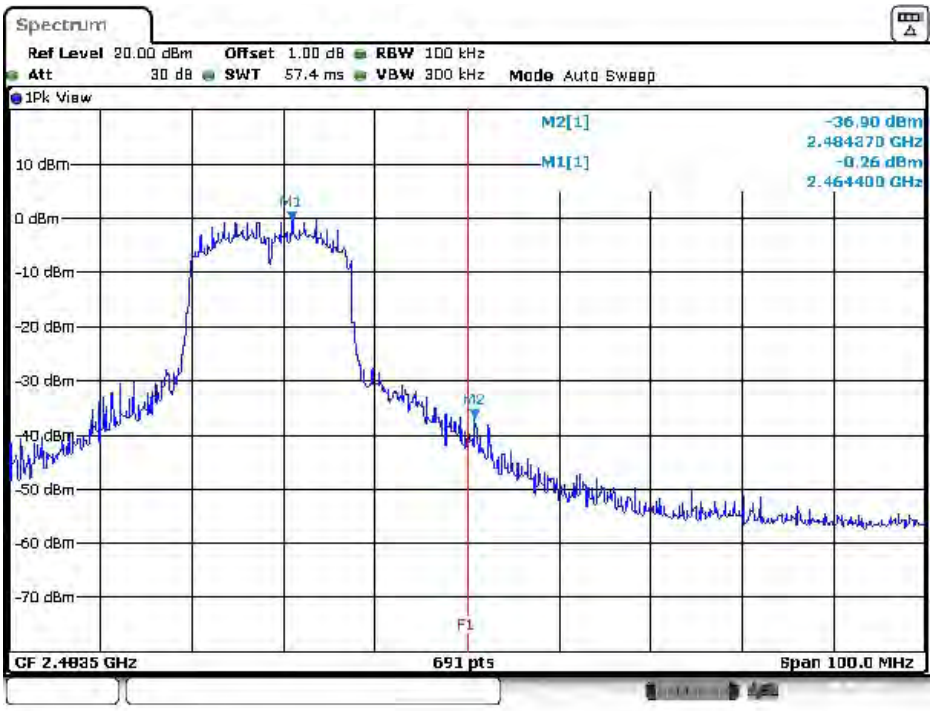
Band Edge, Right Side (G mode / CH High)



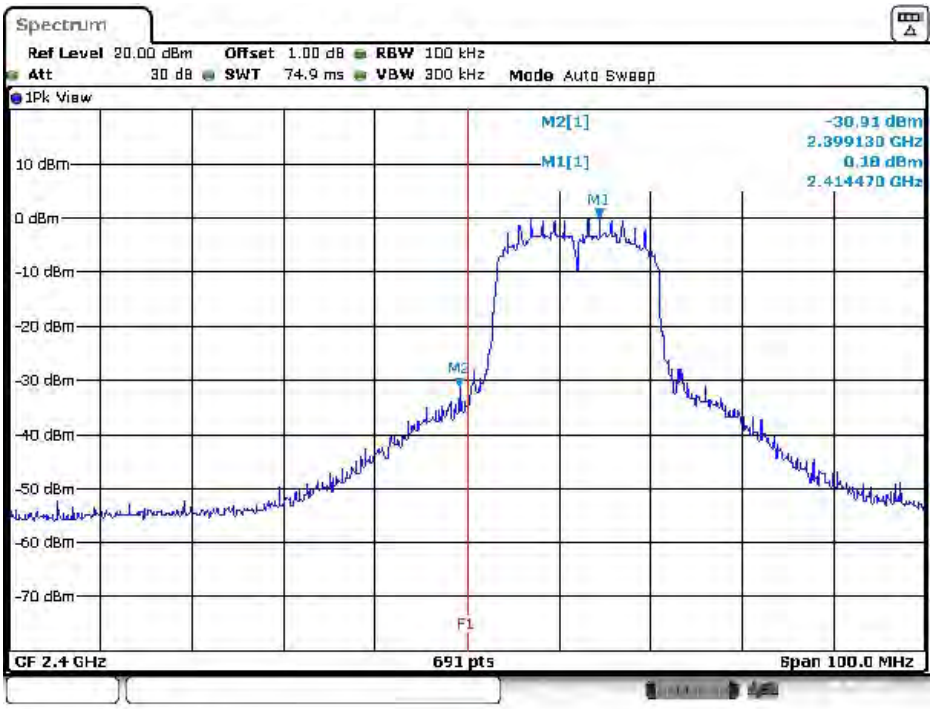
Band Edge, Left Side (N20 mode / CH Low / Chain 0)



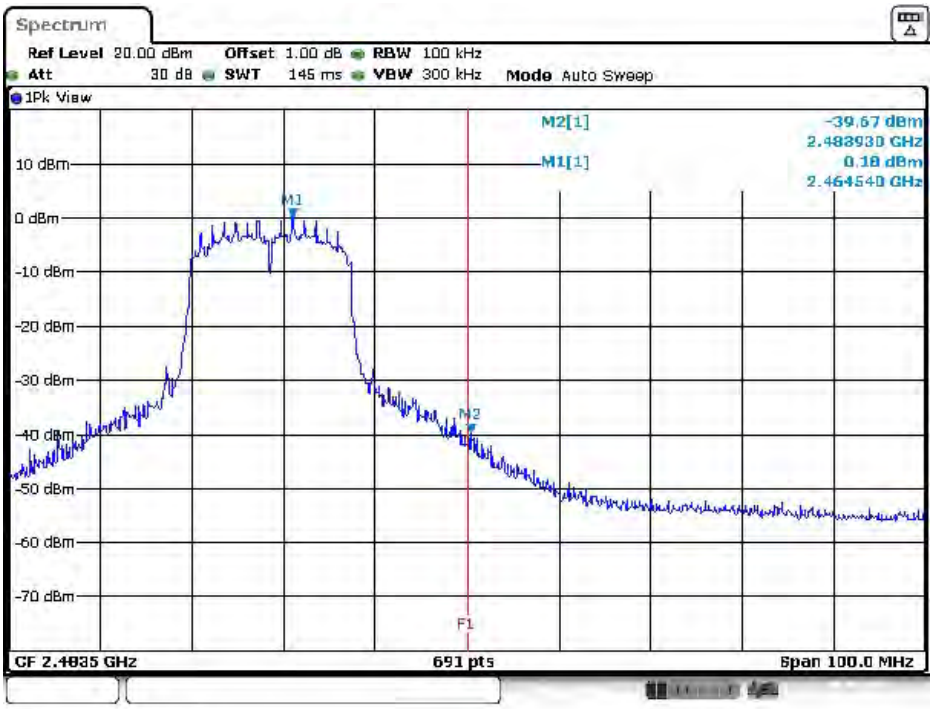
Band Edge, Right Side (N20 mode / CH High / Chain 0)



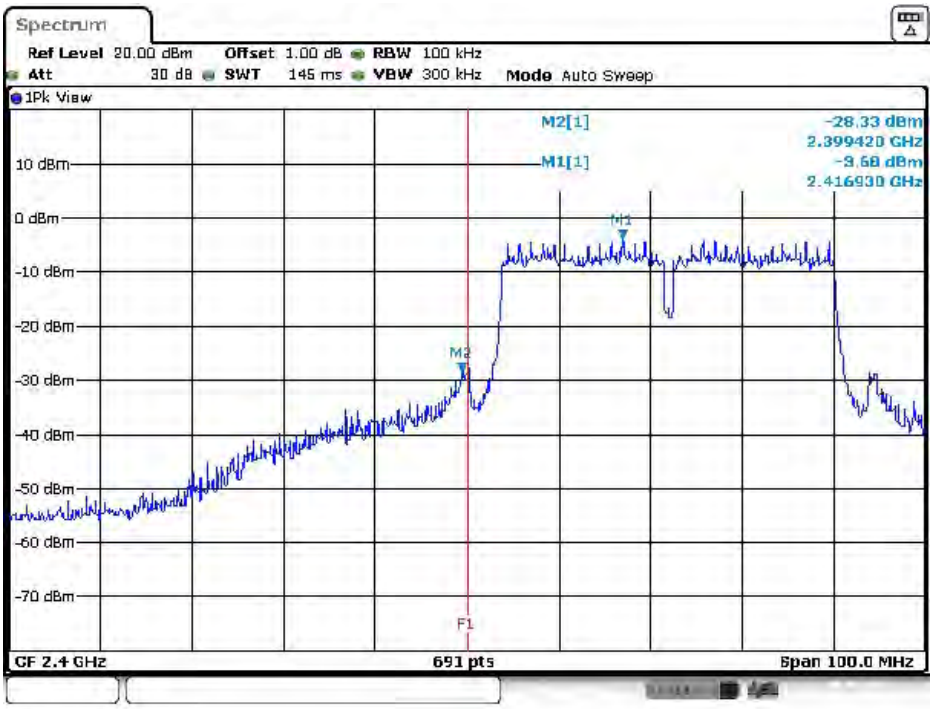
Band Edge, Left Side (N20 mode / CH Low / Chain 1)



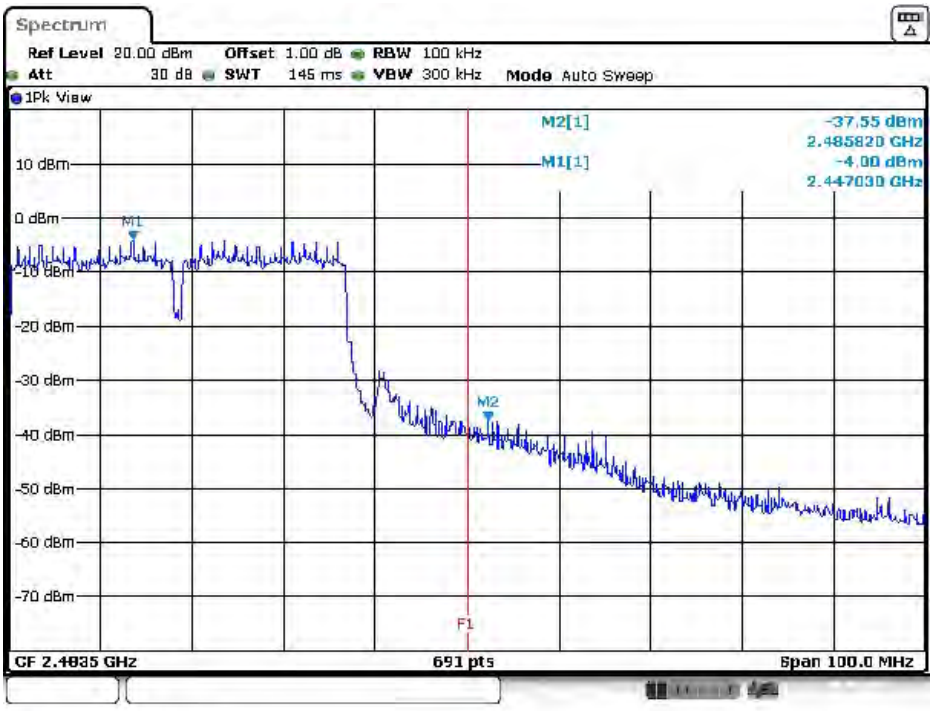
Band Edge, Right Side (N20 mode / CH High / Chain 1)



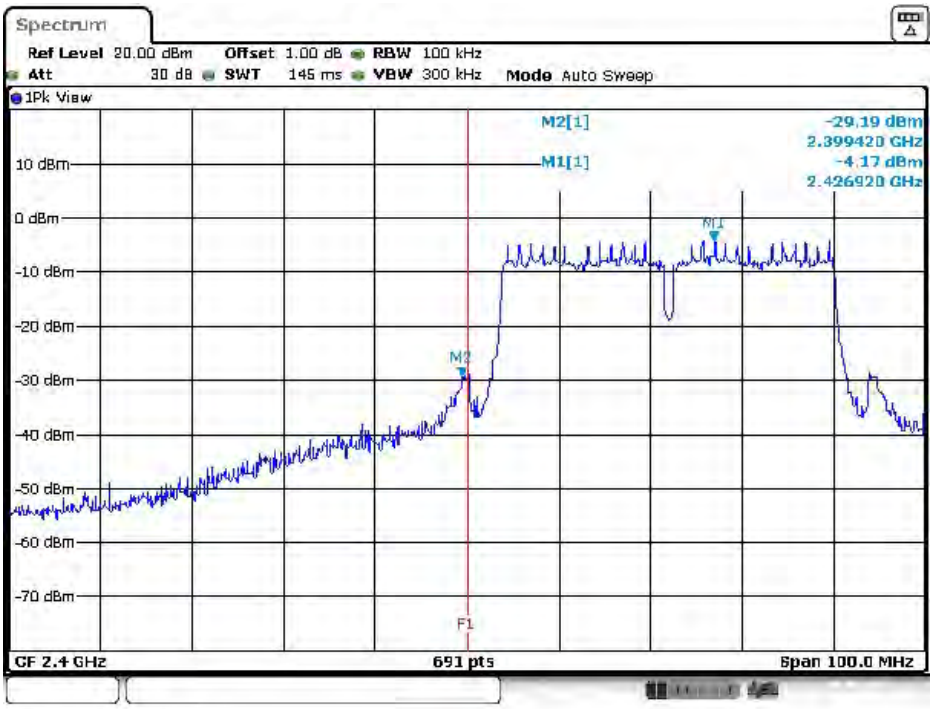
Band Edge, Left Side (N40 mode / CH Low / Chain 0)



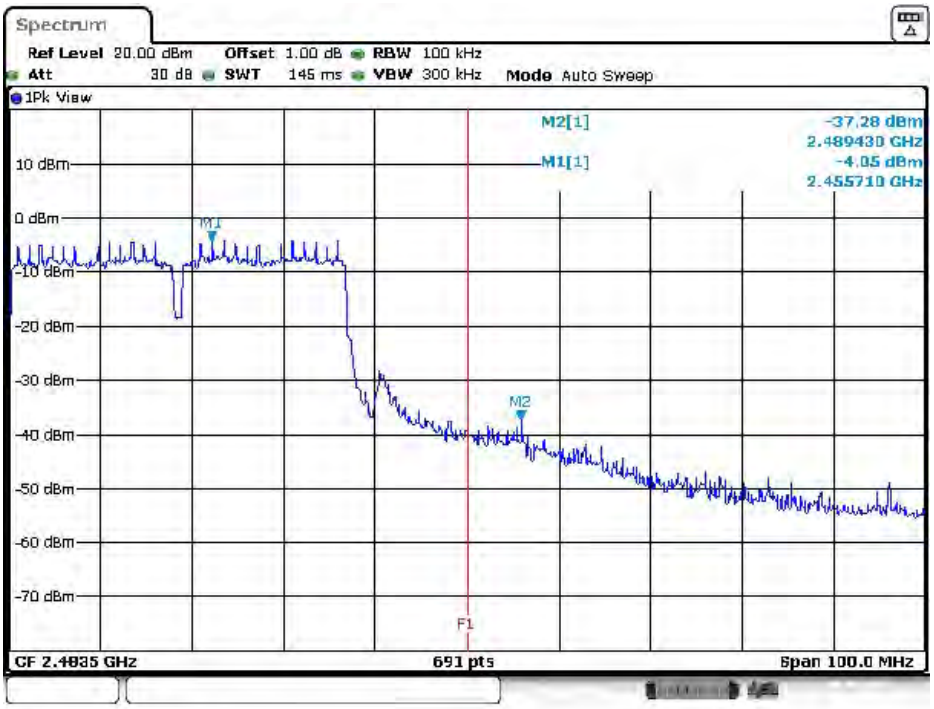
Band Edge, Right Side (N40 mode / CH High / Chain 0)



Band Edge, Left Side (N40 mode / CH Low / Chain 1)



Band Edge, Right Side (N40 mode / CH High / Chain 1)



11 FCC §15.247(e) – Power Spectral Density

11.1 Applicable Standard

According to FCC §15.247(e).

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

11.2 Test Procedure

According to ANSI C63.10-2013

a) Set analyzer center frequency to DTS channel center frequency.

b) Set the span to 1.5 times the DTS bandwidth.

c) Set the RBW to 3 kHz ≤ RBW ≤ 100 kHz.

d) Set the VBW ≥ [3 × RBW].

e) Detector = peak.

f) Sweep time = auto couple.

g) Trace mode = max hold.

h) Allow trace to fully stabilize.

i) Use the peak marker function to determine the maximum amplitude level within the RBW.

j) If measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat

11.3 Test Equipment List and Details

Descriptions	Manufacturers	Models	Serial Numbers	Calibration Date	Calibration Due Date
Spectrum Analyzer	Rohde & Schwarz	FSV40	101140	2016/11/10	2017/11/09
Cable	WOKEN	SFL402	S02-160323-07	2017/02/22	2018/02/21

**** Statement of Traceability:*** BACL Corp. attests that all calibrations have been performed according to TAF requirements, traceable to the ETC.

11.4 Test Environmental Conditions

Temperature:	24° C
Relative Humidity:	58 %
ATM Pressure:	1010 hPa

The testing was performed by Ian Tu from 2017-08-18 to 2017-10-18.

11.5 Test Results

Test Mode: Transmitting

Test Result: Compliant. Please refer to the following table and plots

Channel	Frequency (MHz)	Power Spectral Density (dBm/3kHz)			Limit (dBm/3kHz)	RESULT
		Chain 0	Chain 1	Total		
BLE Mode						
Low	2402	-9.12	N/A	N/A	8	PASS
Mid	2440	-9.47	N/A	N/A	8	PASS
High	2480	-9.27	N/A	N/A	8	PASS
B Mode						
Low	2412	-11.80	N/A	N/A	8	PASS
Mid	2437	-11.73	N/A	N/A	8	PASS
High	2462	-11.63	N/A	N/A	8	PASS
G Mode						
Low	2412	-11.04	N/A	N/A	8	PASS
Mid	2437	-11.18	N/A	N/A	8	PASS
High	2462	-11.05	N/A	N/A	8	PASS
N20 Mode						
Low	2412	-12.72	-12.29	-9.49	8	PASS
Mid	2437	-12.90	-12.51	-9.69	8	PASS
High	2462	-12.86	-12.41	-9.62	8	PASS
N40 Mode						
Low	2422	-16.61	-17.27	-13.92	8	PASS
Mid	2437	-17.24	-17.04	-14.13	8	PASS
High	2452	-16.98	-17.11	-14.03	8	PASS

The device is a client device, employed Cyclic Delay

Diversity (CDD) for 802.11 MIMO transmitting, per KDB 662911 D01 Multiple Transmitter Output v02r01, for power spectral density

(PSD) measurements on the devices:

Array Gain = 10 log(N_{ANT} / N_{SS}) dB.

For B and G mode : Gain = 3.04 dBi, For N20 and N40 mode : Please refer below calculate.

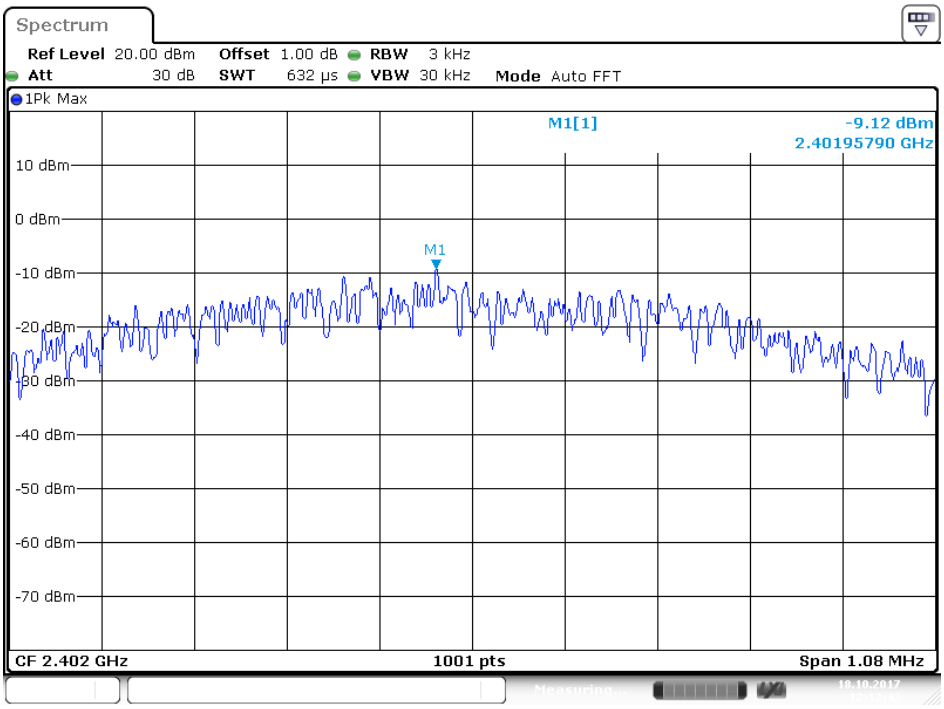
Power Directional Gain : 10log(((10^(Ant1/10)+10^(Ant2/10))/2))=10log(((10^(2.26/10)+10^(3.04/10))/2))=2.67 dBi

Power Density Directional Gain :

10log(((10^(Ant1/10)+10^(Ant2/10))/2))+10log(NTX/Nss)=10log(((10^(2.26/10)+10^(3.04/10))/2))+10log(2/1)=5.68 dBi

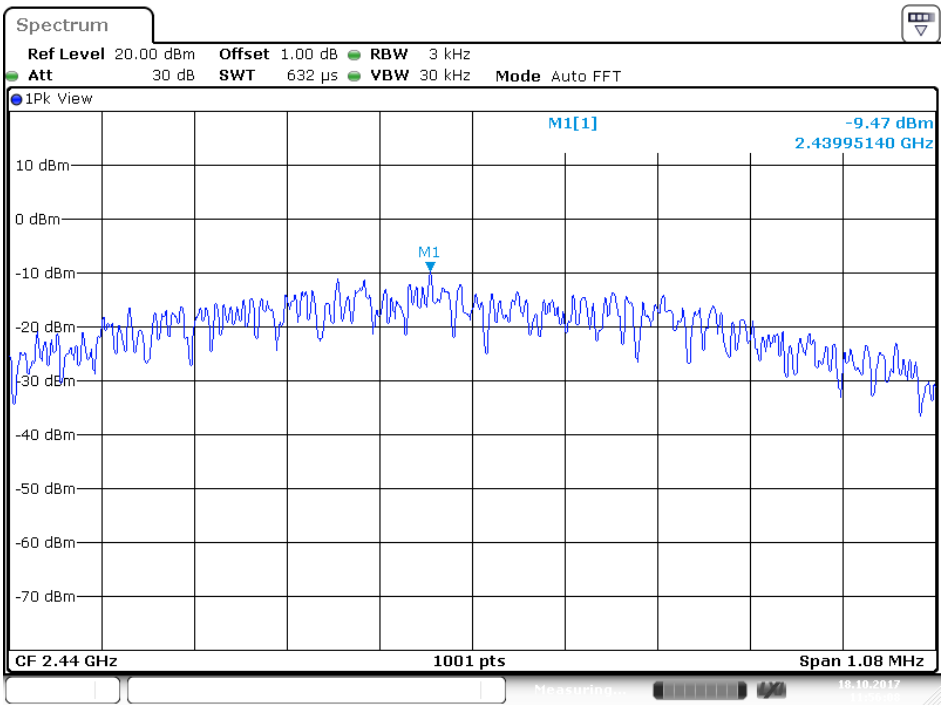
Due to Gain < 6dBi, so the Power and Power density Limits was reduce 0dB

BLE Mode PPSD, Low Channel



Date: 18.OCT.2017 12:12:42

BLE Mode PPSD, Middle Channel



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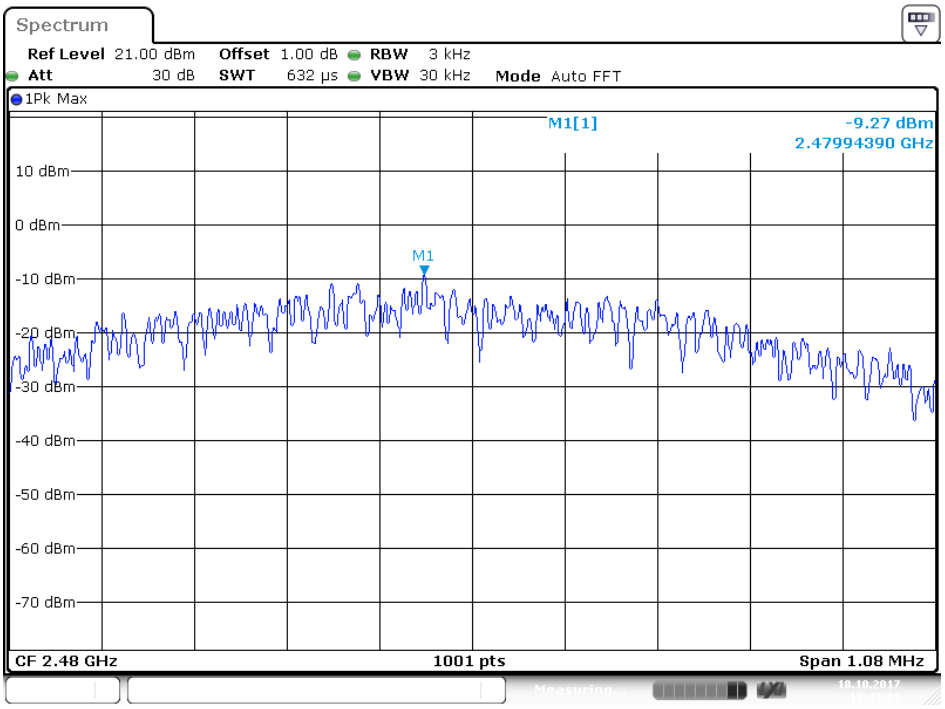
BLE Mode PPSD, High Channel



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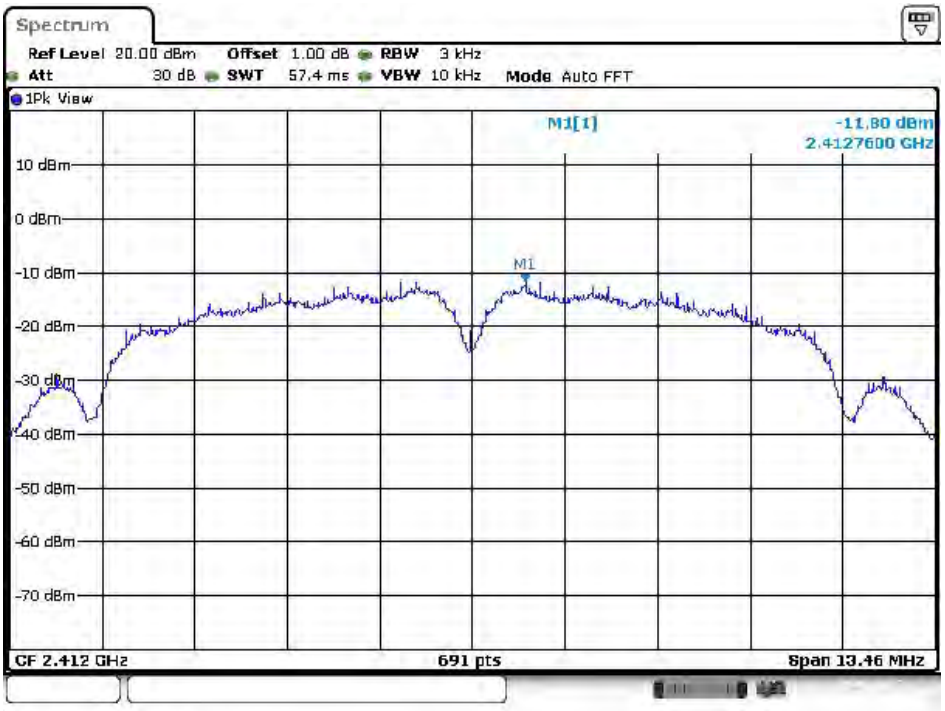
B Mode PPSD, Low Channel



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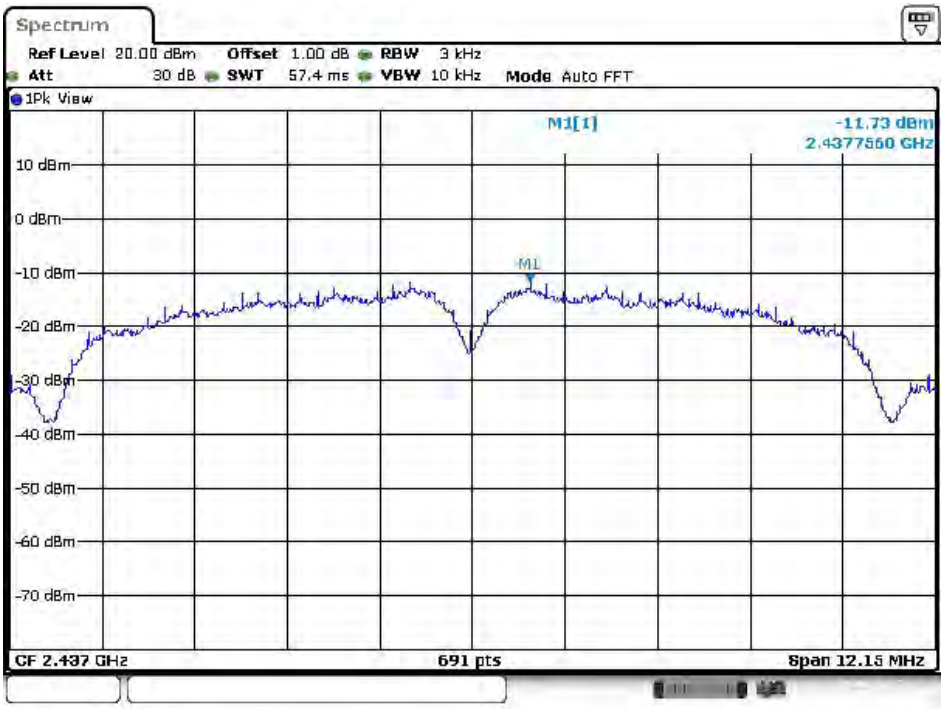
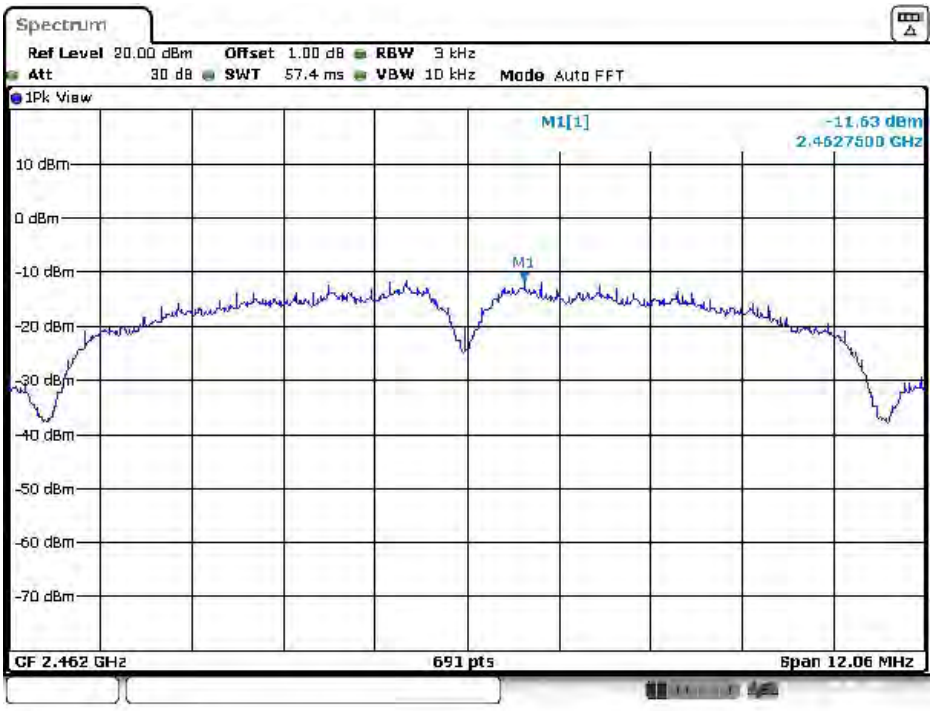
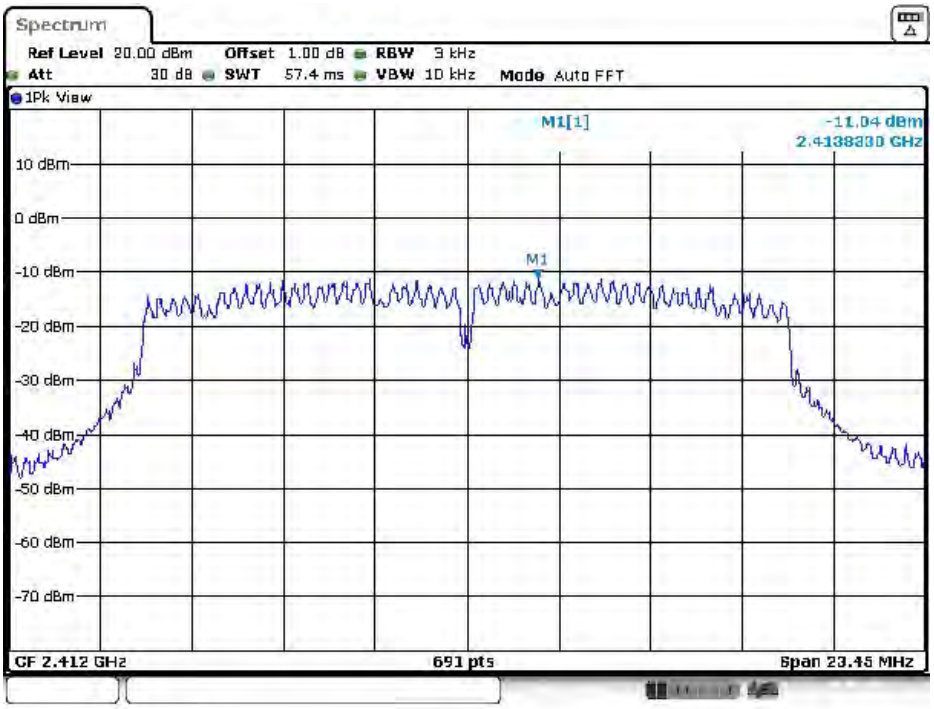
B Mode PPSD, Middle Channel



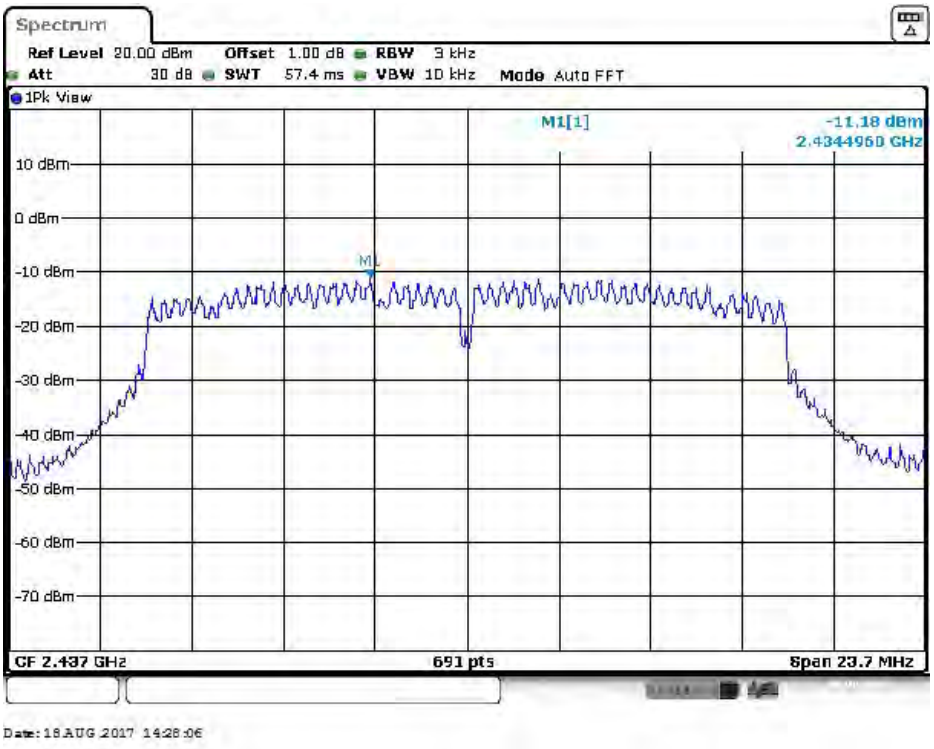
B Mode PPSD, High Channel



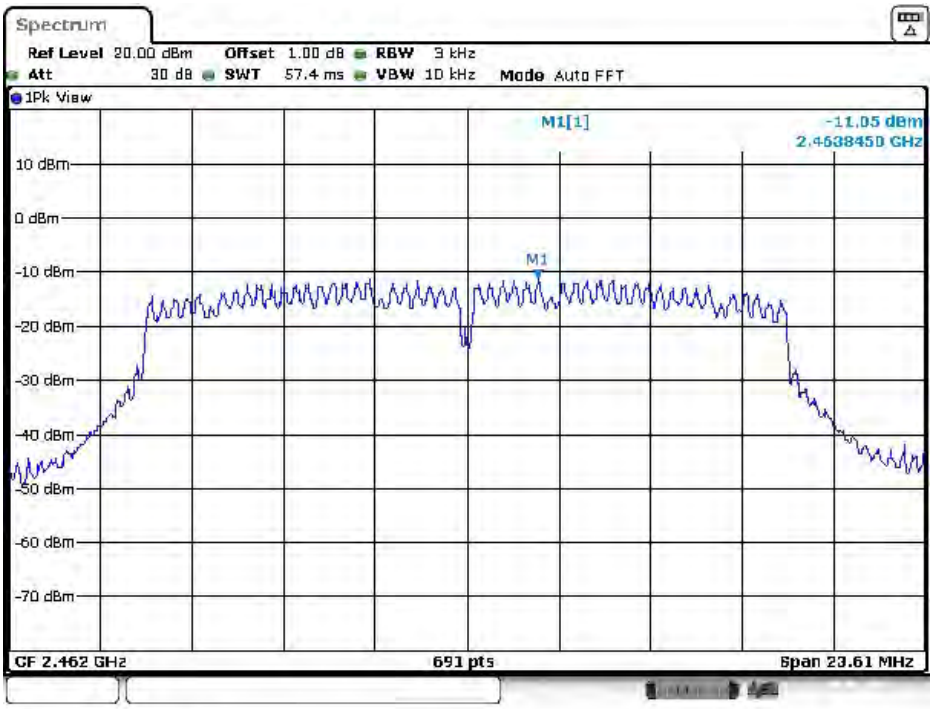
G Mode PPSD, Low Channel



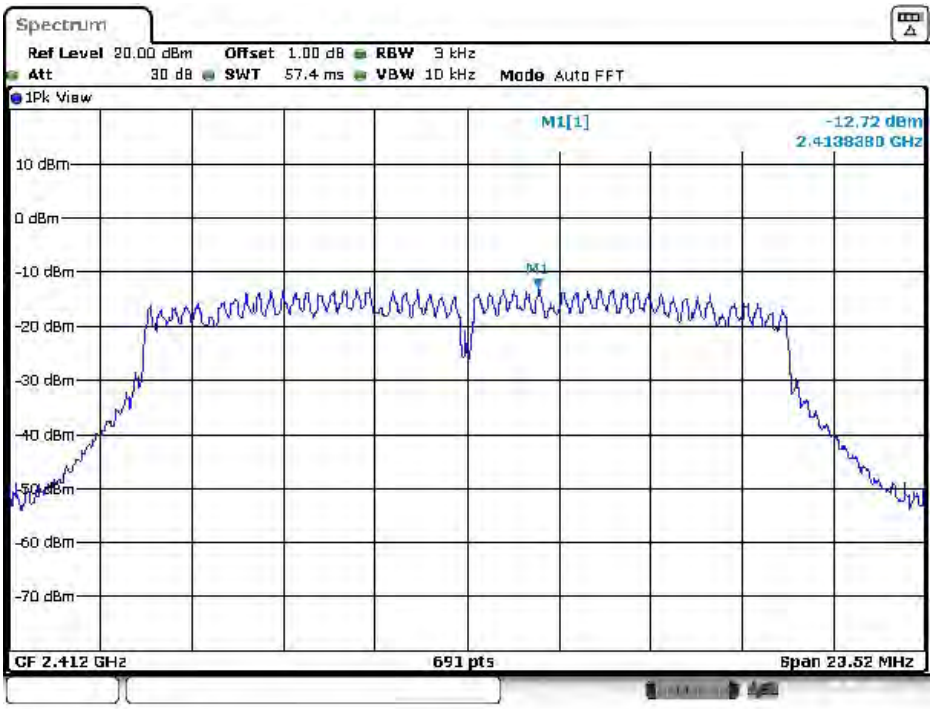
G Mode PPSD, Middle Channel



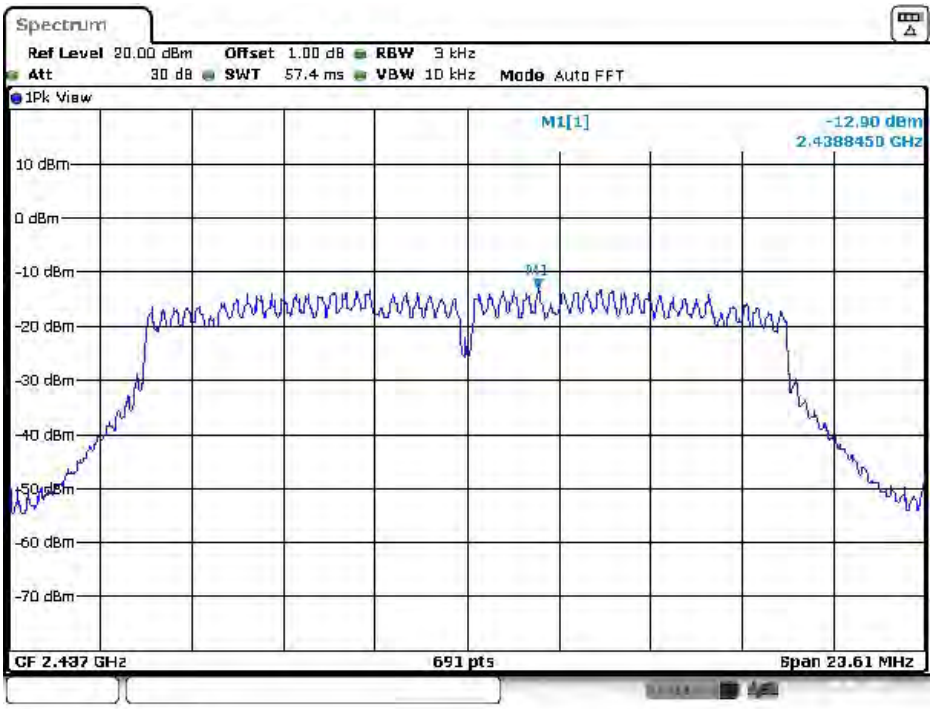
G Mode PPSD, High Channel



N20 Mode PPSD, Low Channel (Chain 0)



N20 Mode PPSD, Middle Channel (Chain 0)



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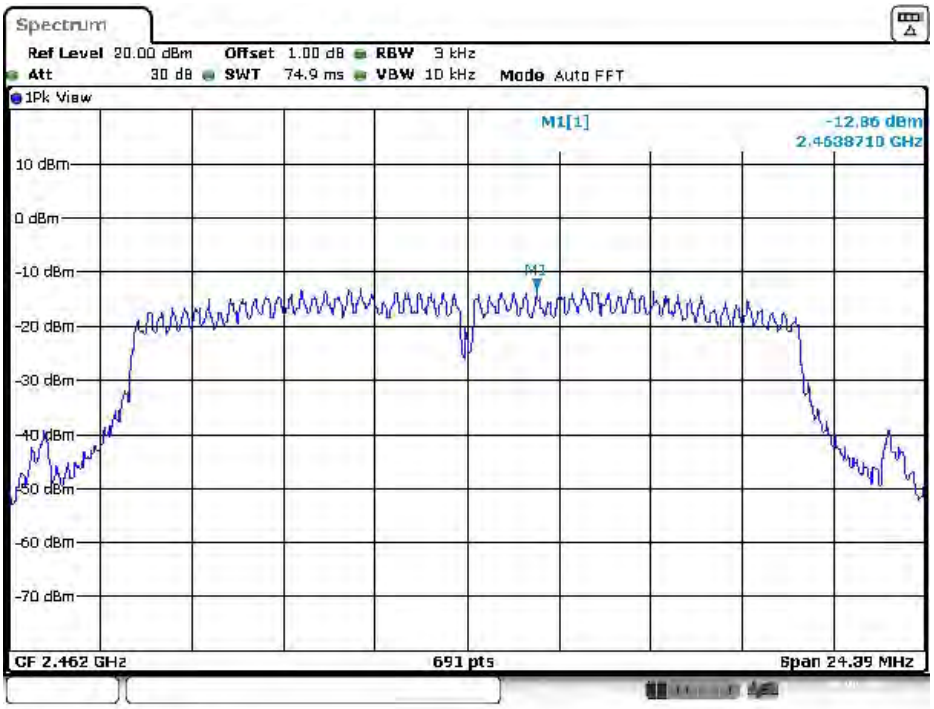
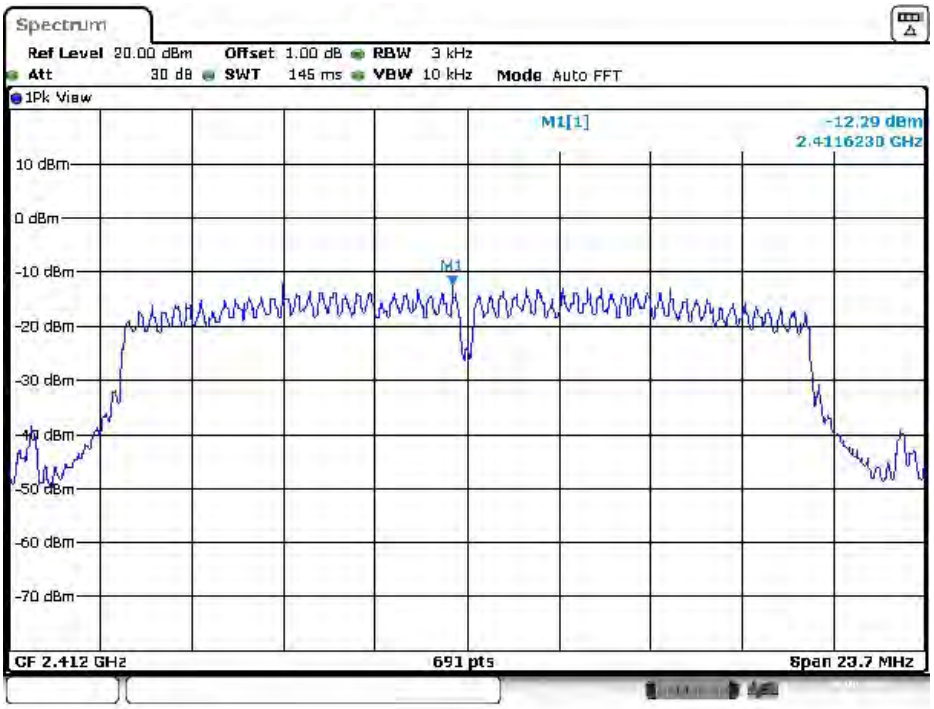
N20 Mode PPSD, High Channel (Chain 0)

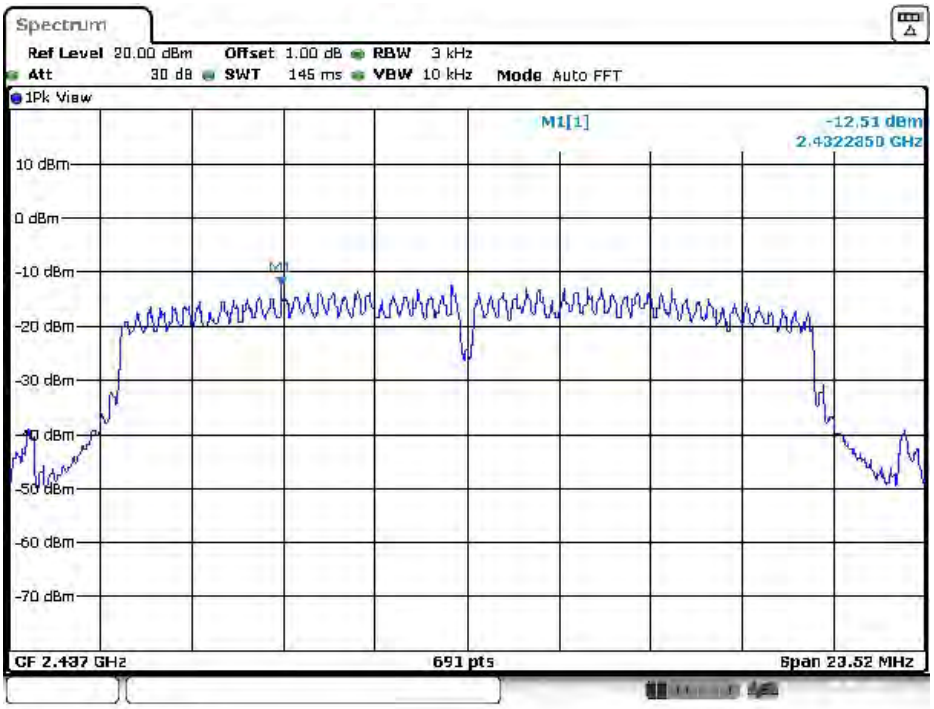


Date: 18.AUG.2017 15:14:37

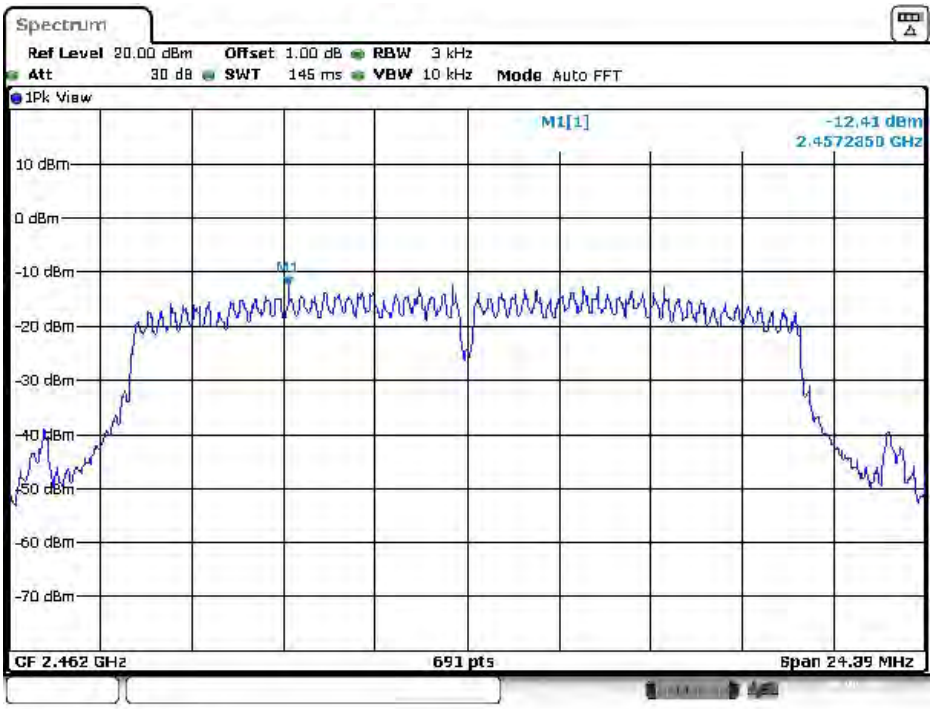
N20 Mode PPSD, Low Channel (Chain 1)



N20 Mode PPSD, Middle Channel (Chain 1)



N20 Mode PPSD, High Channel (Chain 1)



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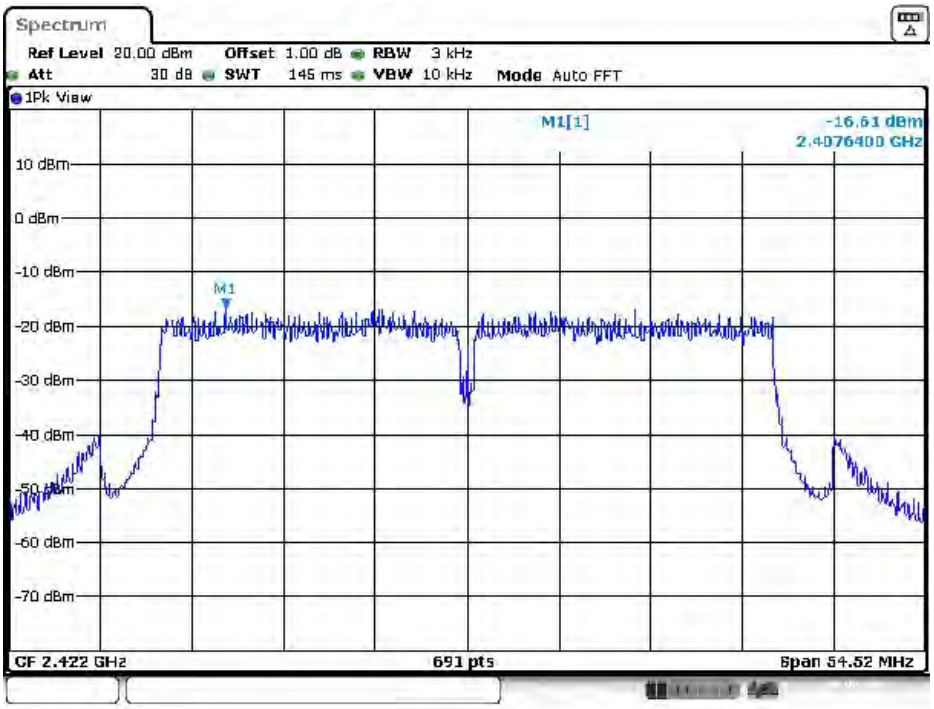
N40 Mode PPSD, Low Channel (Chain 0)



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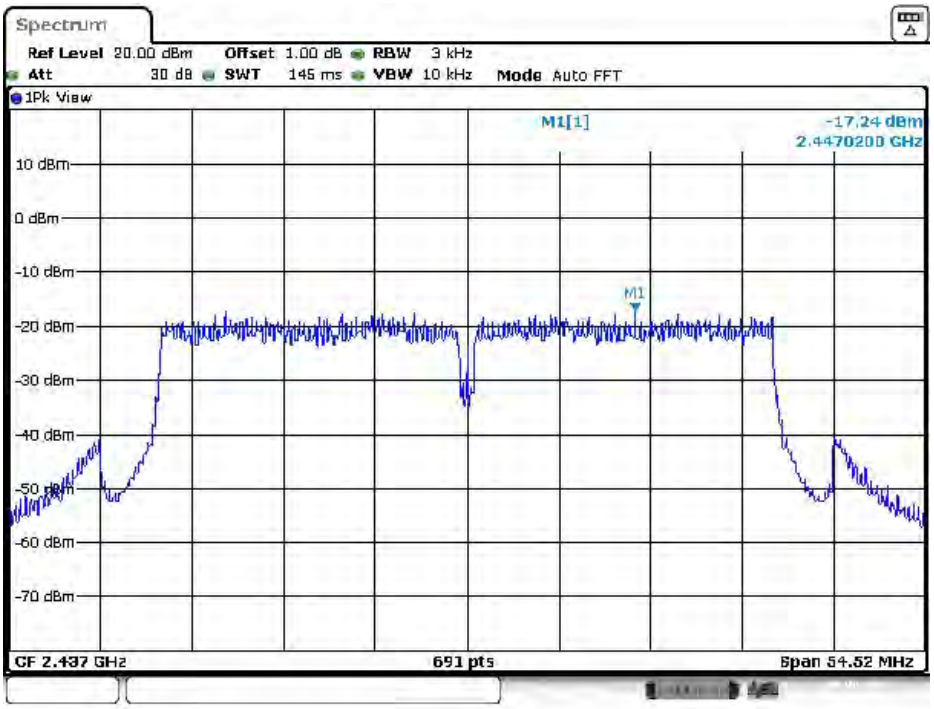
N40 Mode PPSD, Middle Channel (Chain 0)



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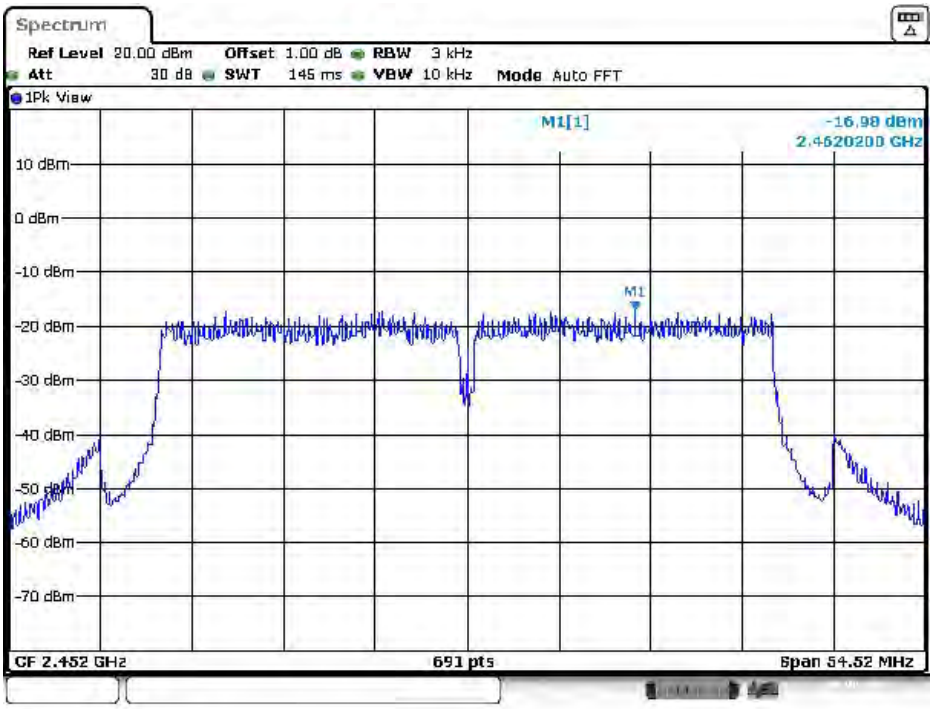
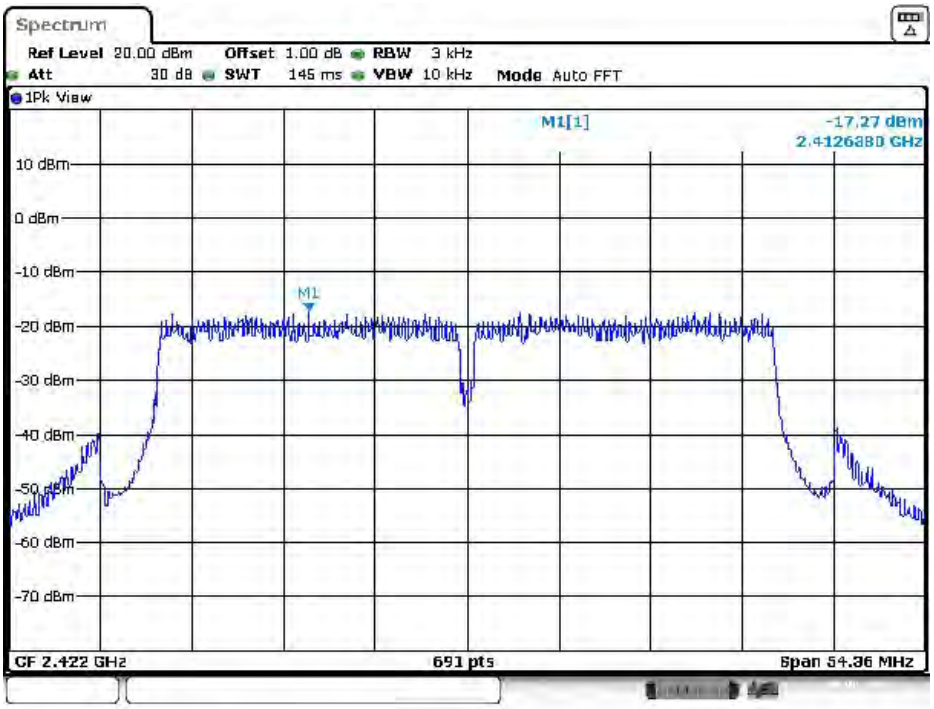
N40 Mode PPSD, High Channel (Chain 0)

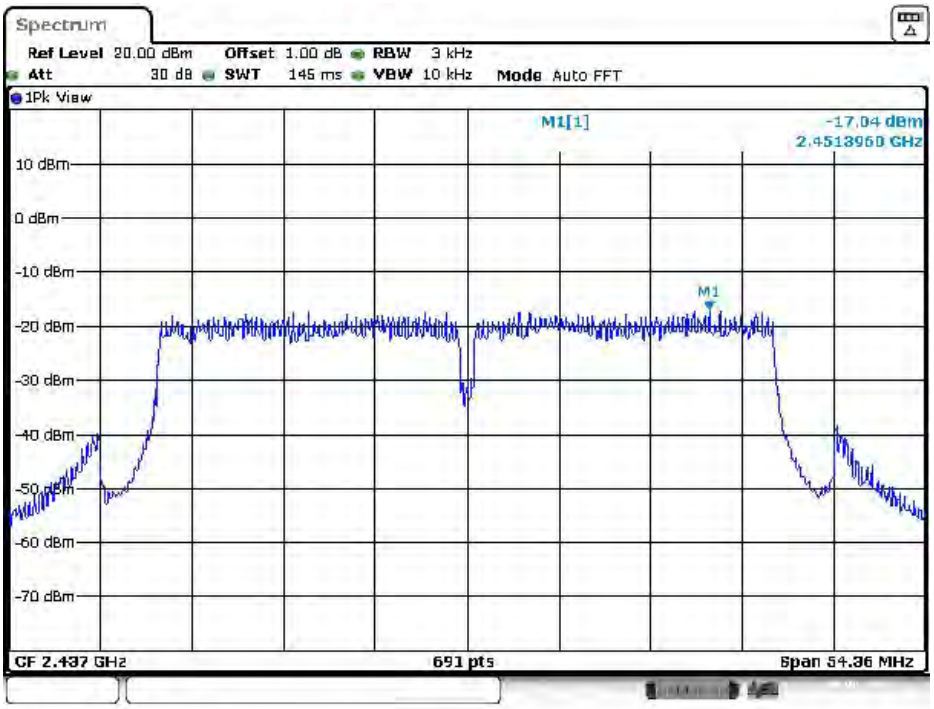


Date: 18.AUG.2017 16:03:56

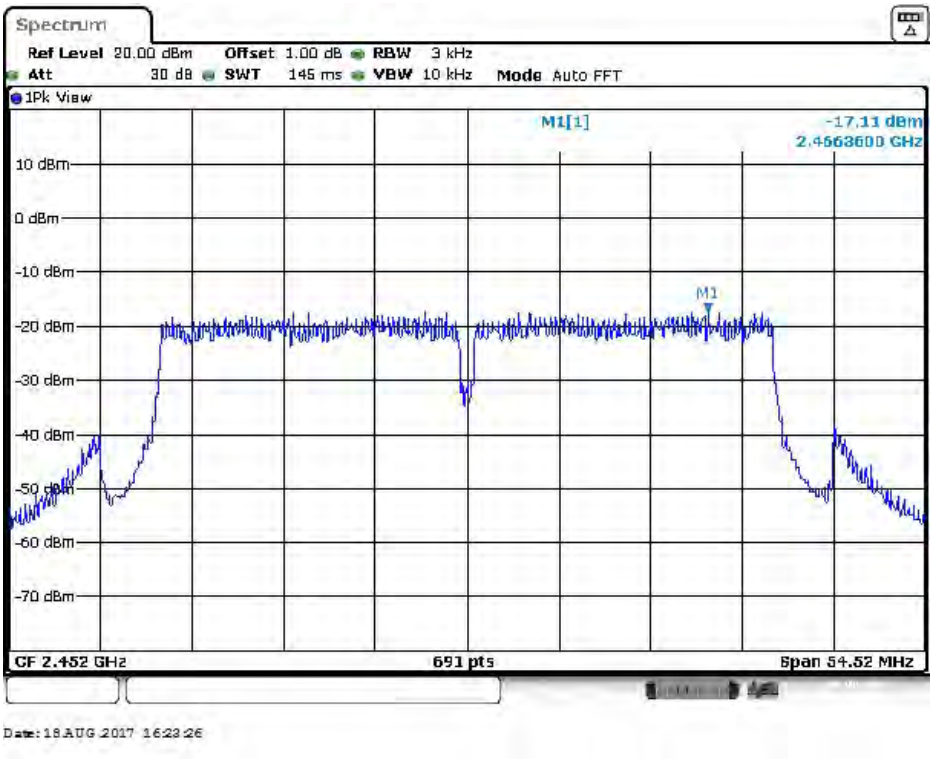
N40 Mode PPSD, Low Channel (Chain 1)



N40 Mode PPSD, Middle Channel (Chain 1)



N40 Mode PPSD, High Channel (Chain 1)



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