FCC Part 15.247

TEST REPORT

For

Winmate Inc.

9F, No. 111-6, Shing-De Rd., San-Chung District, New Taipei City 241, Taiwan

FCC ID: PX9M700MT6625

Report Type:	**Product Type:**
Original Report	Rugged Tablet PC

Report Producer:	Kaylee Chiang
Report Number:	RTWA170511001-00A
Report Date:	2017-08-15
Reviewed By:	Jerry Chang

Bay Area Compliance Laboratories Corp.(Taiwan)
70, Lane 169, Sec. 2, Datong Road,
Xizhi Dist., New Taipei City 22183, Taiwan, R.O.C.
Tel: +886 (2) 2647 6898
Fax: +886 (2) 2647 6895
www.bacl.com.tw

REVISION HISTORY

Revision	Issue Date	Description
1.0	2017.08.15	Original

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1 General Information

1.1 Product Description for Equipment Under Test (EUT)

Applicant:	Winmate Inc. 9F, No. 111-6, Shing-De Rd., San-Chung District, New Taipei City 241, Taiwan
Manufacturer:	Winmate Inc. 9F, No. 111-6, Shing-De Rd., San-Chung District, New Taipei City 241, Taiwan
Product:	Rugged Tablet PC
Main Model:	M700DM8
Series Model:	M700XXX (X can be any combination of "A~Z", "a~z", "0~9" or blank, exclude model: M700DM8)
Trade Name:	WINMATE
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: -1.34dBm (0.0007W) IEEE 802.11b Mode: 18.29dBm (0.0674W) IEEE 802.11g Mode: 23.05dBm (0.2018W) IEEE 802.11n HT20 Mode: 22.98dBm (0.1986W) IEEE 802.11n HT40 Mode: 22.04dBm (0.1599W)
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 - 72.2Mbps IEEE 802.11n HT 40 MHz mode: 13.5 - 150 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:	PCB Antenna / Gain: 2.12 dBi
Voltage Range:	1) Adapter: I/P: 100-240Vac, 50/60Hz, 0.6A O/P: 5Vdc, 3.0A 2) Battery: 3.7Vdc
Date of Test:	May 22, 2017 ~ Aug 15, 2017

**All measurement and test data in this report was gathered from production sample identifier: 170511001 (Assigned by BACL, Taiwan) The EUT supplied by the applicant was received on 2017-05-11.*

Mode difference: The electrical and mechanical constructions of series models are identical to the basic model, except different marketing purpose. The model, M700DM8 is the testing sample, and the final test data are shown on this test report.

1.2 Objective

This report is prepared on behalf of *Winmate Inc.* 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)

N/A.

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 "SP_META" software.

WIFI

Test Software Version		Engineering Mode		
Test Frequency		Low	Mid	High
Power Level Setting	B Mode	15	17	19
	G Mode	19	19	19
	N20 Mode	19	19	18
	N40 Mode	15	19	16

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: MCS0
802.11n ht40: MCS0

2.4 Support Equipment List and Details

Description	Manufacturer	Model Number	FCC ID / DOC	S/N
Tablet	Winmate	E430RM4	DOC	C160802-012-001-001

2.5 External Cable List and Details

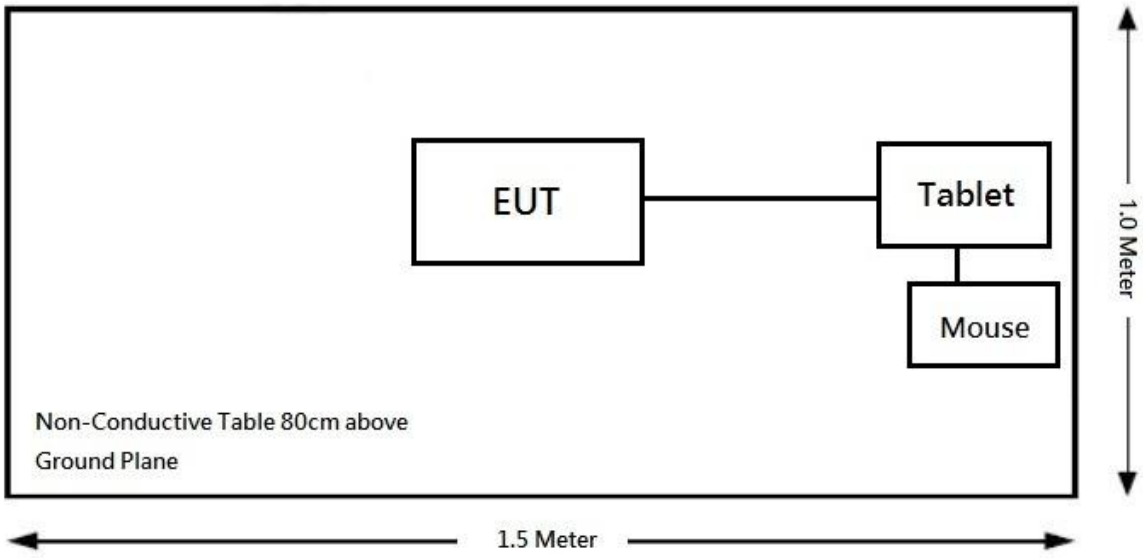
Cable Description	Length (m)	From	To
Micro USB Cable	1.5	NB	EUT

2.6 Block Diagram of Test Setup

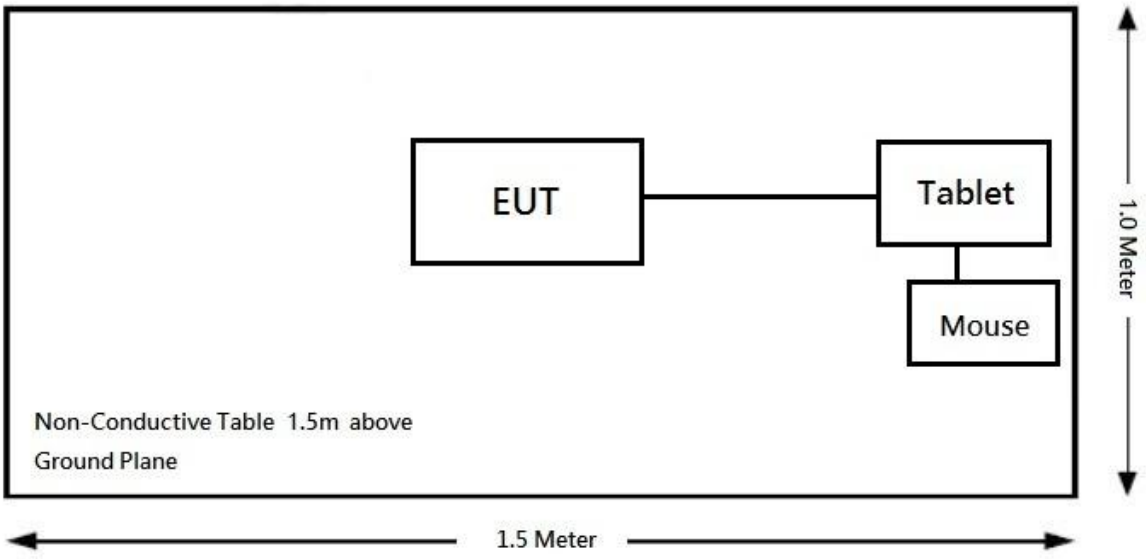
See test photographs attached in Exhibit A for the actual connections between EUT and support equipment.

Radiation:

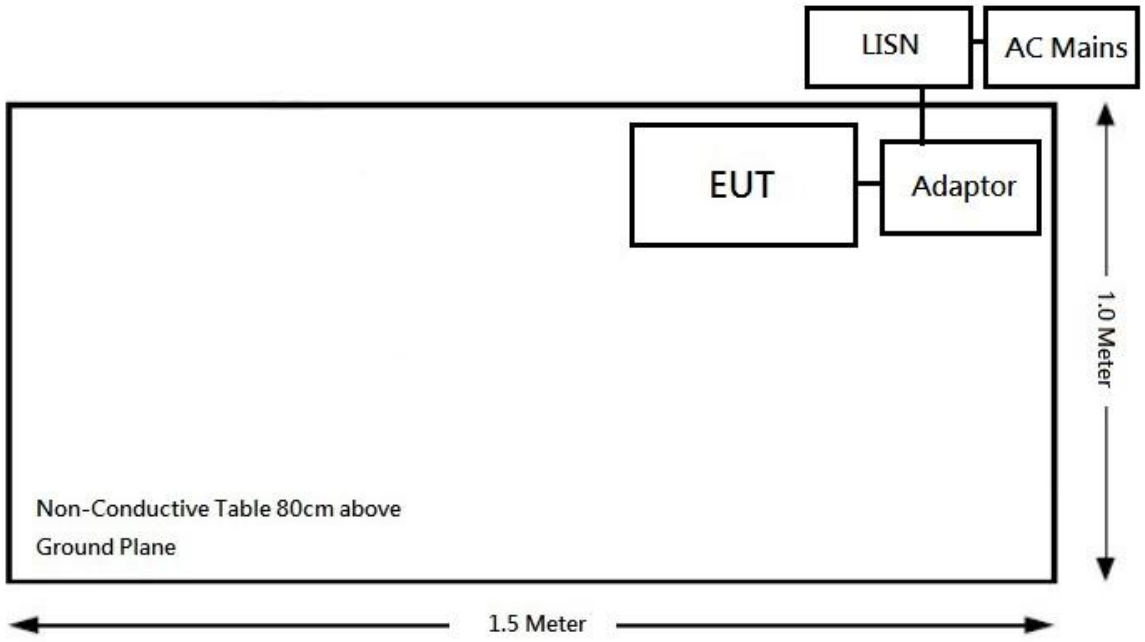
Below 1GHz:



Above 1GHz:



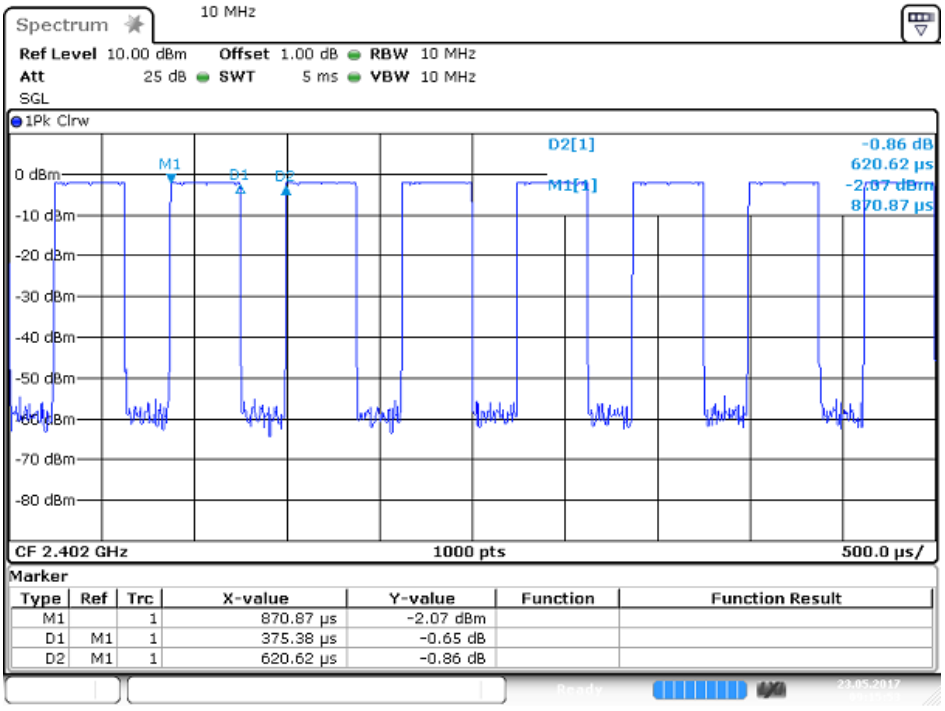
Conduction:


LISN
AC Mains
EUT
Adaptor
1.0 Meter
Non-Conductive Table 80cm above
Ground Plane
1.5 Meter

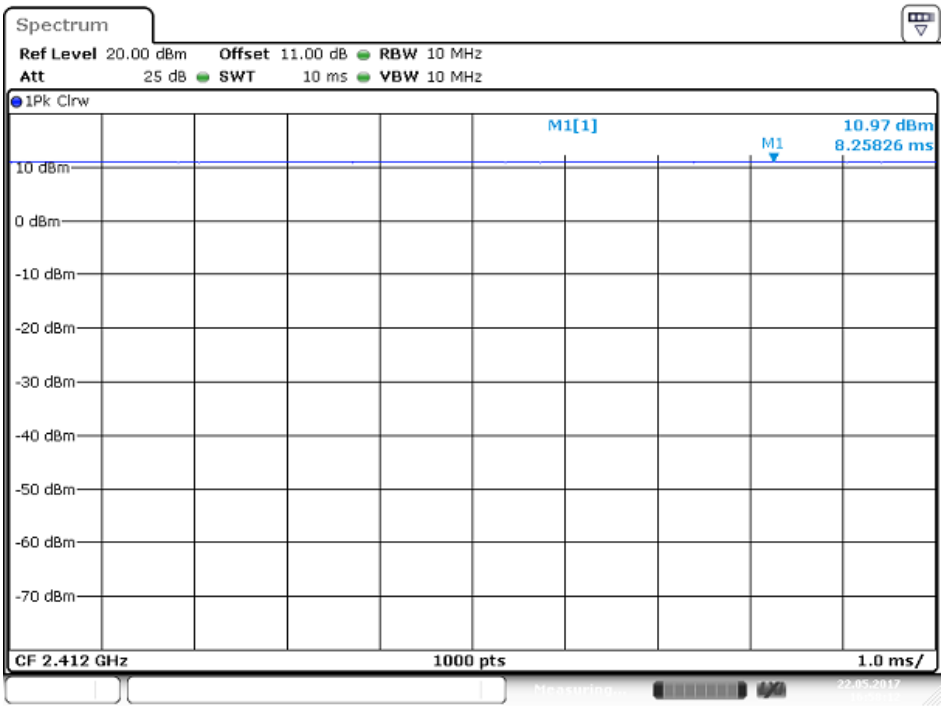
2.7 Duty Cycle

BLE Mode Duty cycle = 0.6, Duty factor=10*LOG (1/Duty cycle)= 2.22dB
B Mode: Duty cycle = 1.00
G Mode: Duty cycle = 1.00
N20 Mode: Duty cycle = 1.00
N40 Mode: Duty cycle = 1.00

BLE Mode



B Mode



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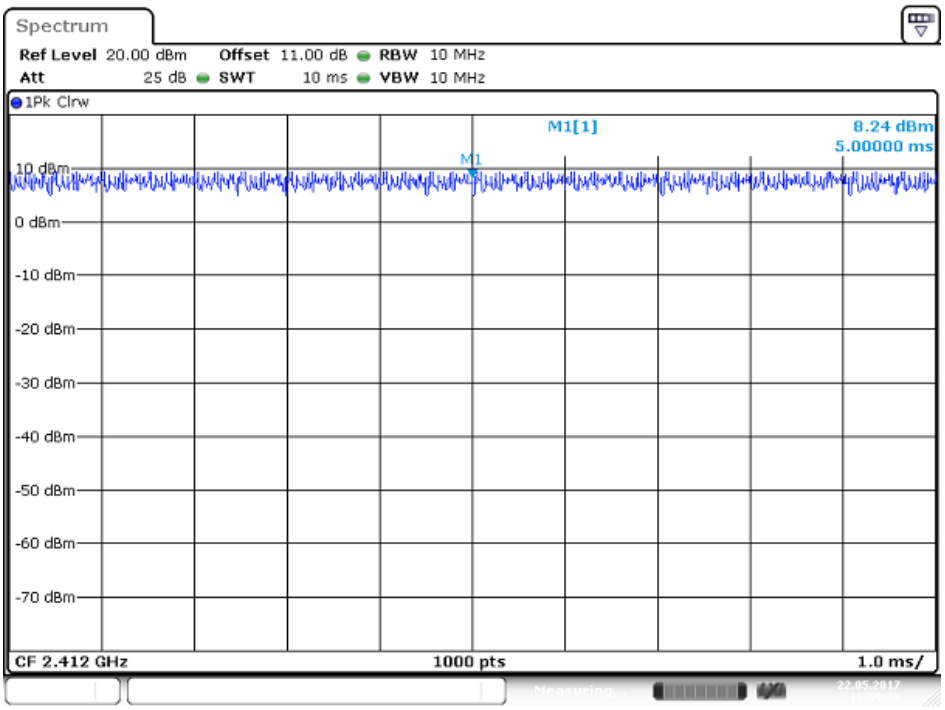
G Mode



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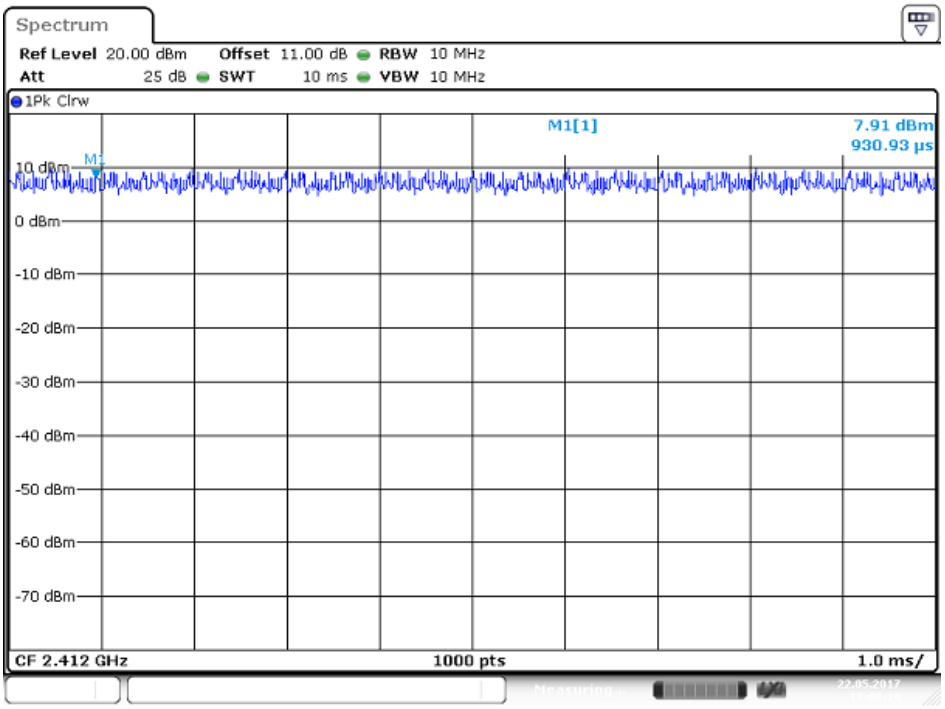
N20 Mode



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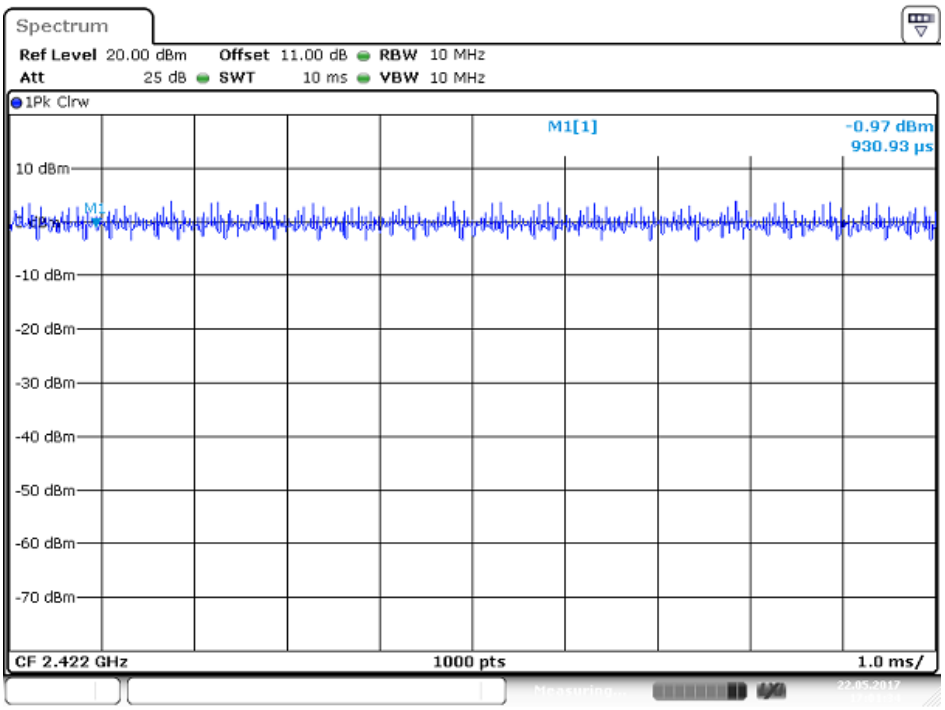
N40 Mode



Date: 22.MAY.2017 17:01:35

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 Mode:

Please refer to the SAR report, report No.: RTWA170511001-08A.

For BLE Mode:

Frequency (MHz)	Tunp-up Power		Evaluation Distrance (mm)	SAR Excluion Result	Extremity SAR Exclusion Limit (1g SAR)
	(dBm)	(mW)			
2480	-1	0.794	5	0.3	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
Winmate INC.	M700DM8	PCB Antenna	2.12 dBi	Compliance

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

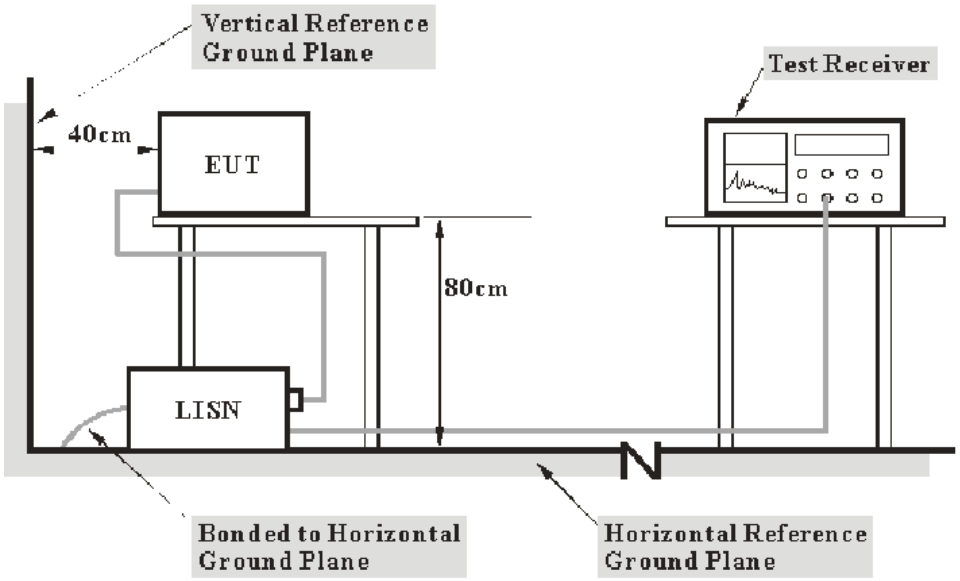
6.2 Measurement Uncertainty

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	2016/7/27	2017/7/26
LISN	EMCO	3816/2	75848	2016/8/4	2017/8/3
EMI Test Receiver	Rohde & Schwarz	ESCI	100540	2016/7/22	2017/7/21
Pulse Limiter	Rohde & Schwarz	ESH3Z2	TXZEM025	2016/8/19	2017/8/18
RF Cable	EMEC	EM-CB5D	001	2016/7/27	2017/7/26
Software	AUDIX	E3	V9.150826k	NCR	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

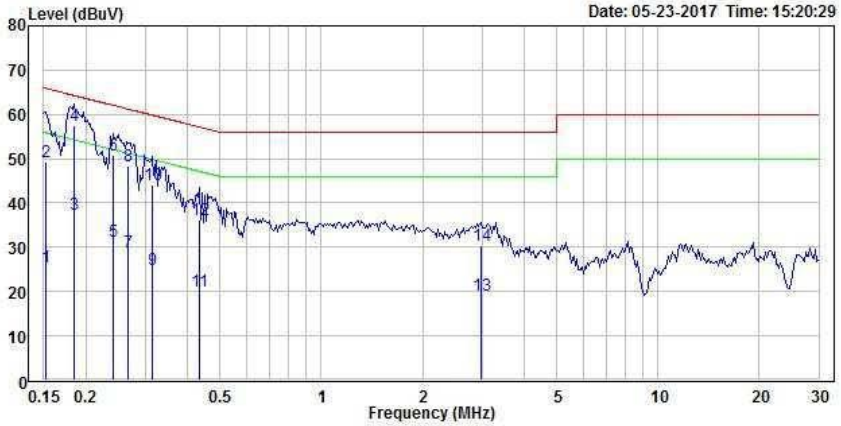
The testing was performed by David Hsu on 2017-05-23.

6.9 Test Results

Please refer to the following plots and tables.

Mode: WFIF+BLE Mode

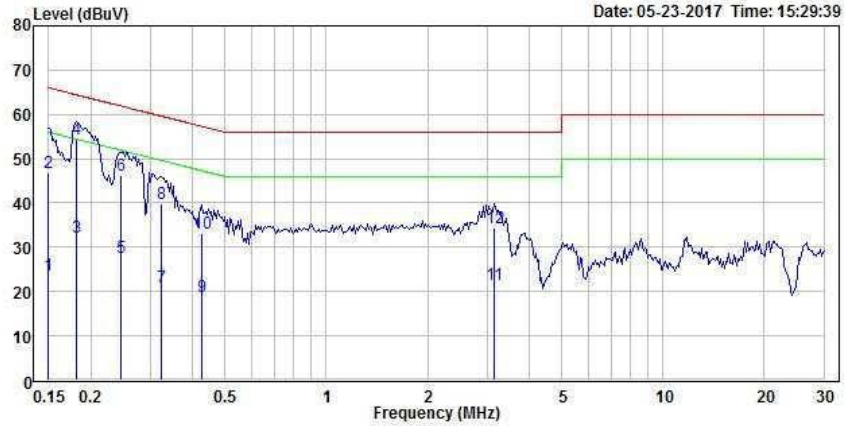
Main: AC 120V/60 Hz, Line



Condition: Line
EUT :
Mode :
Note :

	Freq	Level	Limit Line	Over Limit	Factor	Read Level	Remark	Pol/Phase
	MHz	dBuV	dBuV	dB	dB	dBuV		
1	0.151	25.59	55.92	-30.33	19.56	6.03	Average	Line
2	0.151	49.33	65.92	-16.59	19.56	29.77	QP	Line
3	0.185	37.44	54.27	-16.83	19.57	17.87	Average	Line
4	0.185	57.47	64.27	-6.80	19.57	37.90	QP	Line
5	0.242	31.26	52.04	-20.78	19.57	11.69	Average	Line
6	0.242	50.67	62.04	-11.37	19.57	31.10	QP	Line
7	0.267	28.93	51.21	-22.28	19.56	9.37	Average	Line
8	0.267	48.38	61.21	-12.83	19.56	28.82	QP	Line
9	0.316	25.01	49.81	-24.80	19.55	5.46	Average	Line
10	0.316	44.19	59.81	-15.62	19.55	24.64	QP	Line
11	0.435	20.01	47.17	-27.16	19.54	0.47	Average	Line
12	0.435	36.06	57.17	-21.11	19.54	16.52	QP	Line
13	2.989	19.17	46.00	-26.83	19.65	-0.48	Average	Line
14	2.989	30.49	56.00	-25.51	19.65	10.84	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	0.150	23.63	56.00	-32.37	19.56	4.07	Average	Neutral
2	0.150	46.92	66.00	-19.08	19.56	27.36	QP	Neutral
3	0.181	32.36	54.43	-22.07	19.53	12.83	Average	Neutral
4	0.181	54.54	64.43	-9.89	19.53	35.01	QP	Neutral
5	0.247	27.63	51.87	-24.24	19.52	8.11	Average	Neutral
6	0.247	46.36	61.87	-15.51	19.52	26.84	QP	Neutral
7	0.322	21.03	49.64	-28.61	19.54	1.49	Average	Neutral
8	0.322	39.83	59.64	-19.81	19.54	20.29	QP	Neutral
9	0.426	18.90	47.33	-28.43	19.54	-0.64	Average	Neutral
10	0.426	33.02	57.33	-24.31	19.54	13.48	QP	Neutral
11	3.141	21.67	46.00	-24.33	19.67	2.00	Average	Neutral
12	3.141	34.23	56.00	-21.77	19.67	14.56	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	16.42 – 16.423	960 – 1240	4. 5 – 5. 15
0.495 – 0.505	16.69475 – 16.69525	1300 – 1427	5. 35 – 5. 46
2.1735 – 2.1905	25.5 – 25.67	1435 – 1626.5	7.25 – 7.75
4.125 – 4.128	37.5 – 38.25	1645.5 – 1646.5	8.025 – 8.5
4.17725 – 4.17775	73 – 74.6	1660 – 1710	9.0 – 9.2
4.20725 – 4.20775	74.8 – 75.2	1718.8 – 1722.2	9.3 – 9.5
6.215 – 6.218	108 – 121.94	2200 – 2300	10.6 – 12.7
6.26775 – 6.26825	123 – 138	2310 – 2390	13.25 – 13.4
6.31175 – 6.31225	149.9 – 150.05	2483.5 – 2500	14.47 – 14.5
8.291 – 8.294	156.52475 – 156.52525	2690 – 2900	15.35 – 16.2
8.362 – 8.366	156.7 – 156.9	3260 – 3267	17.7 – 21.4
8.37625 – 8.38675	162.0125 –167.17	3.332 – 3.339	22.01 – 23.12
8.41425 – 8.41475	167.72 – 173.2	3 3458 – 3 358	23.6 – 24.0
12.29 – 12.293	240 – 285	3.600 – 4.400	31.2 – 31.8
12.51975 – 12.52025	322 – 335.4		36.43 – 36.5
12.57675 – 12.57725	399.9 – 410		Above 38.6
13.36 – 13.41	608 – 614		

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

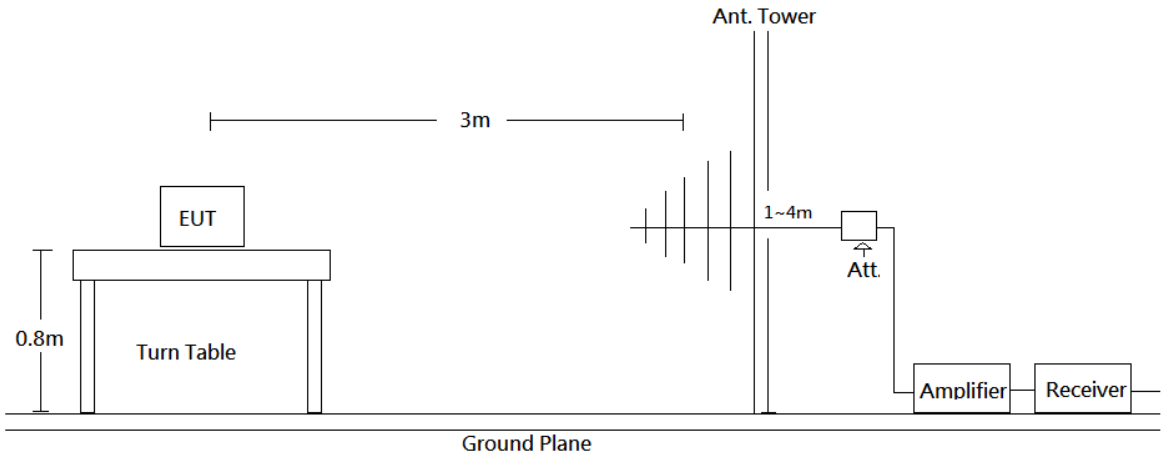
All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency 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.

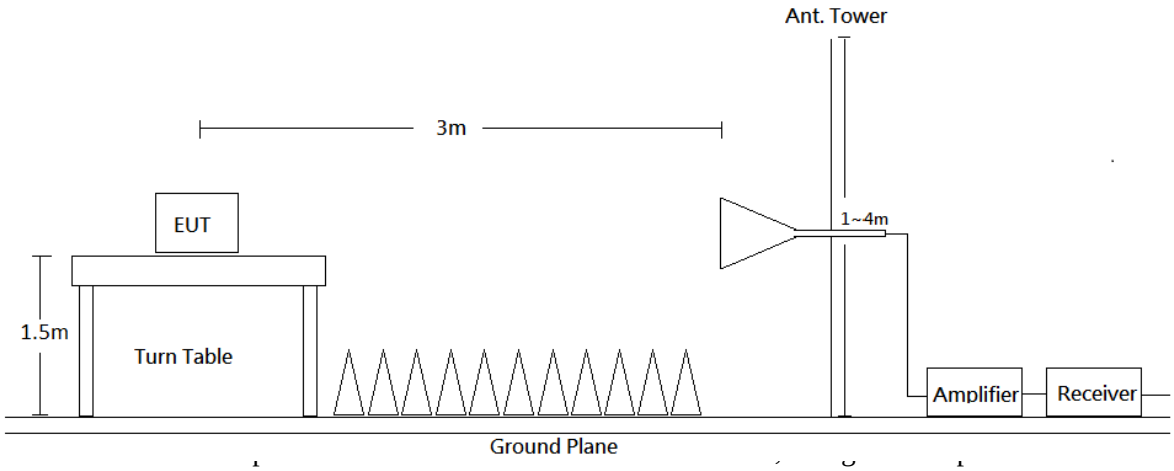
Frequency	Measurement uncertainty
30 MHz~200 MHz	3.76 dB (k=2, 95% level of confidence)
200 MHz~1 GHz	4.12 dB (k=2, 95% level of confidence)
1 GHz~6 GHz	4.84 dB (k=2, 95% level of confidence)
6 GHz~18 GHz	5.16 dB (k=2, 95% level of confidence)
18 GHz~26 GHz	4.84 dB (k=2, 95% level of confidence)
26 GHz~40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

7.3 EUT Setup

Blow 1 GHz:



Above 1 GHz:



Radiate 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
Broadband Antenna	Sunol Sciences	JB6	A050115	2016/11/16	2017/11/15
Amplifier	Sonoma	310N	130602	2016/7/15	2017/7/14
EMI Test Receiver	Rohde & Schwarz	ESR7	101419	2016/11/3	2017/11/2
Mircoflex Cable	UTIFLEX	UFB311A-Q-1440-300300	220490-006	2016/11/2	2017/11/1
Mircoflex Cable	UTIFLEX	UFB197C-1-2362-70U-70U	225757-001	2016/7/15	2017/7/14
Mircoflex Cable	UTIFLEX	UFA210A-1-3149-300300	MFR64639 226389-001	2016/12/1	2017/11/30
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
Horn Antenna	EMCO	3115	9311-4158	2017/5/10	2018/5/9
Horn Antenna	ETS-Lindgren	3116	00062638	2016/9/5	2017/9/4
Preamplifier	EMEC	EM01G18G	060657	2016/12/13	2017/12/12
Preamplifier	EMEC	EM18G40G	060656	2016/12/13	2017/12/12
Spectrum Analyzer	Rohde & Schwarz	FSEK30	825084/006	2016/7/14	2017/7/13
Mircoflex Cable	ROSNAL	K1K50-UP0264-K1K50-80CM	160309-2	2017/1/18	2018/1/17
Mircoflex Cable	ROSNAL	K1K50-UP0264-K1K50-450CM	160309-1	2017/3/24	2018/3/23
Cable	WOKEN	SFL402	00100A1F6A192S	N.C.R	N.C.R
Spectrum Analyzer	Rohde & Schwarz	FSV40	101203	2016/7/19	2017/7/18
Attenuator	MINI-CIRCUITS	BW-S10W5+	N/A	2017/3/9	2018/3/8

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

7.9 Test Environmental Conditions

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

The testing was performed by David Hsu on 2017-05-22 ~ 2017-05-23.

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								
271.53	38.73	-10.28	28.45	46.00	-17.55	100	60	QP
509.18	28.14	-5.59	22.55	46.00	-23.45	100	52	QP
758.47	29.03	-1.59	27.44	46.00	-18.56	100	70	QP
2390.00	61.30	-4.89	56.41	74.00	-17.59	154	341	peak
2390.00	47.86	-4.89	42.97	54.00	-11.03	154	341	AVG
2402.00	90.14	-4.86	85.28	N/A	N/A	154	341	peak
2402.00	73.00	-4.86	68.14	N/A	N/A	154	341	AVG
4804.00	41.45	0.98	42.43	74.00	-31.57	137	148	peak
4804.00	26.45	0.98	27.43	54.00	-26.57	137	148	AVG
BLE, Middle channel								
535.37	26.61	-5.20	21.41	46.00	-24.59	100	63	QP
715.79	31.31	-2.51	28.80	46.00	-17.20	100	32	QP
888.45	26.29	1.17	27.46	46.00	-18.54	100	162	QP
2440.00	95.08	-4.78	90.30	N/A	N/A	157	255	peak
2440.00	76.62	-4.78	71.84	N/A	N/A	157	255	AVG
4880.00	38.64	1.24	39.88	74.00	-34.12	131	47	peak
4880.00	25.97	1.24	27.21	54.00	-26.79	131	47	AVG
BLE, High channel								
202.66	39.31	-11.31	28.00	43.50	-15.50	100	49	QP
525.67	26.25	-5.34	20.91	46.00	-25.09	100	46	QP
853.53	32.37	0.49	32.86	46.00	-13.14	100	324	QP
2480.00	96.42	-4.68	91.74	N/A	N/A	161	255	peak
2480.00	77.24	-4.68	72.56	N/A	N/A	161	255	AVG
2483.50	60.26	-4.69	55.57	74.00	-18.43	161	255	peak
2483.50	47.81	-4.69	43.12	54.00	-10.88	161	255	AVG
4960.00	37.55	1.51	39.06	74.00	-34.94	145	234	peak
4960.00	26.11	1.51	27.62	54.00	-26.38	145	234	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
BLE, Low channel								
132.82	31.48	-10.63	20.85	43.50	-22.65	100	287	QP
356.89	29.75	-8.63	21.12	46.00	-24.88	100	74	QP
709.97	32.48	-2.63	29.85	46.00	-16.15	100	251	QP
2390.00	62.72	-4.89	57.83	74.00	-16.17	181	250	peak
2390.00	47.91	-4.89	43.02	54.00	-10.98	181	250	AVG
2402.00	94.98	-4.86	90.12	N/A	N/A	181	250	peak
2402.00	75.94	-4.86	71.08	N/A	N/A	181	250	AVG
4804.00	40.92	0.98	41.90	74.00	-32.10	123	319	peak
4804.00	25.99	0.98	26.97	54.00	-27.03	123	319	AVG
BLE, Middle channel								
271.53	28.48	-10.28	18.20	46.00	-27.80	100	52	QP
494.63	29.39	-5.82	23.57	46.00	-22.43	100	97	QP
688.63	28.13	-2.95	25.18	46.00	-20.82	100	265	QP
2440.00	88.84	-4.78	84.06	N/A	N/A	191	286	peak
2440.00	72.19	-4.78	67.41	N/A	N/A	191	286	AVG
4880.00	38.45	1.24	39.69	74.00	-34.31	135	192	peak
4880.00	26.08	1.24	27.32	54.00	-26.68	135	192	AVG
BLE, High channel								
186.17	33.19	-12.88	20.31	43.50	-23.19	100	66	QP
356.89	25.43	-8.63	16.80	46.00	-29.20	100	74	QP
447.10	28.09	-6.61	21.48	46.00	-24.52	100	89	QP
2480.00	91.58	-4.68	86.90	N/A	N/A	177	343	peak
2480.00	72.03	-4.68	67.35	N/A	N/A	177	343	AVG
2483.50	61.19	-4.69	56.50	74.00	-17.50	177	343	peak
2483.50	47.82	-4.69	43.13	54.00	-10.87	177	343	AVG
4960.00	38.02	1.51	39.53	74.00	-34.47	125	78	peak
4960.00	26.17	1.51	27.68	54.00	-26.32	125	78	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								
105.66	37.72	-13.06	24.66	43.50	-18.84	100	59	QP
501.42	31.66	-5.70	25.96	46.00	-20.04	100	207	QP
733.25	31.65	-2.14	29.51	46.00	-16.49	100	43	QP
2390.00	62.01	-4.89	57.12	74.00	-16.88	169	295	peak
2390.00	48.58	-4.89	43.69	54.00	-10.31	169	295	AVG
2412.00	109.45	-4.84	104.61	N/A	N/A	169	295	peak
2412.00	105.88	-4.84	101.04	N/A	N/A	169	295	AVG
4824.00	54.23	1.05	55.28	74.00	-18.72	122	331	peak
4824.00	51.95	1.05	53.00	54.00	-1.00	122	331	AVG
B Mode, Middle channel								
188.11	38.50	-12.82	25.68	43.50	-17.82	100	29	QP
448.07	28.50	-6.59	21.91	46.00	-24.09	100	306	QP
709.97	33.62	-2.63	30.99	46.00	-15.01	100	32	QP
2437.00	111.60	-4.78	106.82	N/A	N/A	180	220	peak
2437.00	107.87	-4.78	103.09	N/A	N/A	180	220	AVG
4874.00	53.87	1.23	55.10	74.00	-18.90	156	330	peak
4874.00	51.39	1.23	52.62	54.00	-1.38	156	330	AVG
B Mode, High channel								
102.75	32.29	-13.80	18.49	43.50	-25.01	100	68	QP
369.50	32.40	-8.37	24.03	46.00	-21.97	100	88	QP
734.22	33.37	-2.12	31.25	46.00	-14.75	100	90	QP
2462.00	110.13	-4.72	105.41	N/A	N/A	172	298	peak
2462.00	106.74	-4.72	102.02	N/A	N/A	172	298	AVG
2483.50	65.14	-4.69	60.45	74.00	-13.55	172	298	peak
2483.50	55.17	-4.69	50.48	54.00	-3.52	172	298	AVG
4924.00	52.87	1.40	54.27	74.00	-19.73	145	326	peak
4924.00	50.32	1.40	51.72	54.00	-2.28	145	326	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
B Mode, Low channel								
380.17	27.09	-8.15	18.94	46.00	-27.06	100	21	QP
590.66	25.77	-4.16	21.61	46.00	-24.39	100	234	QP
846.74	28.00	0.34	28.34	46.00	-17.66	100	224	QP
2390.00	60.72	-4.89	55.83	74.00	-18.17	151	208	peak
2390.00	47.57	-4.89	42.68	54.00	-11.32	151	208	AVG
2412.00	102.06	-4.84	97.22	N/A	N/A	151	208	peak
2412.00	98.92	-4.84	94.08	N/A	N/A	151	208	AVG
4824.00	47.87	1.05	48.92	74.00	-25.08	150	192	peak
4824.00	43.45	1.05	44.50	54.00	-9.50	150	192	AVG
B Mode, Middle channel								
273.47	30.16	-10.23	19.93	46.00	-26.07	100	163	QP
563.50	27.66	-4.72	22.94	46.00	-23.06	100	236	QP
769.14	27.72	-1.34	26.38	46.00	-19.62	100	212	QP
2437.00	105.90	-4.78	101.12	N/A	N/A	167	153	peak
2437.00	102.49	-4.78	97.71	N/A	N/A	167	153	AVG
4874.00	53.14	1.23	54.37	74.00	-19.63	123	333	peak
4874.00	50.67	1.23	51.90	54.00	-2.10	123	333	AVG
B Mode, High channel								
222.06	36.03	-12.66	23.37	46.00	-22.63	100	60	QP
585.81	27.30	-4.25	23.05	46.00	-22.95	100	206	QP
785.63	27.94	-0.92	27.02	46.00	-18.98	100	222	QP
2462.00	104.48	-4.72	99.76	N/A	N/A	155	152	peak
2462.00	101.09	-4.72	96.37	N/A	N/A	155	152	AVG
2483.50	62.77	-4.69	58.08	74.00	-15.92	155	152	peak
2483.50	50.90	-4.69	46.21	54.00	-7.79	155	152	AVG
4924.00	55.58	1.40	56.98	74.00	-17.02	119	105	peak
4924.00	51.89	1.40	53.29	54.00	-0.71	119	105	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								
221.09	42.33	-12.71	29.62	46.00	-16.38	100	74	QP
612.97	26.22	-3.81	22.41	46.00	-23.59	100	57	QP
841.89	27.54	0.26	27.80	46.00	-18.20	100	156	QP
2390.00	67.78	-4.89	62.89	74.00	-11.11	201	294	peak
2390.00	51.26	-4.89	46.37	54.00	-7.63	201	294	AVG
2412.00	109.04	-4.84	104.20	N/A	N/A	201	294	peak
2412.00	99.07	-4.84	94.23	N/A	N/A	201	294	AVG
4824.00	57.09	1.05	58.14	74.00	-15.86	114	320	peak
4824.00	41.47	1.05	42.52	54.00	-11.48	114	320	AVG
G Mode, Middle channel								
252.13	41.35	-11.91	29.44	46.00	-16.56	100	73	QP
448.07	30.37	-6.59	23.78	46.00	-22.22	100	306	QP
734.22	31.50	-2.12	29.38	46.00	-16.62	100	90	QP
2437.00	110.58	-4.78	105.80	N/A	N/A	195	227	peak
2437.00	100.72	-4.78	95.94	N/A	N/A	195	227	AVG
4874.00	56.74	1.23	57.97	74.00	-16.03	123	337	peak
4874.00	42.07	1.23	43.30	54.00	-10.70	123	337	AVG
G Mode, High channel								
252.13	40.23	-11.91	28.32	46.00	-17.68	100	73	QP
576.11	29.17	-4.46	24.71	46.00	-21.29	100	40	QP
881.66	28.13	1.04	29.17	46.00	-16.83	100	168	QP
2462.00	110.90	-4.72	106.18	N/A	N/A	211	293	peak
2462.00	100.69	-4.72	95.97	N/A	N/A	211	293	AVG
2483.50	78.12	-4.69	73.43	74.00	-0.57	211	293	peak
2483.50	57.02	-4.69	52.33	54.00	-1.67	211	293	AVG
4924.00	54.63	1.40	56.03	74.00	-17.97	109	332	peak
4924.00	39.96	1.40	41.36	54.00	-12.64	109	332	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
G Mode, Low channel								
242.43	29.60	-12.02	17.58	46.00	-28.42	100	232	QP
419.94	37.61	-7.25	30.36	46.00	-15.64	100	115	QP
710.94	33.23	-2.61	30.62	46.00	-15.38	100	26	QP
2390.00	63.54	-4.89	58.65	74.00	-15.35	144	194	peak
2390.00	49.25	-4.89	44.36	54.00	-9.64	144	194	AVG
2412.00	101.39	-4.84	96.55	N/A	N/A	144	194	peak
2412.00	91.80	-4.84	86.96	N/A	N/A	144	194	AVG
4824.00	44.72	1.05	45.77	74.00	-28.23	153	288	peak
4824.00	33.64	1.05	34.69	54.00	-19.31	153	288	AVG
G Mode, Middle channel								
236.61	33.69	-12.11	21.58	46.00	-24.42	100	276	QP
475.23	34.85	-6.12	28.73	46.00	-17.27	100	107	QP
750.71	40.20	-1.79	38.41	46.00	-7.59	100	25	QP
2437.00	105.92	-4.78	101.14	N/A	N/A	154	154	peak
2437.00	96.20	-4.78	91.42	N/A	N/A	154	154	AVG
4874.00	50.34	1.23	51.57	74.00	-22.43	166	104	peak
4874.00	36.53	1.23	37.76	54.00	-16.24	166	104	AVG
G Mode, High channel								
303.54	27.81	-9.77	18.04	46.00	-27.96	100	31	QP
505.30	26.94	-5.65	21.29	46.00	-24.71	100	74	QP
776.90	27.25	-1.14	26.11	46.00	-19.89	100	262	QP
2462.00	104.64	-4.72	99.92	N/A	N/A	141	171	peak
2462.00	95.26	-4.72	90.54	N/A	N/A	141	171	AVG
2483.50	70.37	-4.69	65.68	74.00	-8.32	141	171	peak
2483.50	51.83	-4.69	47.14	54.00	-6.86	141	171	AVG
4924.00	45.46	1.40	46.86	74.00	-27.14	144	104	peak
4924.00	35.56	1.40	36.96	54.00	-17.04	144	104	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								
79.47	28.82	-16.72	12.10	40.00	-27.90	100	359	QP
492.69	26.86	-5.84	21.02	46.00	-24.98	100	86	QP
663.41	27.10	-3.21	23.89	46.00	-22.11	100	40	QP
2390.00	71.05	-4.89	66.16	74.00	-7.84	203	295	peak
2390.00	52.39	-4.89	47.50	54.00	-6.50	203	295	AVG
2412.00	108.32	-4.84	103.48	N/A	N/A	203	295	peak
2412.00	98.34	-4.84	93.50	N/A	N/A	203	295	AVG
4824.00	55.76	1.05	56.81	74.00	-17.19	136	333	peak
4824.00	37.96	1.05	39.01	54.00	-14.99	136	333	AVG
N20 Mode, Middle channel								
187.14	37.28	-12.85	24.43	43.50	-19.07	100	280	QP
473.29	30.02	-6.16	23.86	46.00	-22.14	100	199	QP
660.50	33.33	-3.24	30.09	46.00	-15.91	100	81	QP
2437.00	110.37	-4.78	105.59	74.00	N/A	188	297	peak
2437.00	100.76	-4.78	95.98	54.00	N/A	188	297	AVG
4874.00	59.02	1.23	60.25	74.00	-13.75	123	331	peak
4874.00	41.24	1.23	42.47	54.00	-11.53	123	331	AVG
N20 Mode, High channel								
256.01	39.17	-11.63	27.54	46.00	-18.46	100	63	QP
564.47	26.44	-4.70	21.74	46.00	-24.26	100	78	QP
812.79	34.30	-0.32	33.98	46.00	-12.02	100	340	QP
2462.00	109.10	-4.72	104.38	N/A	N/A	212	295	peak
2462.00	99.57	-4.72	94.85	N/A	N/A	212	295	AVG
2483.50	78.28	-4.69	73.59	74.00	-0.41	212	295	peak
2483.50	56.78	-4.69	52.09	54.00	-1.91	212	295	AVG
4924.00	59.37	1.40	60.77	74.00	-13.23	133	328	peak
4924.00	41.89	1.40	43.29	54.00	-10.71	133	328	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								
236.61	32.19	-12.11	20.08	46.00	-25.92	100	276	QP
477.17	30.04	-6.10	23.94	46.00	-22.06	100	8	QP
493.66	26.99	-5.82	21.17	46.00	-24.83	100	145	QP
2390.00	62.11	-4.89	57.22	74.00	-16.78	167	194	peak
2390.00	49.61	-4.89	44.72	54.00	-9.28	167	194	AVG
2412.00	100.13	-4.84	95.29	N/A	N/A	167	194	peak
2412.00	91.17	-4.84	86.33	N/A	N/A	167	194	AVG
4824.00	47.22	1.05	48.27	74.00	-25.73	131	32	peak
4824.00	31.84	1.05	32.89	54.00	-21.11	131	32	AVG
N20 Mode, Middle channel								
302.57	30.99	-9.79	21.20	46.00	-24.80	100	155	QP
500.45	29.47	-5.71	23.76	46.00	-22.24	100	160	QP
676.99	26.55	-3.07	23.48	46.00	-22.52	100	193	QP
2437.00	106.12	-4.78	101.34	N/A	N/A	156	153	peak
2437.00	95.92	-4.78	91.14	N/A	N/A	156	153	AVG
4874.00	51.12	1.23	52.35	74.00	-21.65	148	216	peak
4874.00	36.40	1.23	37.63	54.00	-16.37	148	216	AVG
N20 Mode, High channel								
50.37	37.82	-16.25	21.57	40.00	-18.43	100	215	QP
473.29	33.11	-6.16	26.95	46.00	-19.05	100	108	QP
591.63	26.23	-4.14	22.09	46.00	-23.91	100	104	QP
2462.00	105.26	-4.72	100.54	N/A	N/A	150	159	peak
2462.00	95.07	-4.72	90.35	N/A	N/A	150	159	AVG
2483.50	75.22	-4.69	70.53	74.00	-13.98	150	159	peak
2483.50	54.43	-4.69	49.74	54.00	-9.26	150	159	AVG
4924.00	53.67	1.40	55.07	74.00	-18.93	139	79	peak
4924.00	37.20	1.40	38.60	54.00	-15.40	139	79	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								
254.07	39.11	-11.77	27.34	46.00	-18.66	100	53	QP
560.59	26.17	-4.77	21.40	46.00	-24.60	100	68	QP
775.93	28.06	-1.16	26.90	46.00	-19.10	100	64	QP
2390.00	73.96	-4.89	69.07	74.00	-4.93	172	297	peak
2390.00	56.59	-4.89	51.70	54.00	-2.30	172	297	AVG
2422.00	104.85	-4.81	100.04	N/A	N/A	172	297	peak
2422.00	94.81	-4.81	90.00	N/A	N/A	172	297	AVG
4844.00	56.18	1.12	57.30	74.00	-16.70	144	332	peak
4844.00	43.98	1.12	45.10	54.00	-8.90	144	332	AVG
N40 Mode, Middle channel								
396.66	31.74	-7.80	23.94	46.00	-22.06	100	39	QP
585.81	27.00	-4.25	22.75	46.00	-23.25	100	70	QP
863.23	26.03	0.68	26.71	46.00	-19.29	100	1	QP
2390.00	72.77	-4.89	67.88	74.00	-6.12	163	296	peak
2390.00	55.32	-4.89	50.43	54.00	-3.57	163	296	AVG
2437.00	108.31	-4.78	103.53	N/A	N/A	163	296	peak
2437.00	98.27	-4.78	93.49	N/A	N/A	163	296	AVG
2483.50	75.48	-4.69	70.79	74.00	-3.21	163	296	peak
2483.50	58.16	-4.69	53.47	54.00	-0.53	163	296	AVG
4874.00	53.22	1.23	54.45	74.00	-19.55	152	333	peak
4874.00	40.72	1.23	41.95	54.00	-12.05	152	333	AVG
N40 Mode, High channel								
213.33	40.55	-12.90	27.65	43.50	-15.85	100	77	QP
372.41	29.00	-8.30	20.70	46.00	-25.30	100	46	QP
492.69	27.11	-5.84	21.27	46.00	-24.73	100	86	QP
2452.00	105.20	-4.75	100.45	N/A	N/A	159	295	peak
2452.00	94.97	-4.75	90.22	N/A	N/A	159	295	AVG
2483.50	77.63	-4.69	72.94	74.00	-1.06	159	295	peak
2483.50	55.47	-4.69	50.78	54.00	-3.22	159	295	AVG
4904.00	51.43	1.33	52.76	74.00	-21.24	122	324	peak
4904.00	38.31	1.33	39.64	54.00	-14.36	122	324	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								
422.85	29.27	-7.18	22.09	46.00	-23.91	100	9	QP
621.70	28.81	-3.70	25.11	46.00	-20.89	100	244	QP
745.86	26.74	-1.89	24.85	46.00	-21.15	100	207	QP
2390.00	68.85	-4.89	63.96	74.00	-10.04	152	176	peak
2390.00	50.97	-4.89	46.08	54.00	-7.92	152	176	AVG
2422.00	98.65	-4.81	93.84	N/A	N/A	152	176	peak
2422.00	88.38	-4.81	83.57	N/A	N/A	152	176	AVG
4844.00	47.95	1.12	49.07	74.00	-24.93	131	103	peak
4844.00	34.24	1.12	35.36	54.00	-18.64	131	103	AVG
N40 Mode, Middle channel								
246.31	31.03	-12.04	18.99	46.00	-27.01	100	245	QP
547.01	29.27	-5.03	24.24	46.00	-21.76	100	73	QP
737.13	30.71	-2.07	28.64	46.00	-17.36	100	249	QP
2390.00	68.73	-4.89	63.84	74.00	-10.16	144	155	peak
2390.00	51.89	-4.89	47.00	54.00	-7.00	144	155	AVG
2437.00	102.50	-4.78	97.72	N/A	N/A	144	155	peak
2437.00	92.47	-4.78	87.69	N/A	N/A	144	155	AVG
2483.50	69.90	-4.69	65.21	74.00	-8.79	144	155	peak
2483.50	53.98	-4.69	49.29	54.00	-4.71	144	155	AVG
4874.00	44.40	1.23	45.63	74.00	-28.37	122	218	peak
4874.00	33.24	1.23	34.47	54.00	-19.53	122	218	AVG
N40 Mode, High channel								
236.61	31.97	-12.11	19.86	46.00	-26.14	100	276	QP
520.82	26.53	-5.42	21.11	46.00	-24.89	100	101	QP
770.11	27.84	-1.31	26.53	46.00	-19.47	100	217	QP
2452.00	98.56	-4.75	93.81	N/A	N/A	147	170	peak
2452.00	88.76	-4.75	84.01	N/A	N/A	147	170	AVG
2483.50	72.43	-4.69	67.74	74.00	-6.26	147	170	peak
2483.50	51.07	-4.69	46.38	54.00	-7.62	147	170	AVG
4904.00	44.50	1.33	45.83	74.00	-28.17	128	210	peak
4904.00	32.89	1.33	34.22	54.00	-19.78	128	210	AVG

Result = Reading + Correct Factor

Margin = Result – Limit

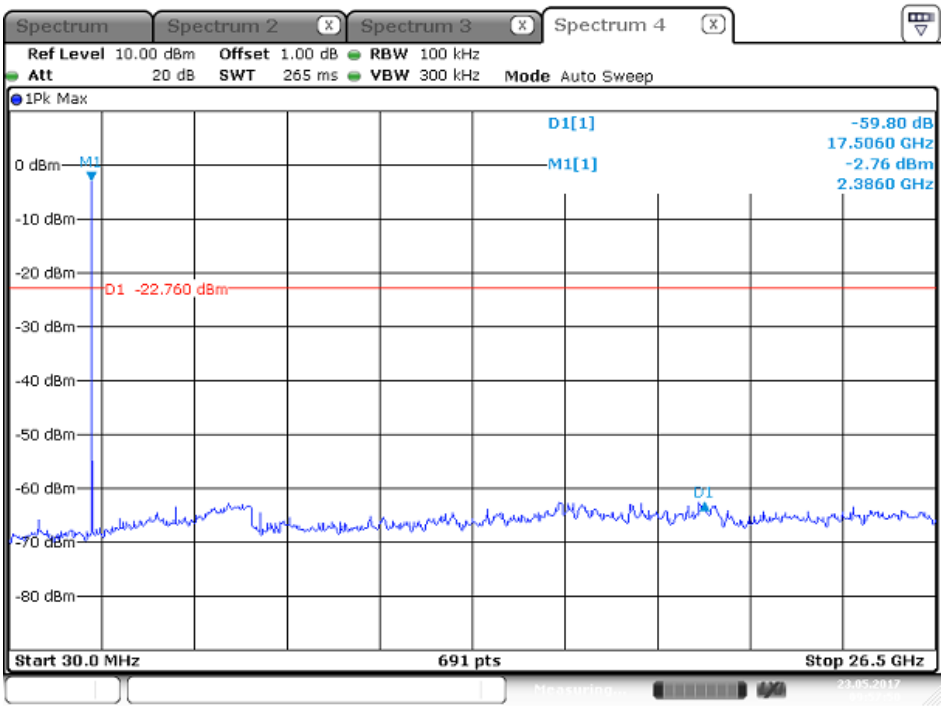
Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

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

Conducted Spurious Emissions:

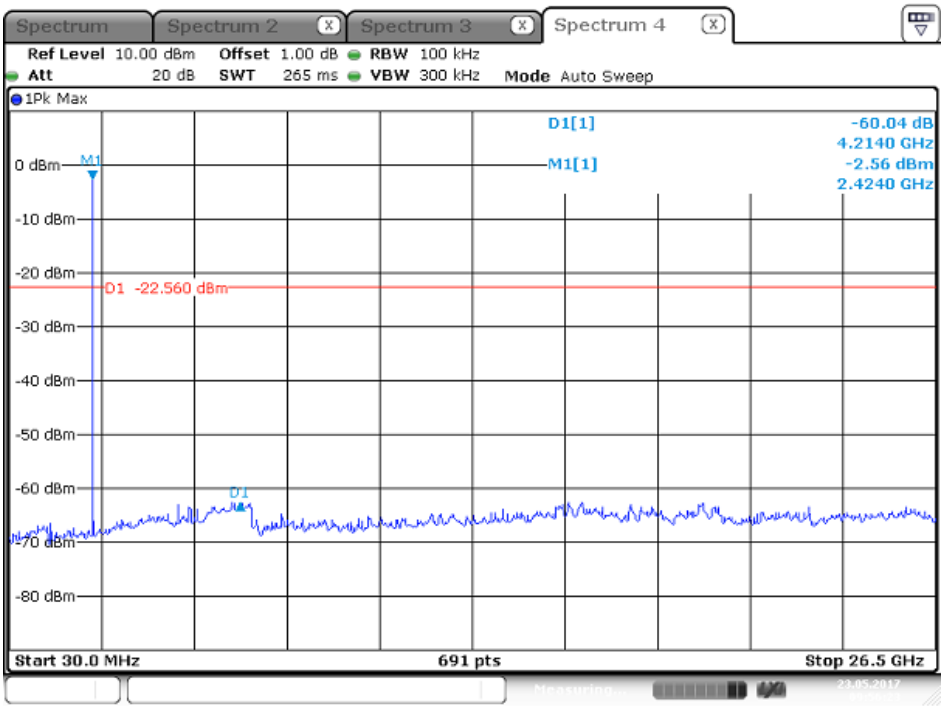
Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)	Result
BLE Mode				
Low	2402	59.80	≥ 20	PASS
Mid	2440	60.04	≥ 20	PASS
High	2480	59.95	≥ 20	PASS
B Mode				
Low	2412	46.83	≥ 20	PASS
Mid	2437	48.61	≥ 20	PASS
High	2462	51.71	≥ 20	PASS
G Mode				
Low	2412	46.79	≥ 20	PASS
Mid	2437	47.47	≥ 20	PASS
High	2462	47.84	≥ 20	PASS
N20 Mode				
Low	2412	47.98	≥ 20	PASS
Mid	2437	48.53	≥ 20	PASS
High	2462	47.29	≥ 20	PASS
N40 Mode				
Low	2422	41.09	≥ 20	PASS
Mid	2437	45.07	≥ 20	PASS
High	2452	42.32	≥ 20	PASS

BLE Mode Low Channel



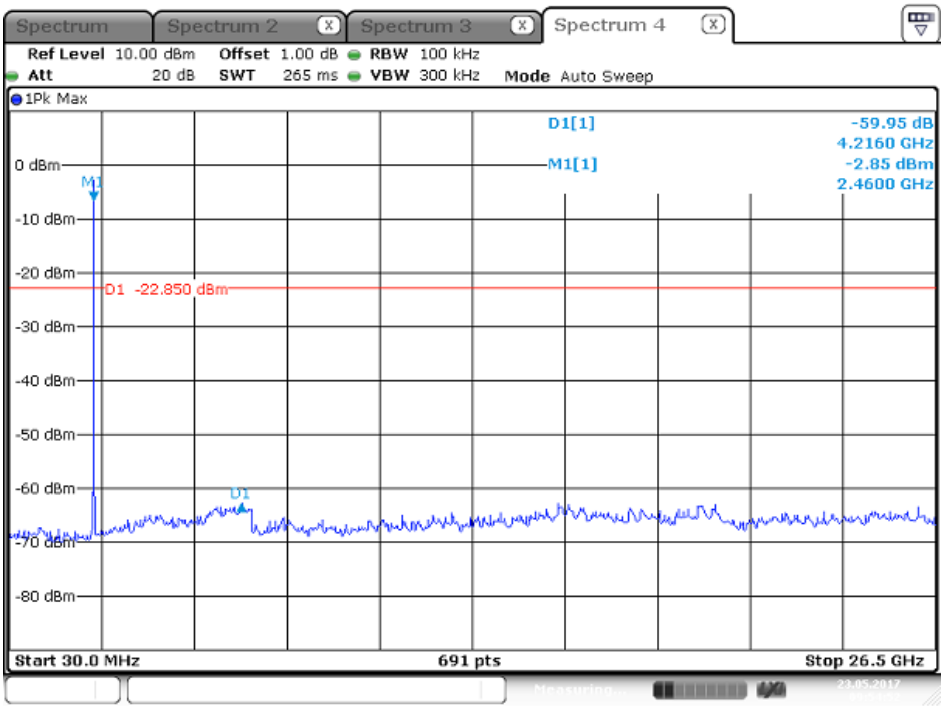
Date: 23MAY.2017 09:57:51

BLE Mode Middle Channel



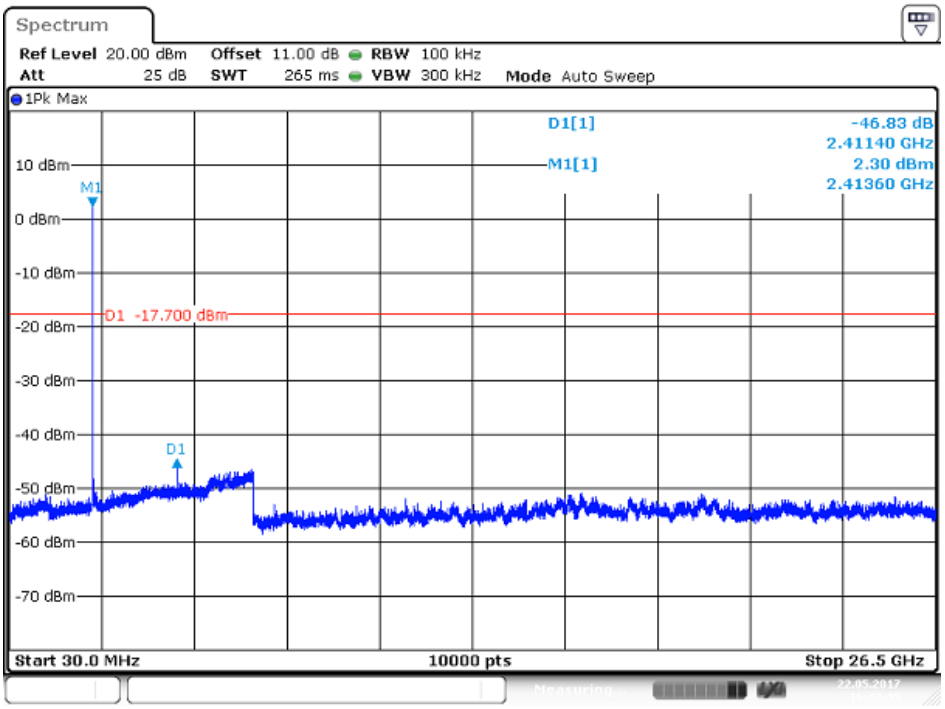
Date: 23MAY.2017 09:56:24

BLE Mode High Channel



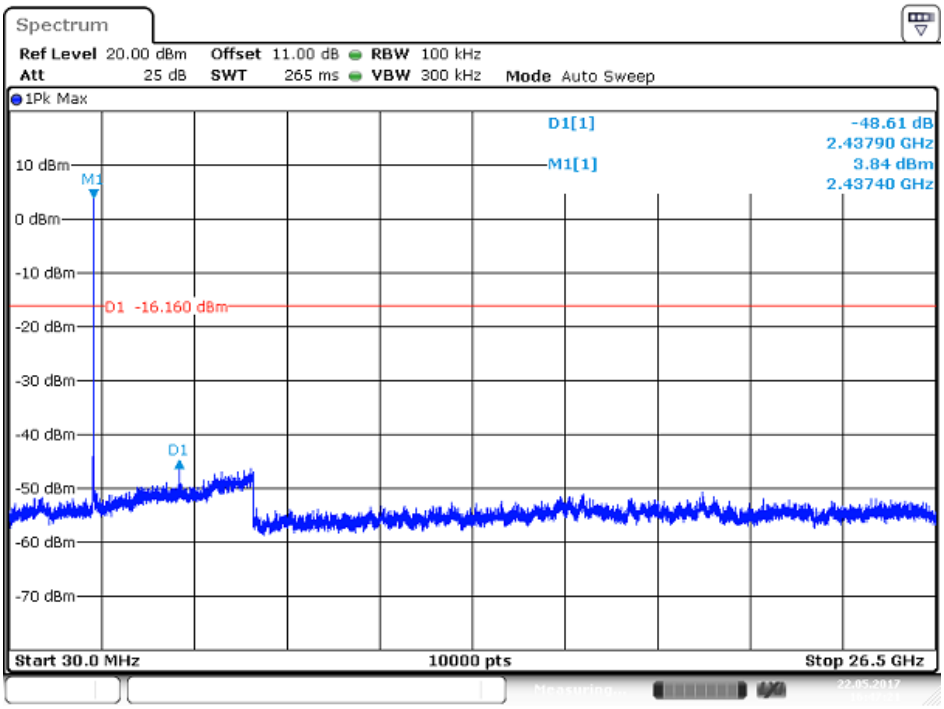
Date: 23MAY.2017 09:54:52

B Mode Low Channel



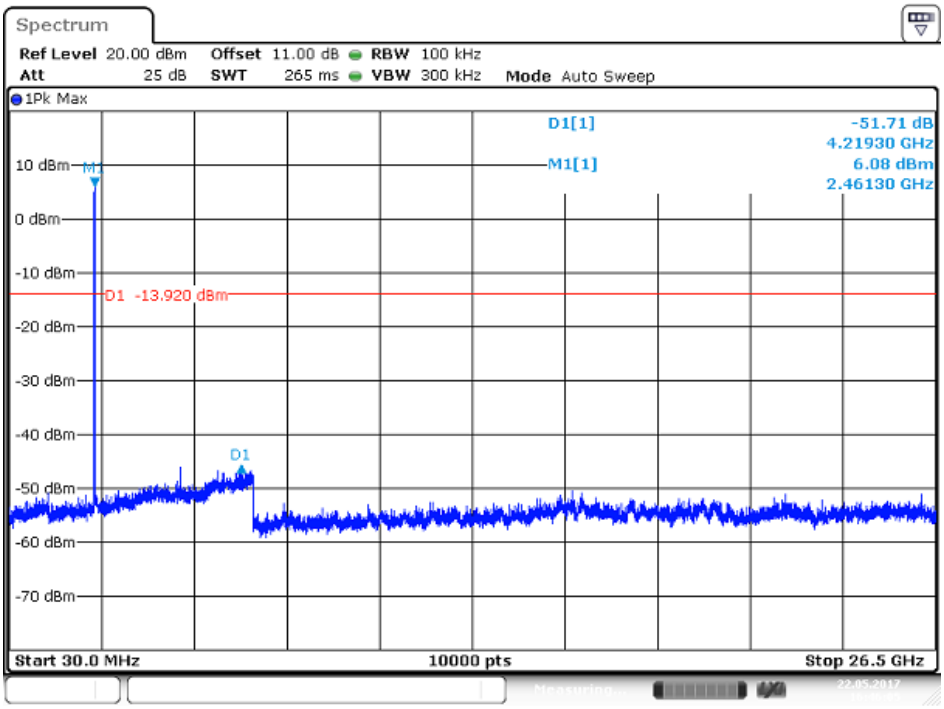
Date: 22MAY.2017 16:42:45

B Mode Middle Channel



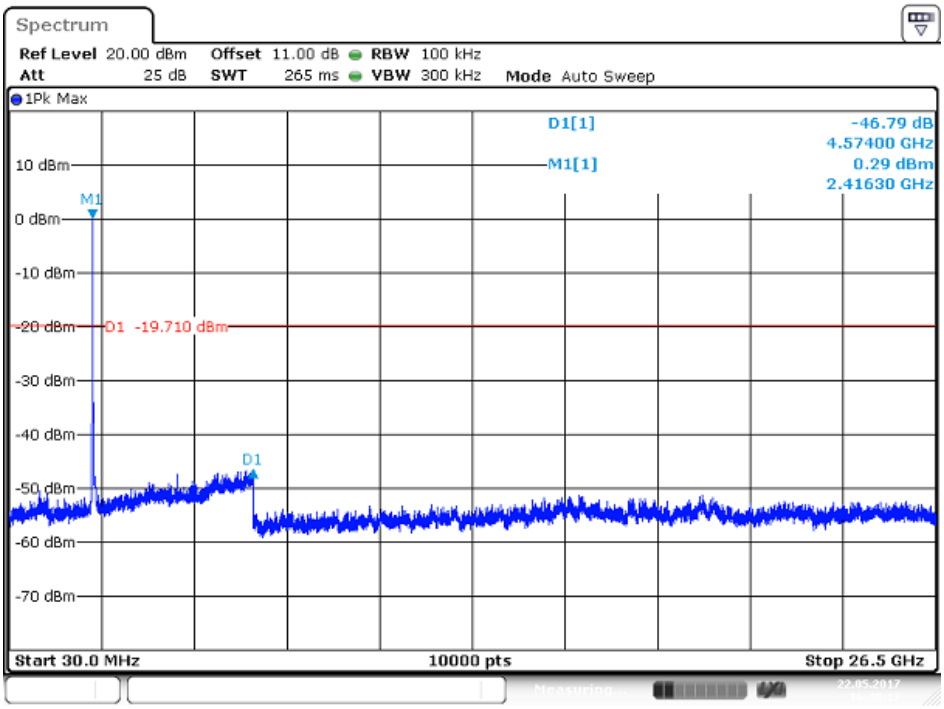
Date: 22.MAY.2017 16:47:20

B Mode High Channel



Date: 22.MAY.2017 16:46:05

G Mode Low Channel



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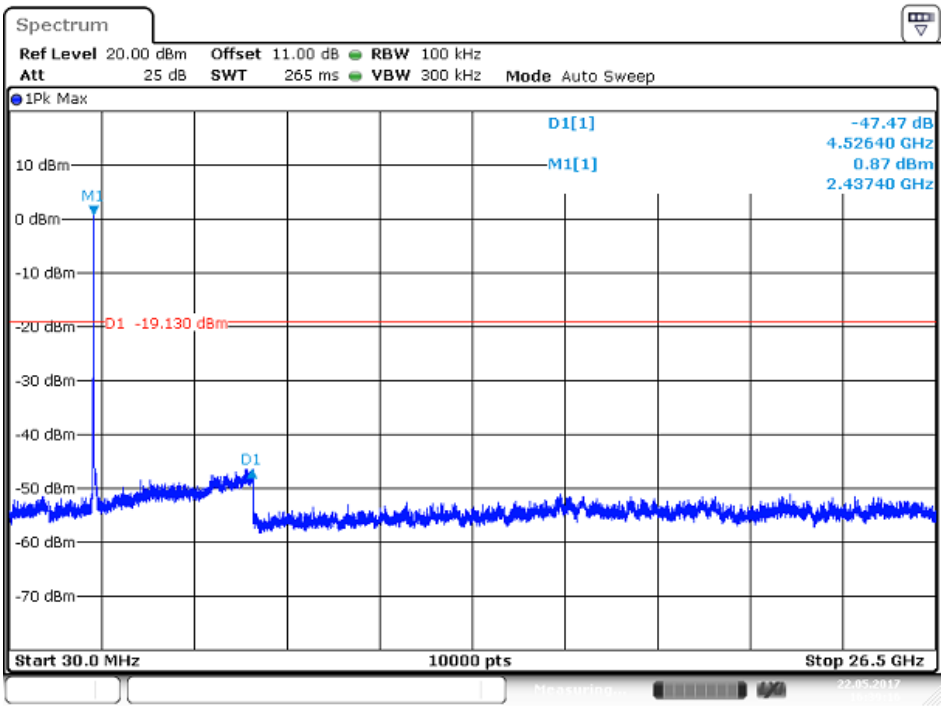
G Mode Middle Channel



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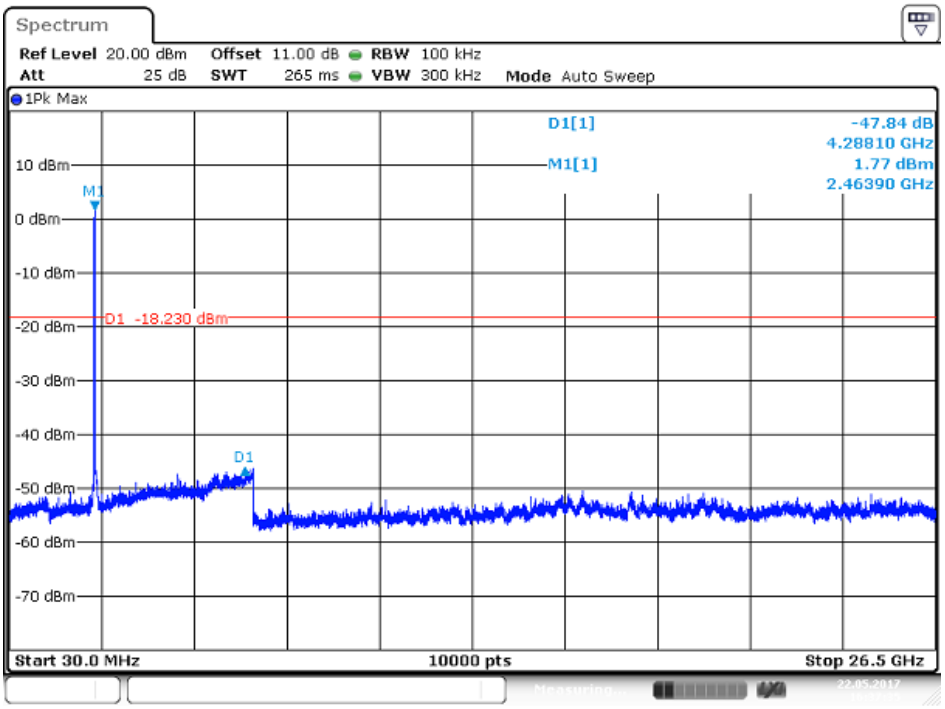
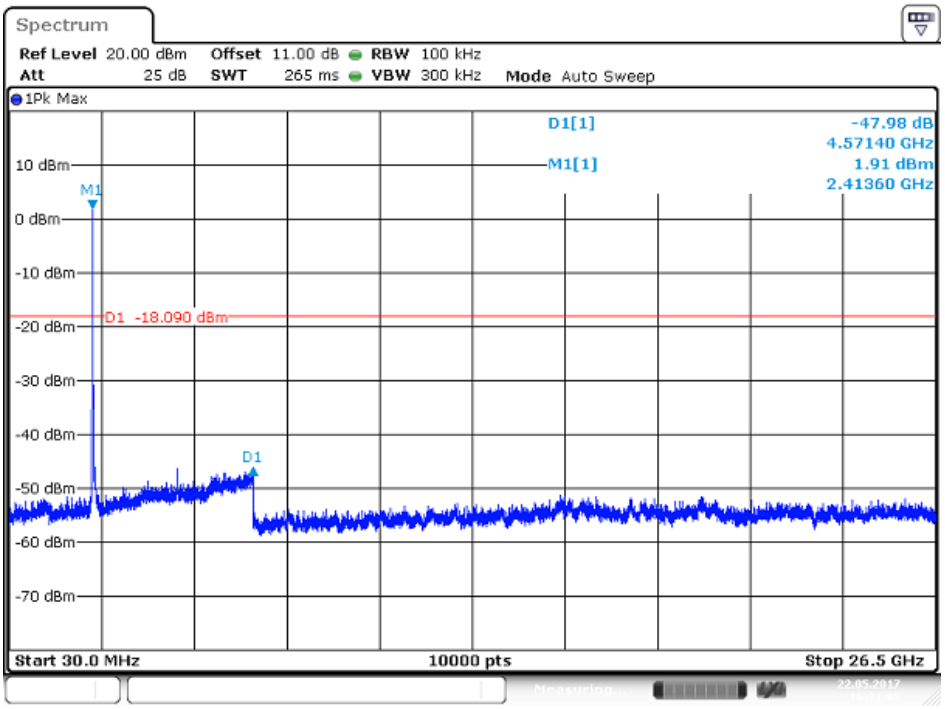
G Mode High Channel



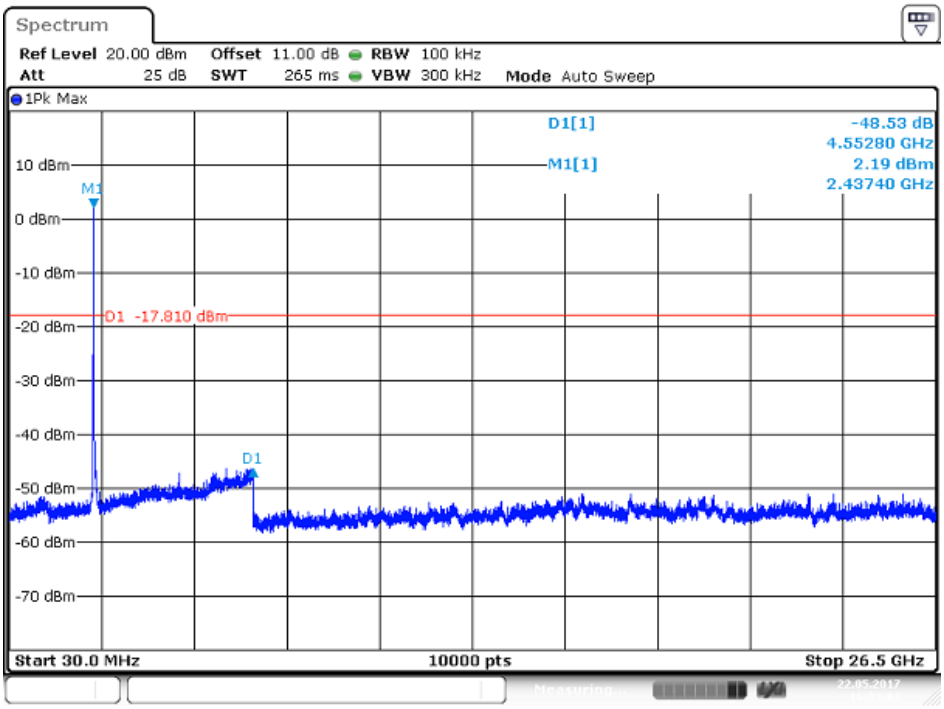
Date: 22.MAY.2017 16:37:35

N20 Mode Low Channel



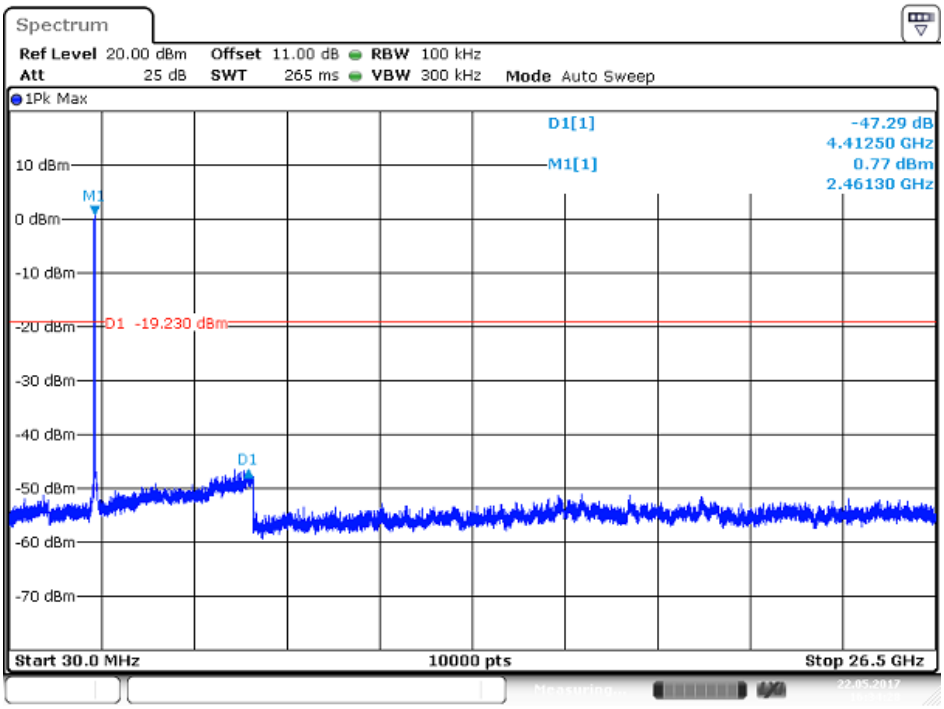
Date: 22.MAY.2017 16:31:09

N20 Mode Middle Channel



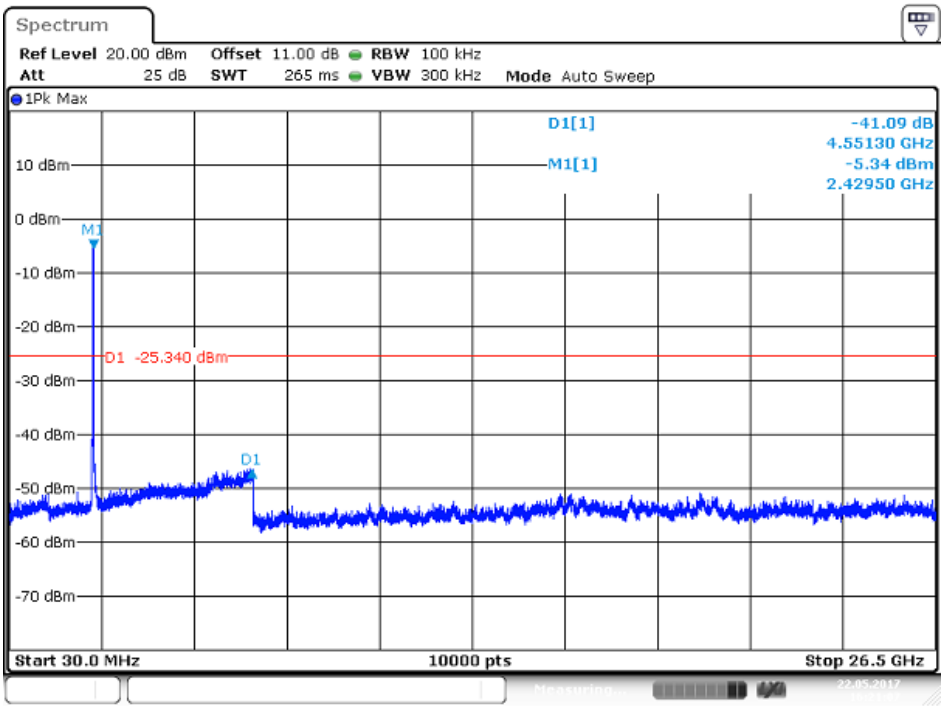
Date: 22.MAY.2017 16:33:02

N20 Mode High Channel



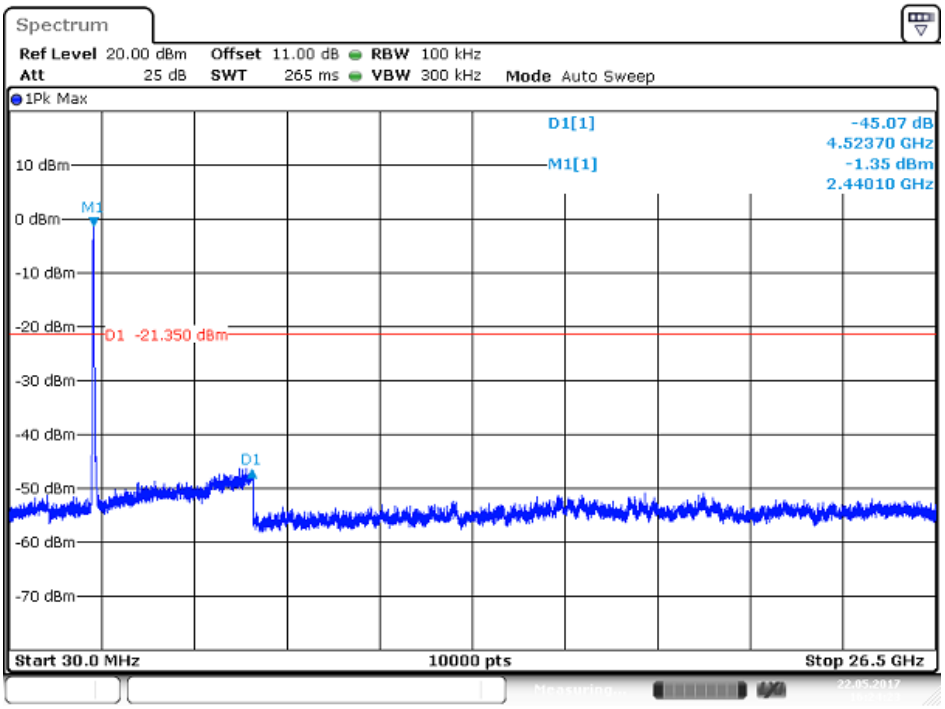
Date: 22.MAY.2017 16:34:28

N40 Mode Low Channel



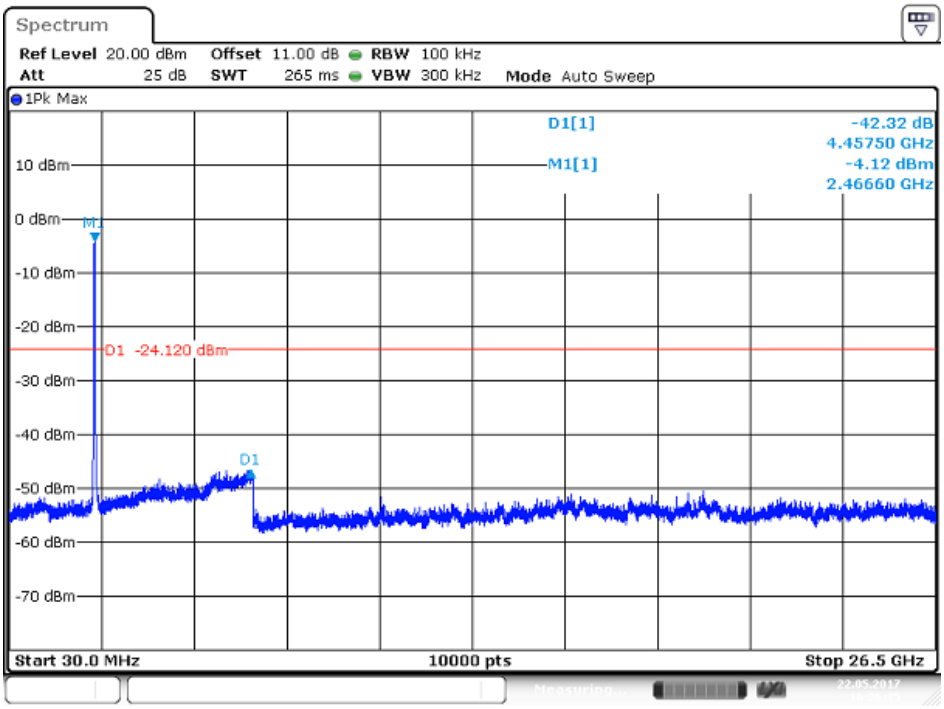
Date: 22.MAY.2017 16:21:07

N40 Mode Middle Channel



Date: 22.MAY.2017 16:24:23

N40 Mode High Channel



Date: 22.MAY.2017 16:26:36

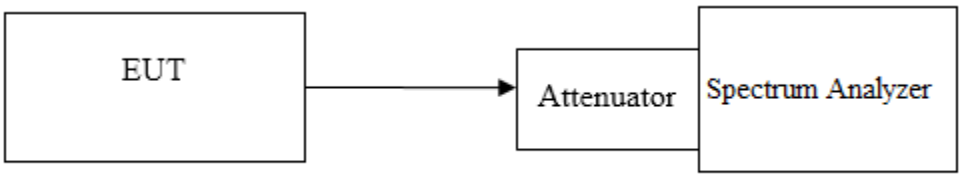
8 FCC §15.247(a)(2) – 6 dB Emission Bandwidth

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
Cable	WOKEN	SFL402	00100A1F6A192S	N.C.R	N.C.R
Spectrum Analyzer	Rohde & Schwarz	FSV40	101203	2016/7/19	2017/7/18
Attenuator	MINI-CIRCUITS	BW-S10W5+	N/A	2017/3/14	2018/3/13

**** 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 David Hsu on 2017-05-22 ~ 2017-08-12.

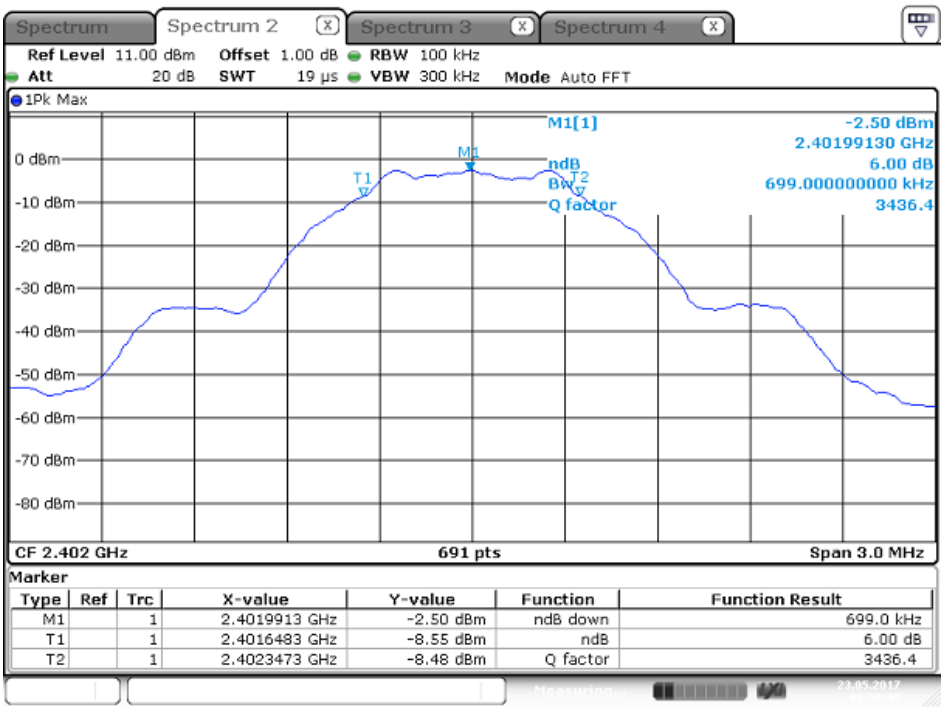
8.5 Test Results

Please refer to the following plots

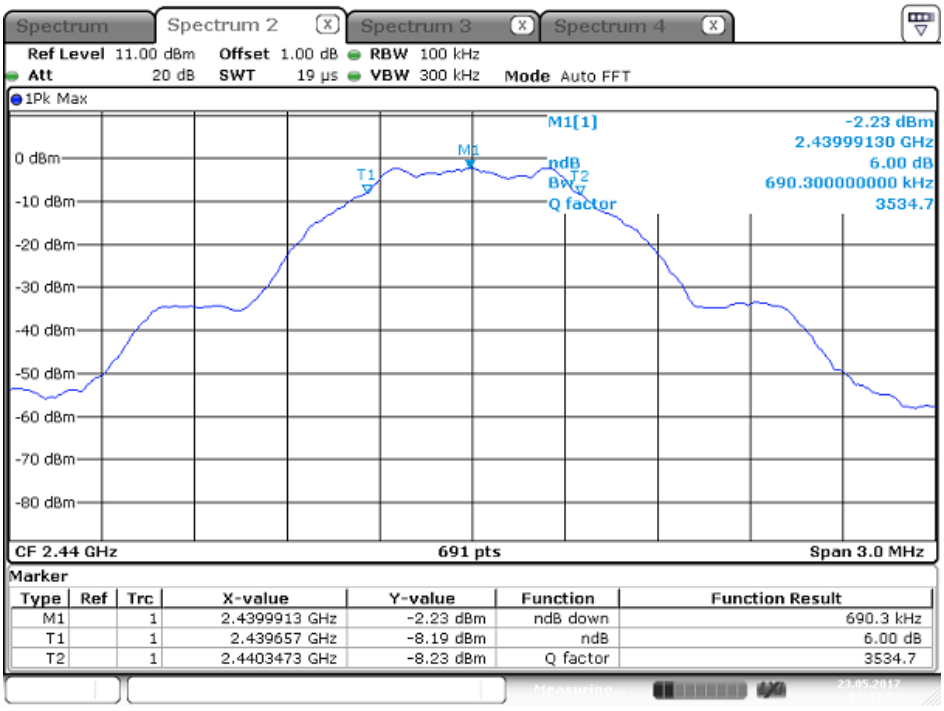
Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	Limit (kHz)	Result
BLE Mode				
Low	2402	0.699	>500	PASS
Mid	2440	0.690	>500	PASS
High	2480	0.699	>500	PASS
B Mode				
Low	2412	10.048	>500	PASS
Mid	2437	10.048	>500	PASS
High	2462	10.048	>500	PASS
G Mode				
Low	2412	16.348	>500	PASS
Mid	2437	16.336	>500	PASS
High	2462	16.360	>500	PASS
N20 Mode				
Low	2412	17.672	>500	PASS
Mid	2437	17.676	>500	PASS
High	2462	17.584	>500	PASS
N40 Mode				
Low	2422	36.046	>500	PASS
Mid	2437	36.318	>500	PASS
High	2452	36.334	>500	PASS

6 dB Emission Bandwidth

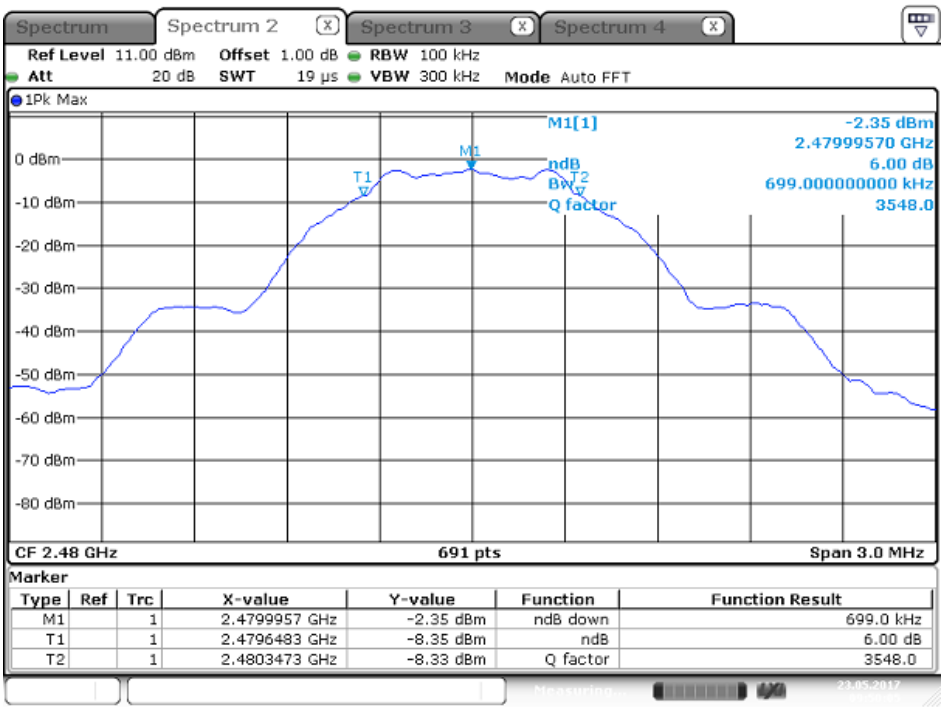
BLE Mode Low Channel



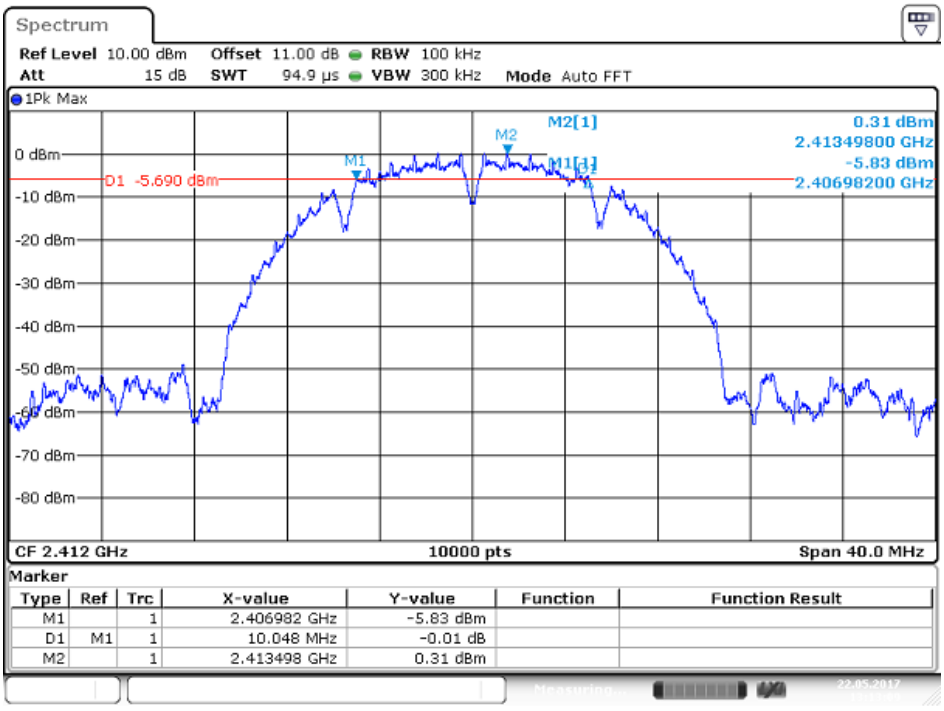
BLE Mode Middle Channel



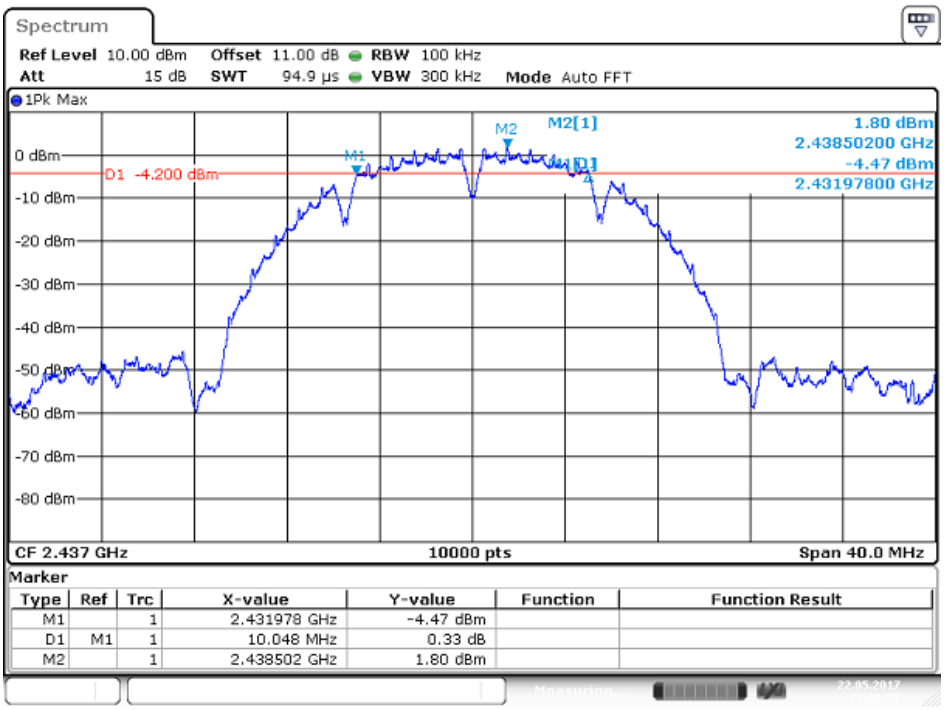
BLE Mode High Channel



B Mode Low Channel

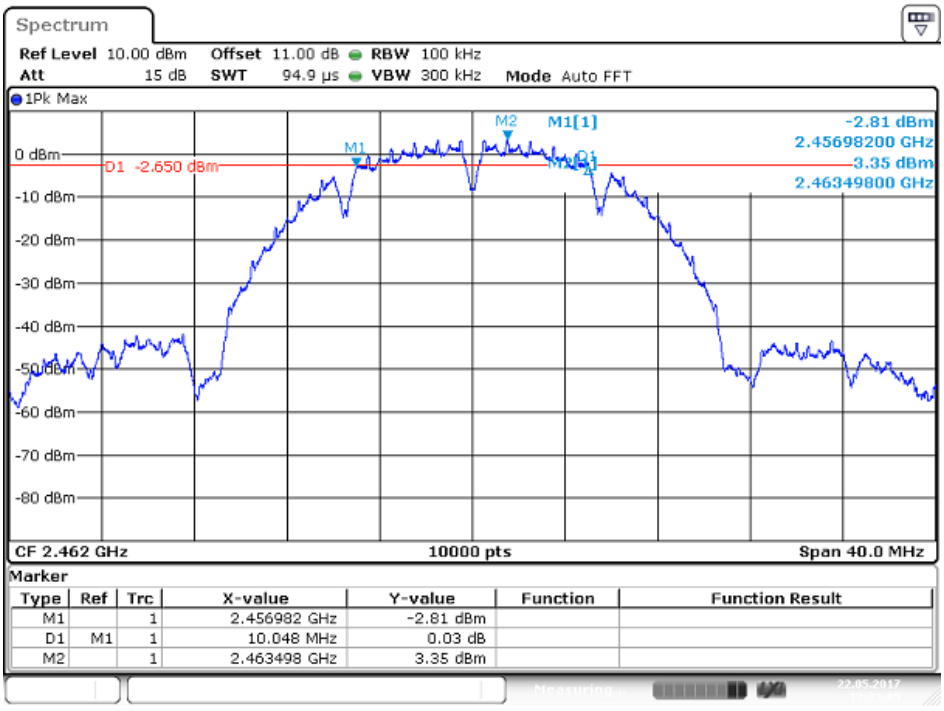


B Mode Middle Channel



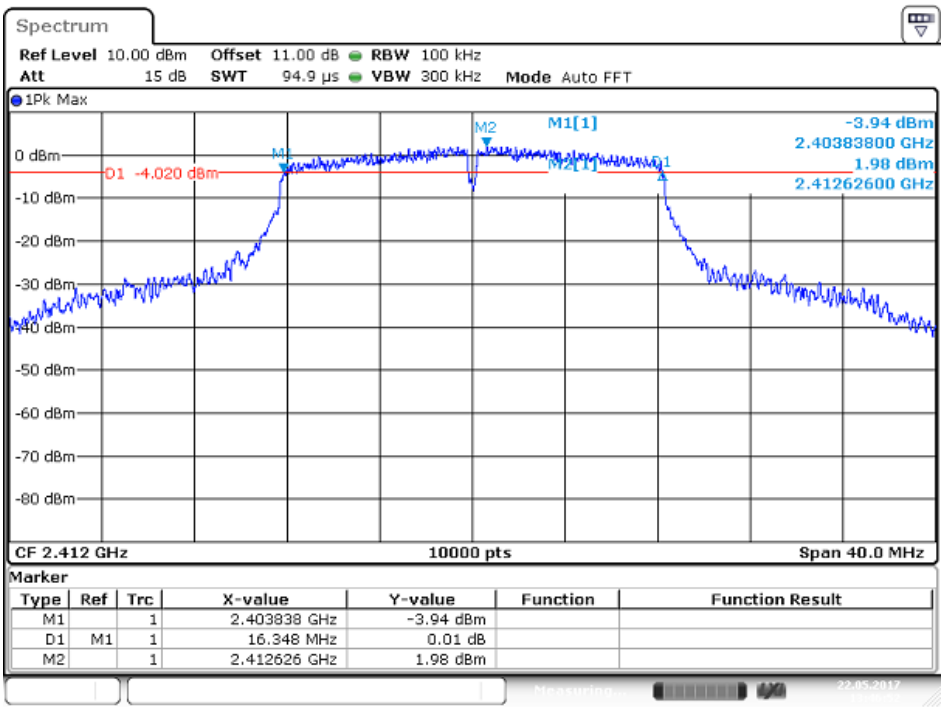
Date: 22MAY.2017 13:20:57

B Mode High Channel



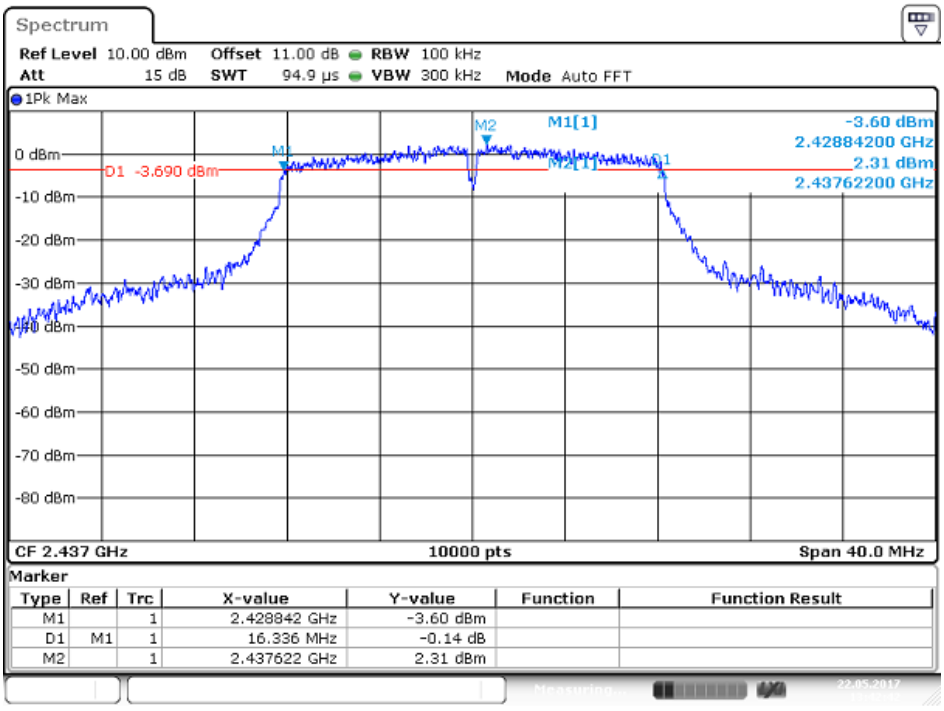
Date: 22MAY.2017 13:23:05

G Mode Low Channel



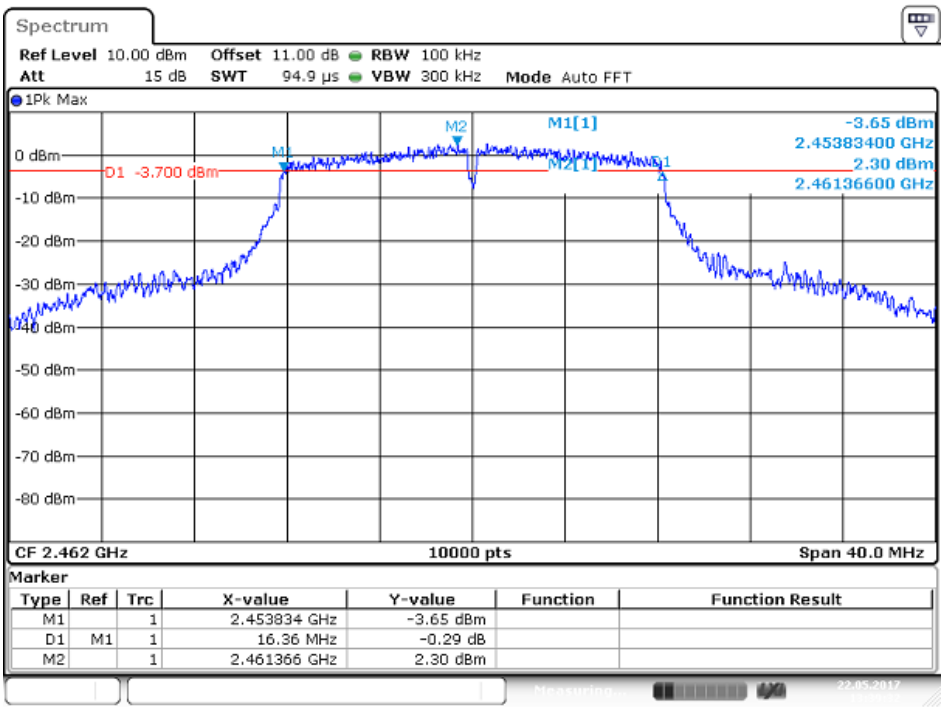
Date: 22MAY.2017 13:46:52

G Mode Middle Channel



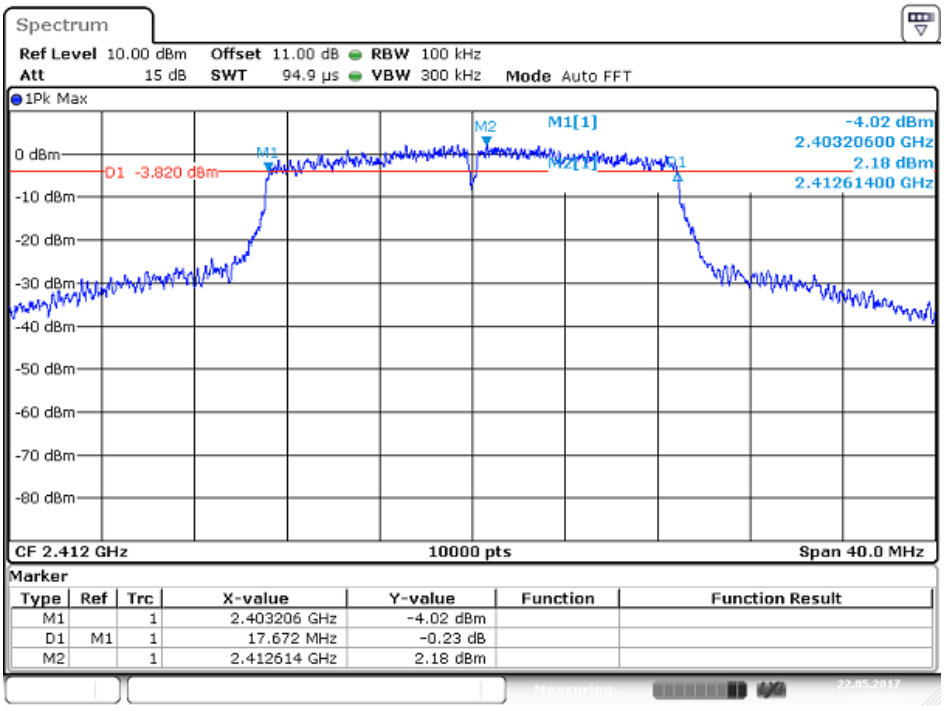
Date: 22MAY.2017 13:42:42

G Mode High Channel



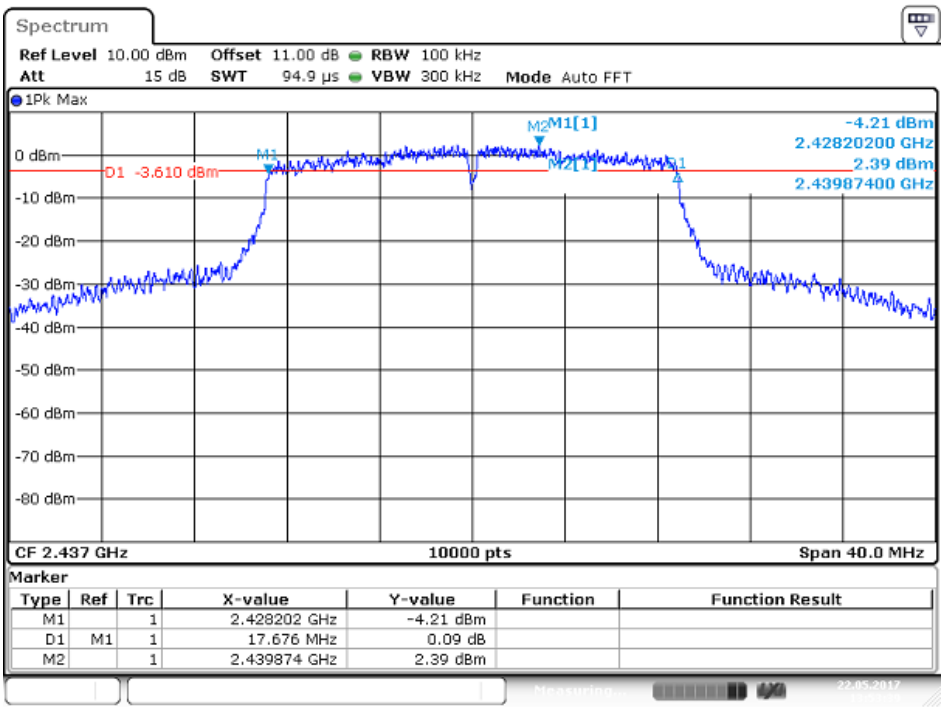
Date: 22MAY.2017 13:39:32

N20 Mode Low Channel



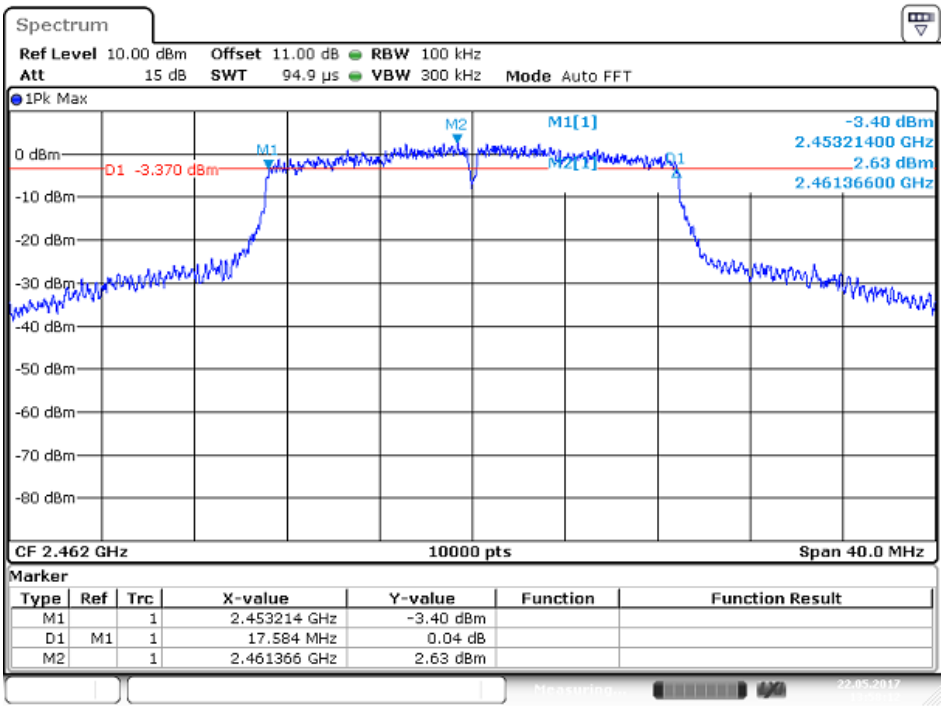
Date: 22MAY.2017 13:50:47

N20 Mode Middle Channel



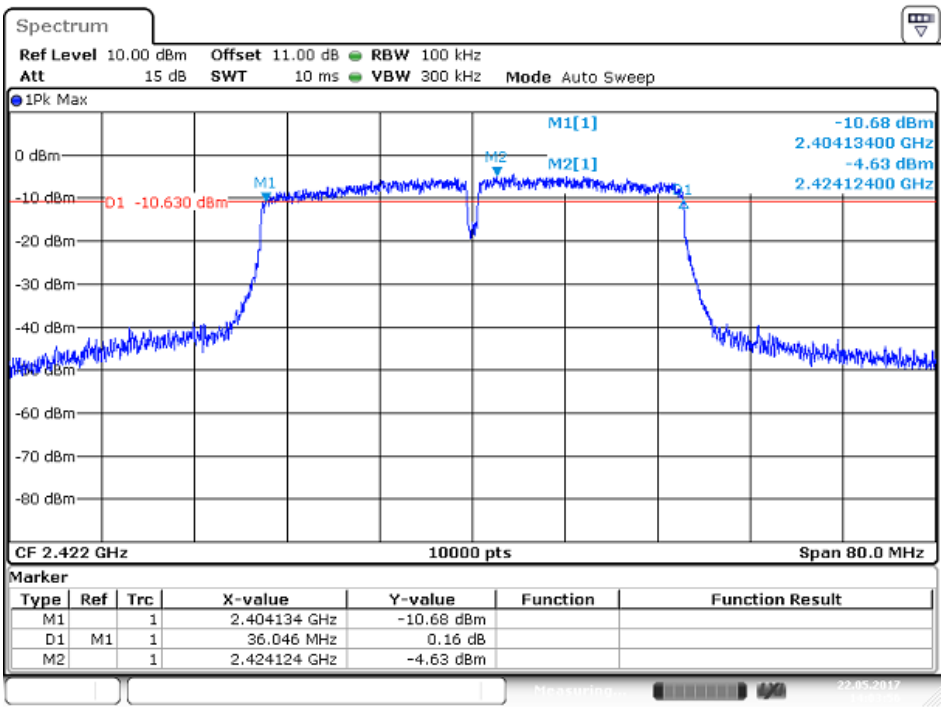
Date: 22MAY.2017 13:53:38

N20 Mode High Channel



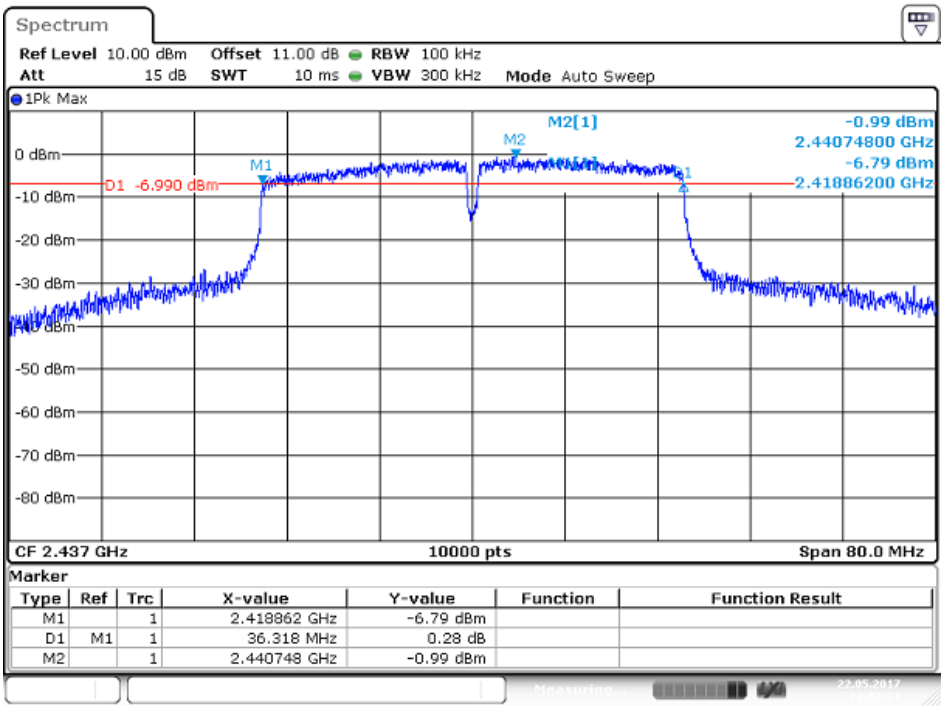
Date: 22MAY.2017 13:58:13

N40 Mode Low Channel



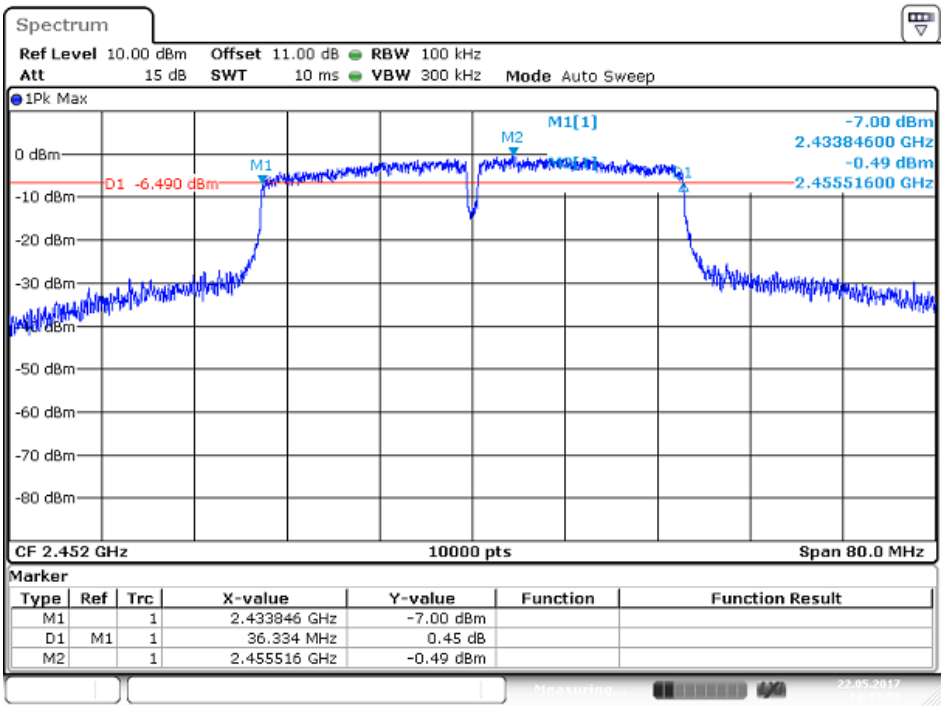
Date: 22MAY.2017 14:03:56

N40 Mode Middle Channel



Date: 22MAY.2017 14:07:11

N40 Mode High Channel



Date: 22MAY.2017 14:13:53

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

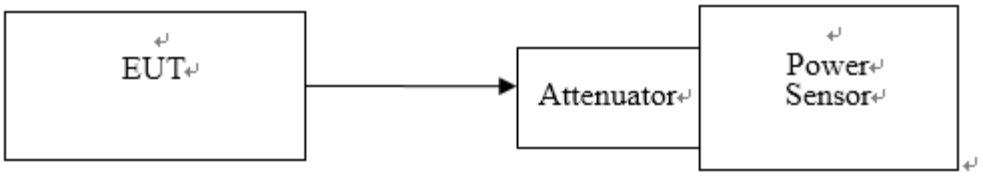
9.1 Applicable Standard

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 sence.
3. Add a correction factor to the display.



9.3 Test Equipment List and Details

Descriptions	Manufacturers	Models	Serial Numbers	Calibration Date	Calibration Due Date
Cable	WOKEN	SFL402	00100A1F6A192S	N.C.R	N.C.R
Power Sensor	KEYSIGHT	U2021XA	MY54080018	2017/3/21	2018/3/20
Attenuator	MINI-CIRCUITS	BW-S10W5+	N/A	2017/3/14	2018/3/13

**** 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 David Hsu on 2017-05-22 ~ 2017-05-23.

9.5 Test Results

Channel	Frequency (MHz)	Conducted Peak Output Power (dBm)	Limit (dBm)	Result
BLE Mode				
Low	2402	-1.81	30	PASS
Mid	2440	-1.34	30	PASS
High	2480	-1.38	30	PASS
B Mode				
Low	2412	15.45	30	PASS
Mid	2437	17.42	30	PASS
High	2462	18.29	30	PASS
G Mode				
Low	2412	22.91	30	PASS
Mid	2437	23.05	30	PASS
High	2462	22.78	30	PASS
N20 Mode				
Low	2412	22.62	30	PASS
Mid	2437	22.97	30	PASS
High	2462	22.98	30	PASS
N40 Mode				
Low	2422	19.95	30	PASS
Mid	2437	22.04	30	PASS
High	2452	21.70	30	PASS

Channel	Frequency (MHz)	Conducted Average Output Power (dBm)	Duty factor (dB)	Total Conducted Average Output Power (dBm)	Limit (dBm)	Result
BLE Mode						
Low	2402	-4.15	2.22	-1.93	30	PASS
Mid	2440	-3.71	2.22	-1.49	30	PASS
High	2480	-3.90	2.22	-1.68	30	PASS
B Mode						
Low	2412	12.19	0	12.19	30	PASS
Mid	2437	14.27	0	14.27	30	PASS
High	2462	15.22	0	15.22	30	PASS
G Mode						
Low	2412	15.11	0	15.11	30	PASS
Mid	2437	15.14	0	15.14	30	PASS
High	2462	14.98	0	14.98	30	PASS
N20 Mode						
Low	2412	15.03	0	15.03	30	PASS
Mid	2437	14.97	0	14.97	30	PASS
High	2462	14.79	0	14.79	30	PASS
N40 Mode						
Low	2422	11.64	0	11.64	30	PASS
Mid	2437	14.94	0	14.94	30	PASS
High	2452	12.53	0	12.53	30	PASS

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

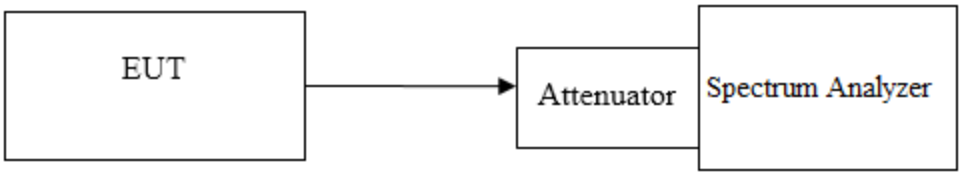
10.1 Applicable Standard

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
Cable	WOKEN	SFL402	00100A1F6A192S	N.C.R	N.C.R
Spectrum Analyzer	Rohde & Schwarz	FSV40	101203	2016/7/19	2017/7/18
Attenuator	MINI-CIRCUITS	BW-S10W5+	N/A	2017/3/14	2018/3/13

**** 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

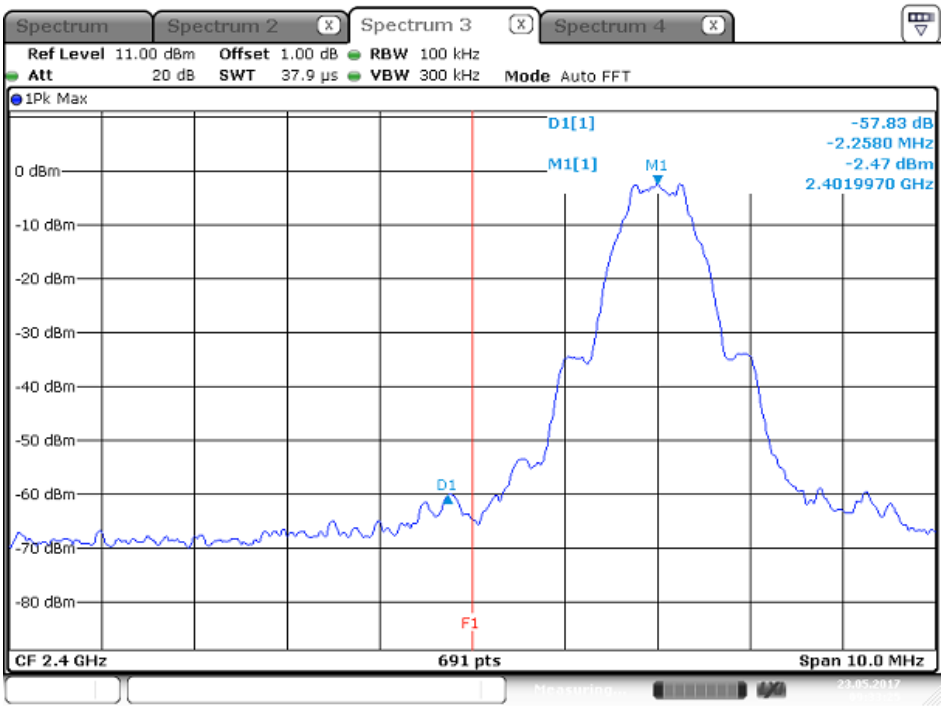
The testing was performed by David Hsu on 2017-05-22 ~ 2017-05-23.

10.5 Test Results

Please refer to the following plots

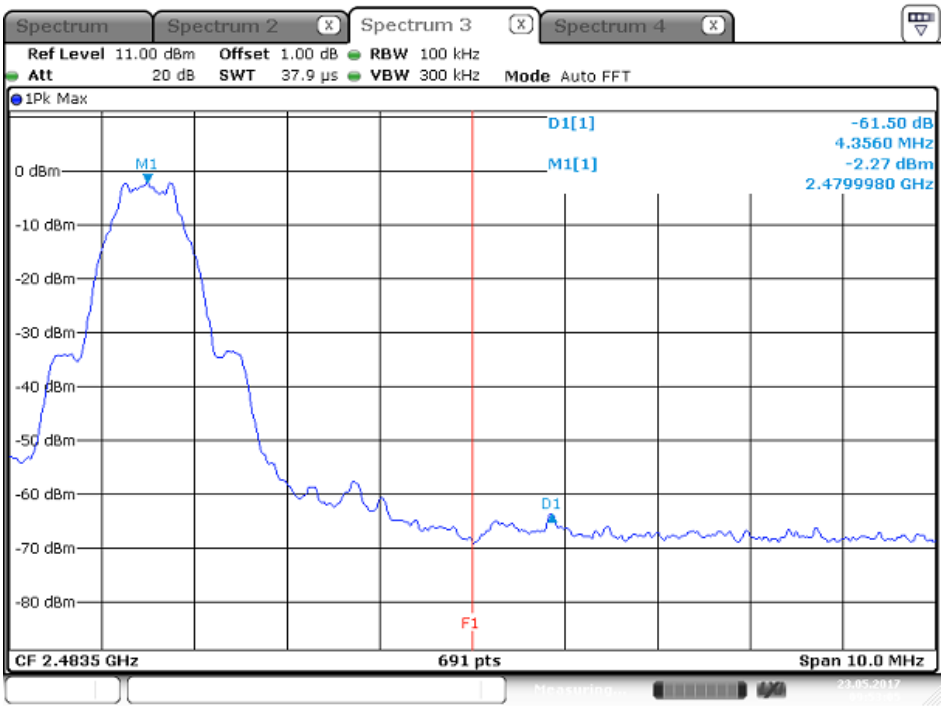
Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)	Result
BLE Mode				
Low	2402	57.83	≥ 20	PASS
High	2480	61.50	≥ 20	PASS
B Mode				
Low	2412	47.90	≥ 20	PASS
High	2462	52.97	≥ 20	PASS
G Mode				
Low	2412	29.98	≥ 20	PASS
High	2462	42.15	≥ 20	PASS
N20 Mode				
Low	2412	26.93	≥ 20	PASS
High	2462	41.48	≥ 20	PASS
N40 Mode				
Low	2422	33.60	≥ 20	PASS
High	2452	35.98	≥ 20	PASS

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



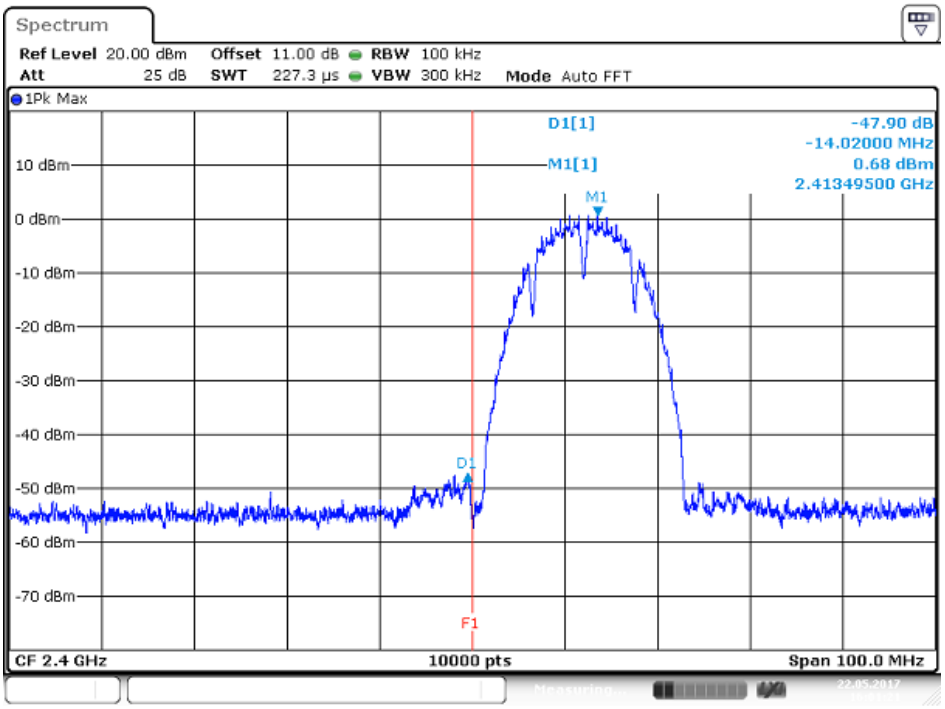
Date: 23MAY.2017 09:33:26

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



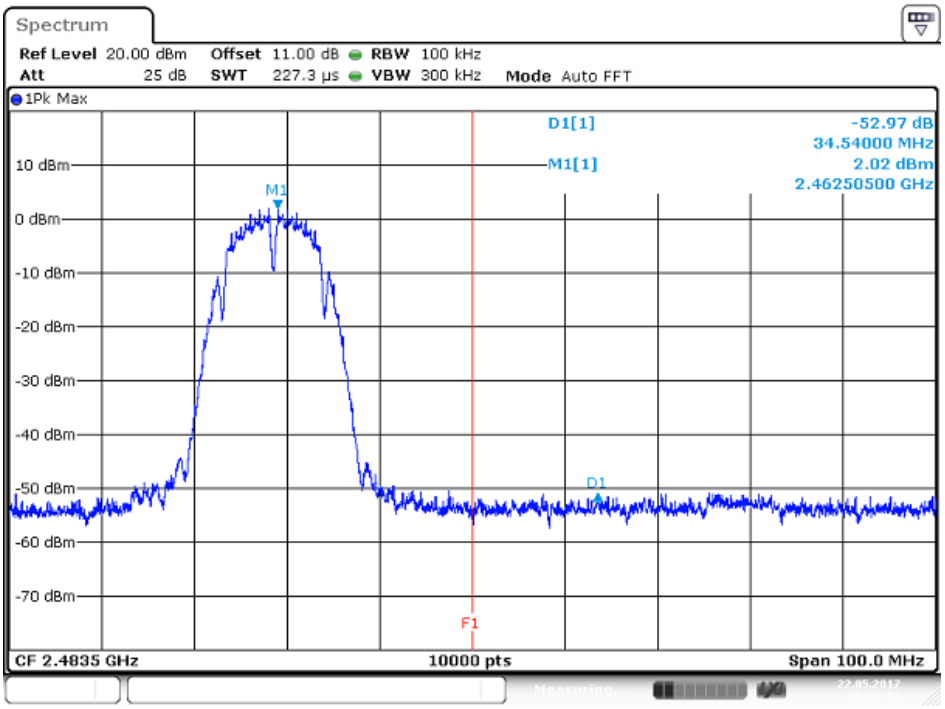
Date: 23MAY.2017 09:53:04

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



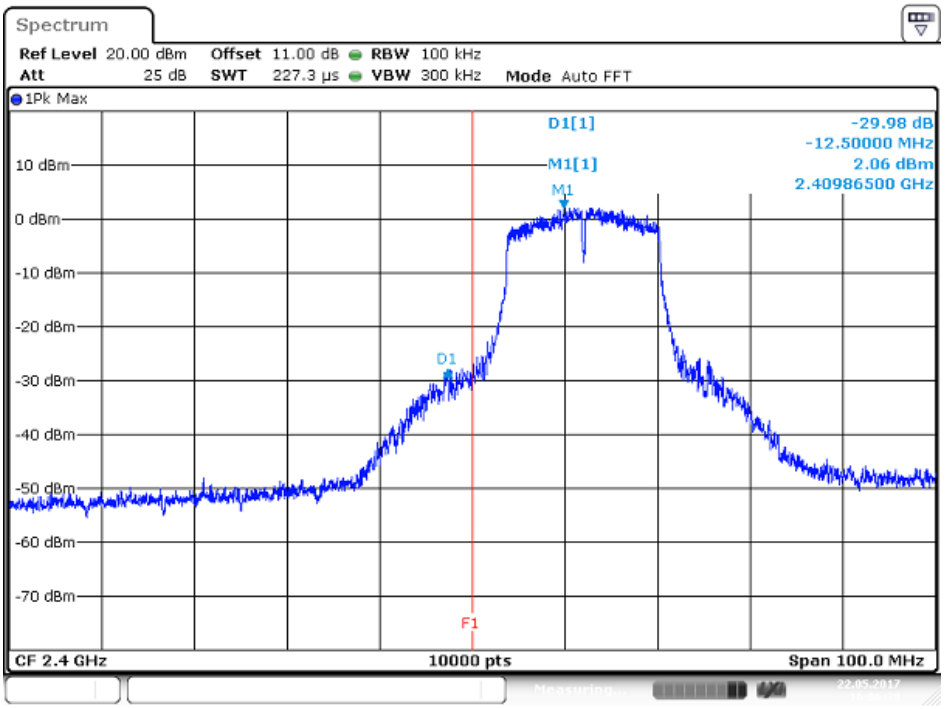
Date: 22.MAY.2017 16:01:21

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



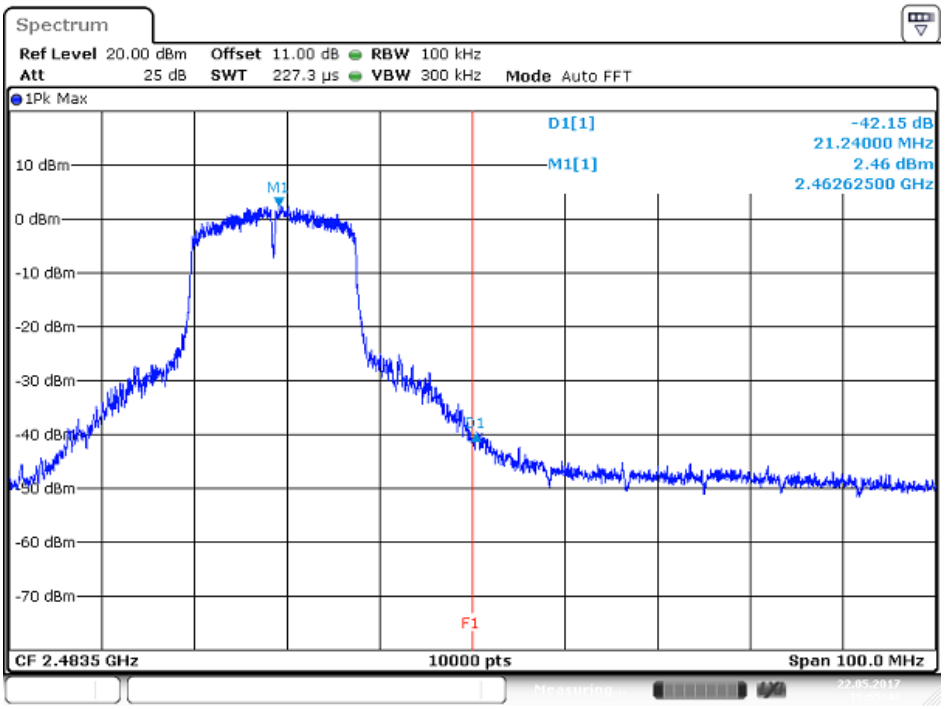
Date: 22.MAY.2017 15:56:57

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



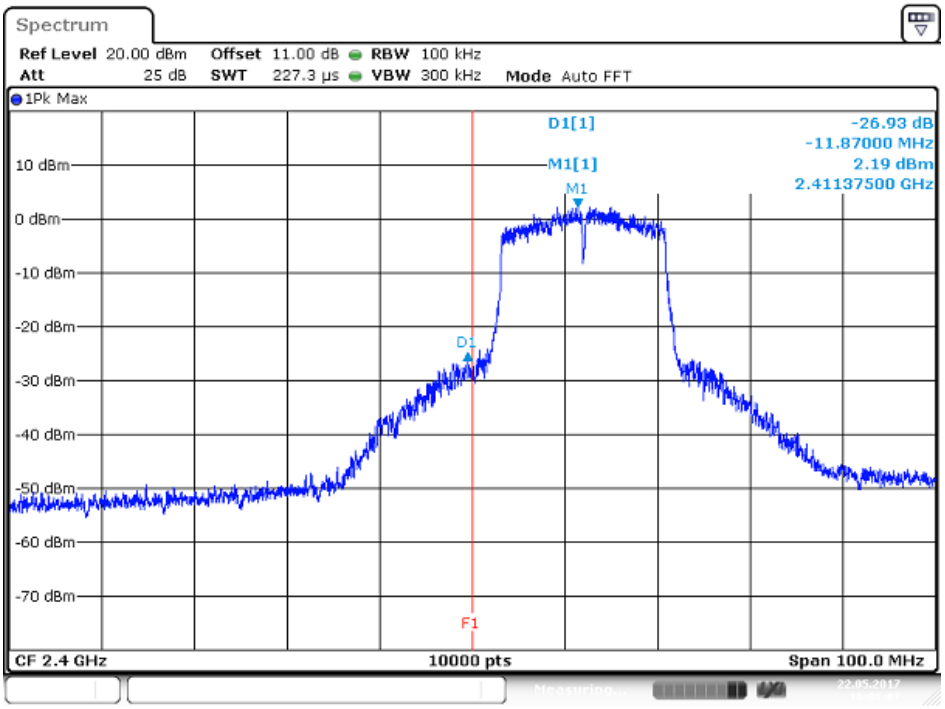
Date: 22.MAY.2017 16:06:39

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



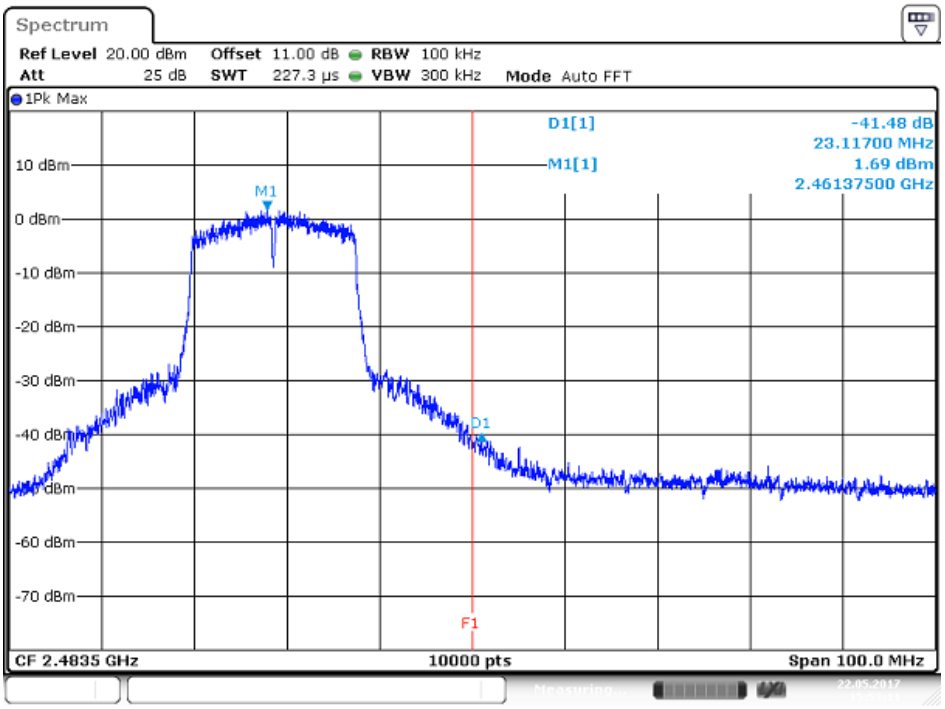
Date: 22.MAY.2017 15:55:42

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



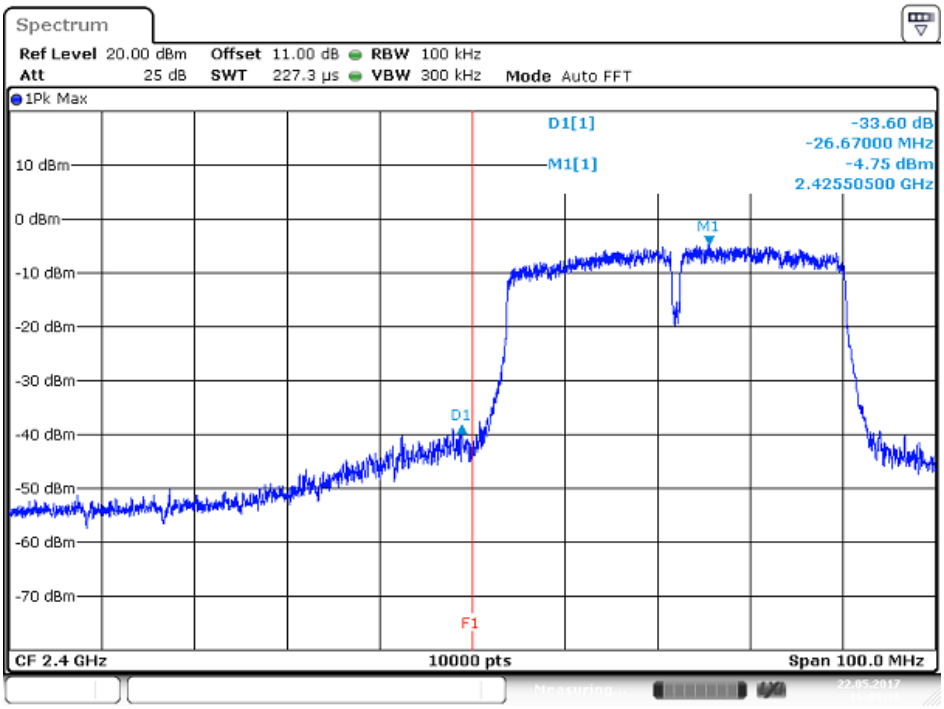
Date: 22.MAY.2017 16:08:08

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



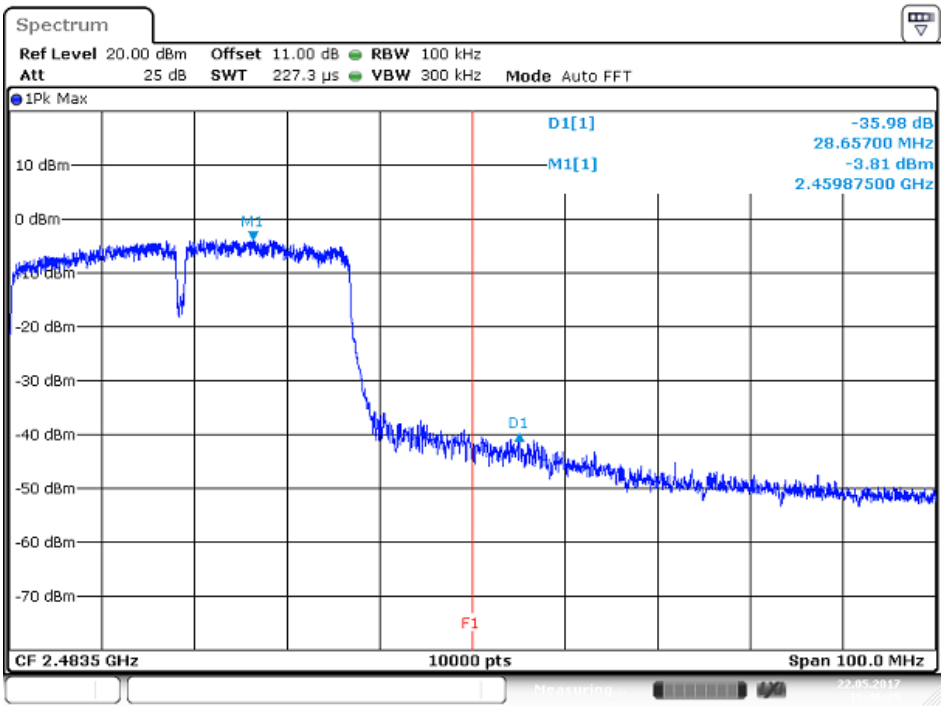
Date: 22.MAY.2017 15:53:10

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



Date: 22.MAY.2017 16:09:37

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



Date: 22.MAY.2017 15:46:25

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.

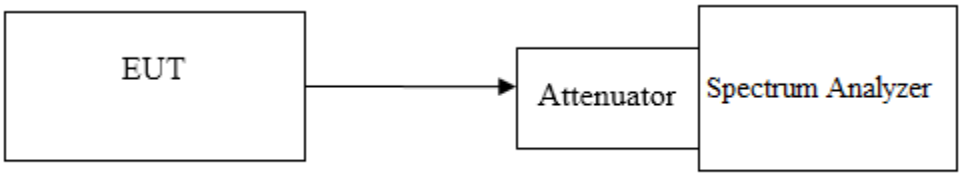
f) Sweep time = auto couple.

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
Cable	WOKEN	SFL402	00100A1F6A192S	N.C.R	N.C.R
Spectrum Analyzer	Rohde & Schwarz	FSV40	101203	2016/7/19	2017/7/18
Attenuator	MINI-CIRCUITS	BW-S10W5+	N/A	2017/3/14	2018/3/13

**** 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

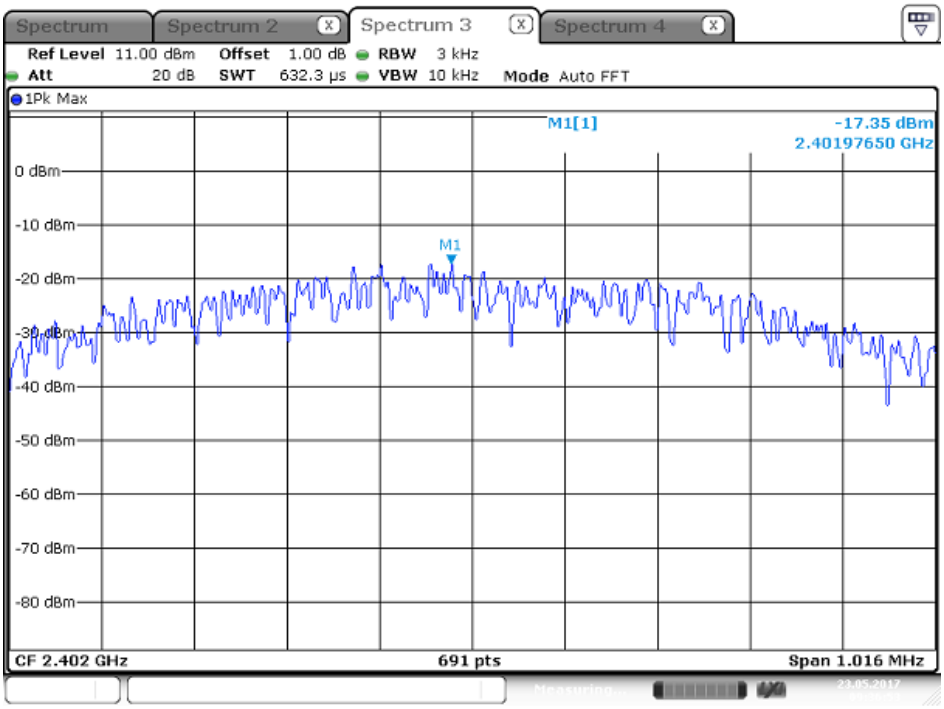
The testing was performed by David Hsu on 2017-05-22 ~ 2017-08-12.

11.5 Test Results

Please refer to the following plots

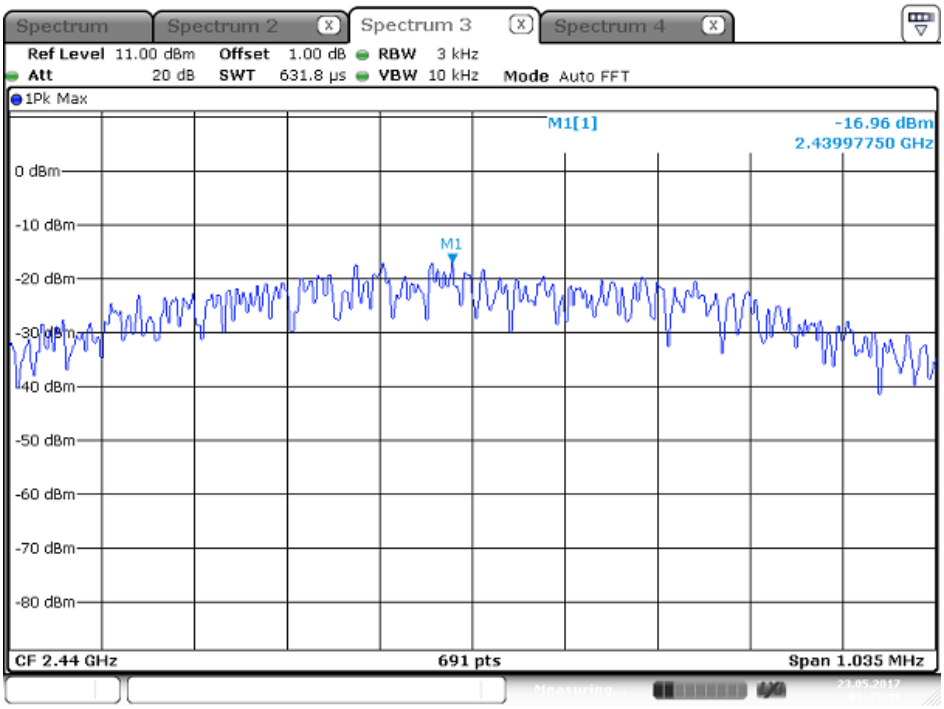
Channel	Frequency (MHz)	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
BLE Mode				
Low	2402	-17.35	8	PASS
Mid	2440	-16.96	8	PASS
High	2480	-17.16	8	PASS
B Mode				
Low	2412	-16.46	8	PASS
Mid	2437	-14.13	8	PASS
High	2462	-14.28	8	PASS
G Mode				
Low	2412	-14.04	8	PASS
Mid	2437	-13.86	8	PASS
High	2462	-12.06	8	PASS
N20 Mode				
Low	2412	-11.75	8	PASS
Mid	2437	-11.68	8	PASS
High	2462	-12.46	8	PASS
N40 Mode				
Low	2422	-12.86	8	PASS
Mid	2437	-12.96	8	PASS
High	2452	-12.98	8	PASS

BLE Mode PPSD, Low Channel



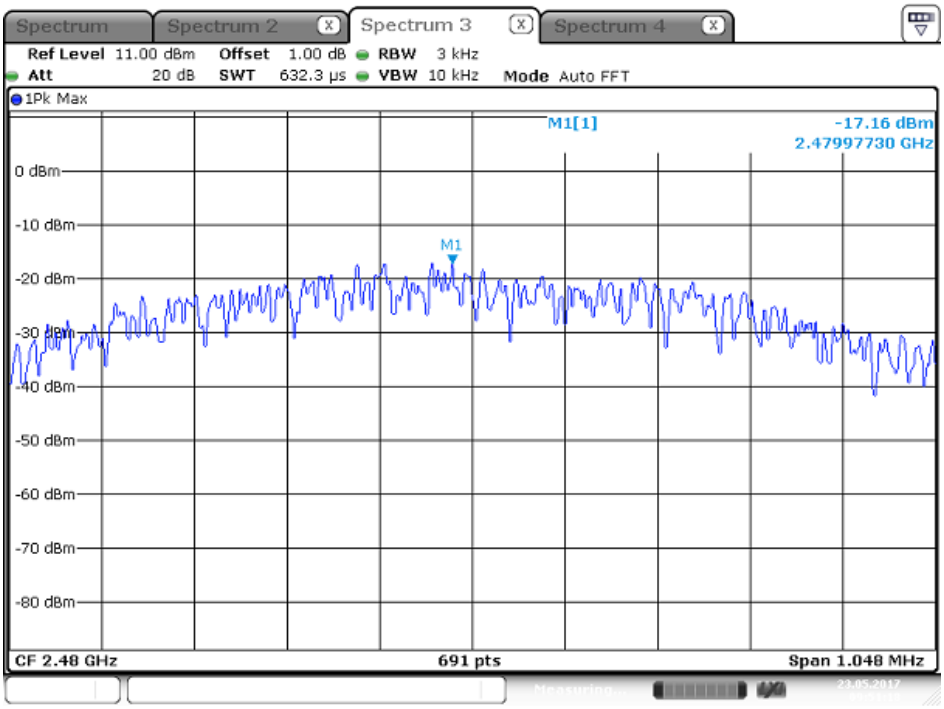
Date: 23MAY.2017 09:36:58

BLE Mode PPSD, Middle Channel



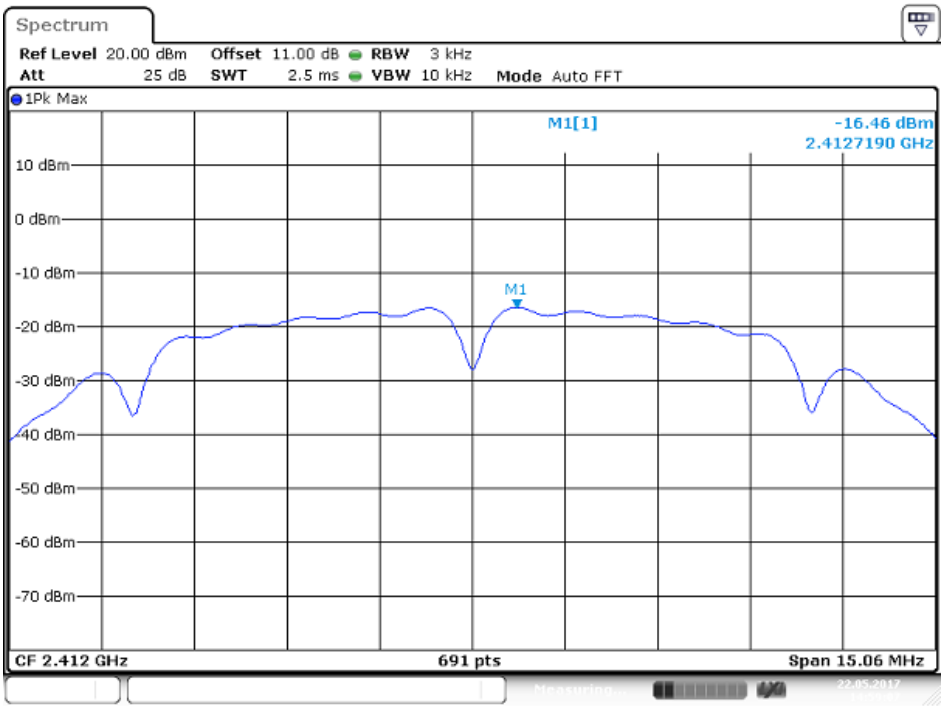
Date: 23MAY.2017 09:45:42

BLE Mode PPSD, High Channel



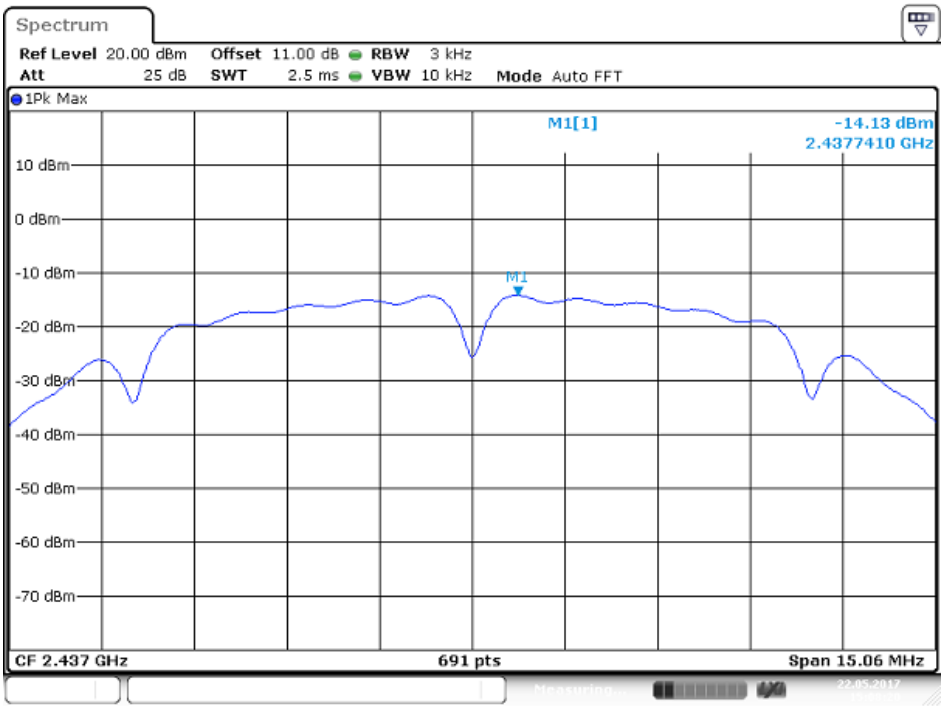
Date: 23MAY.2017 09:51:18

B Mode PPSD, Low Channel



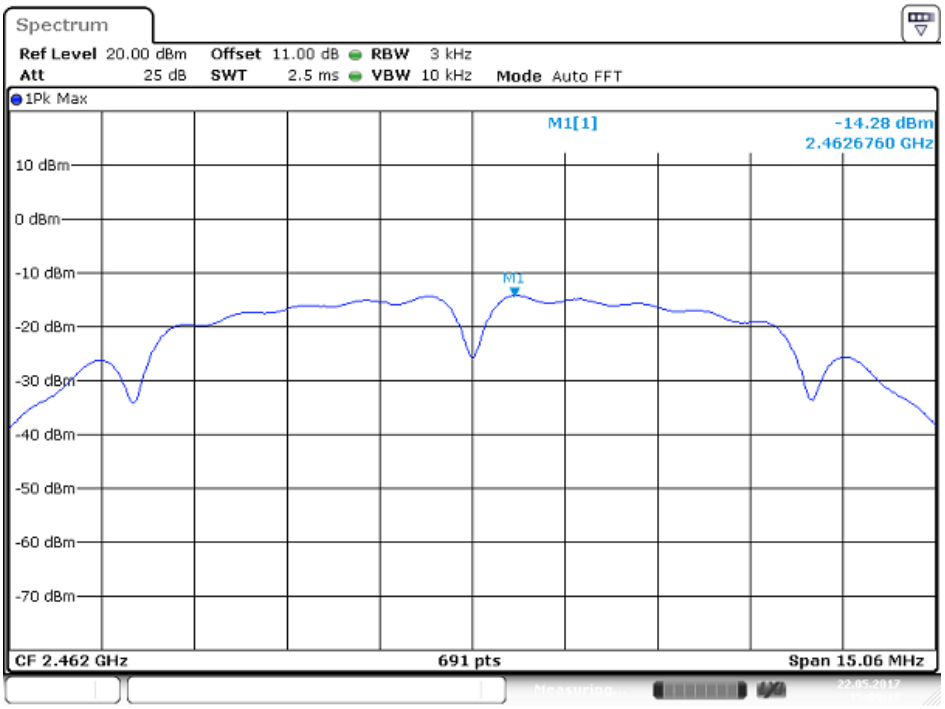
Date: 22MAY.2017 14:59:08

B Mode PPSD, Middle Channel



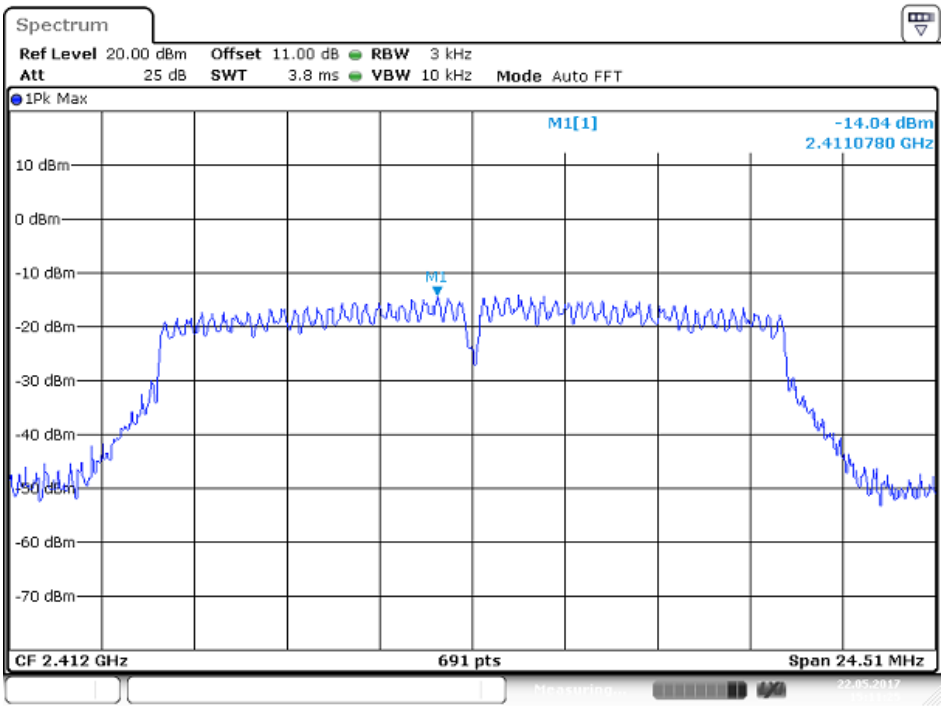
Date: 22.MAY.2017 15:08:20

B Mode PPSD, High Channel



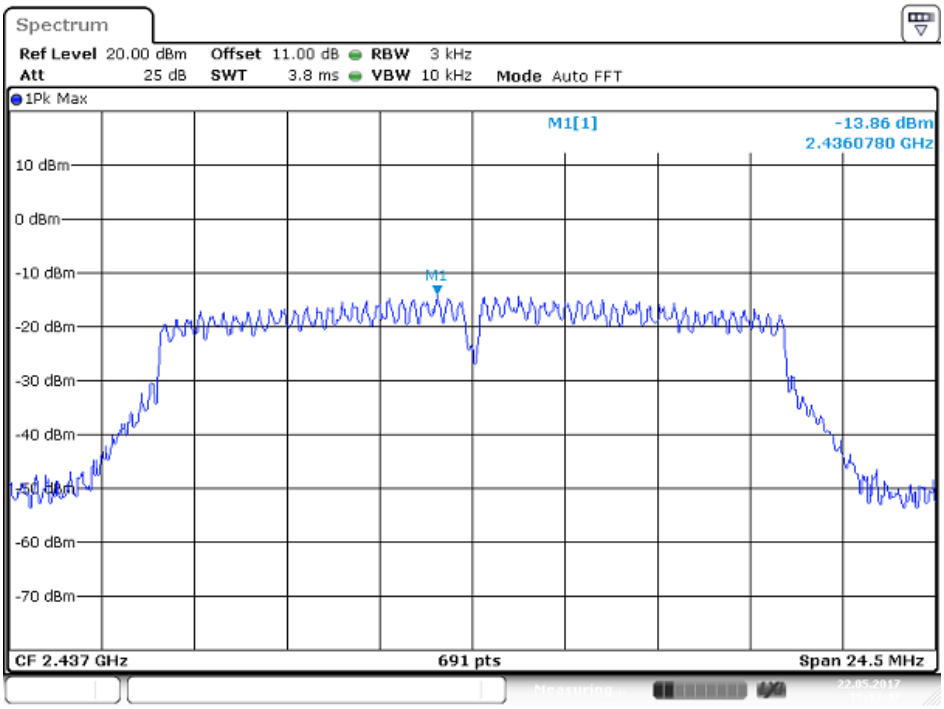
Date: 22.MAY.2017 15:09:18

G Mode PPSD, Low Channel



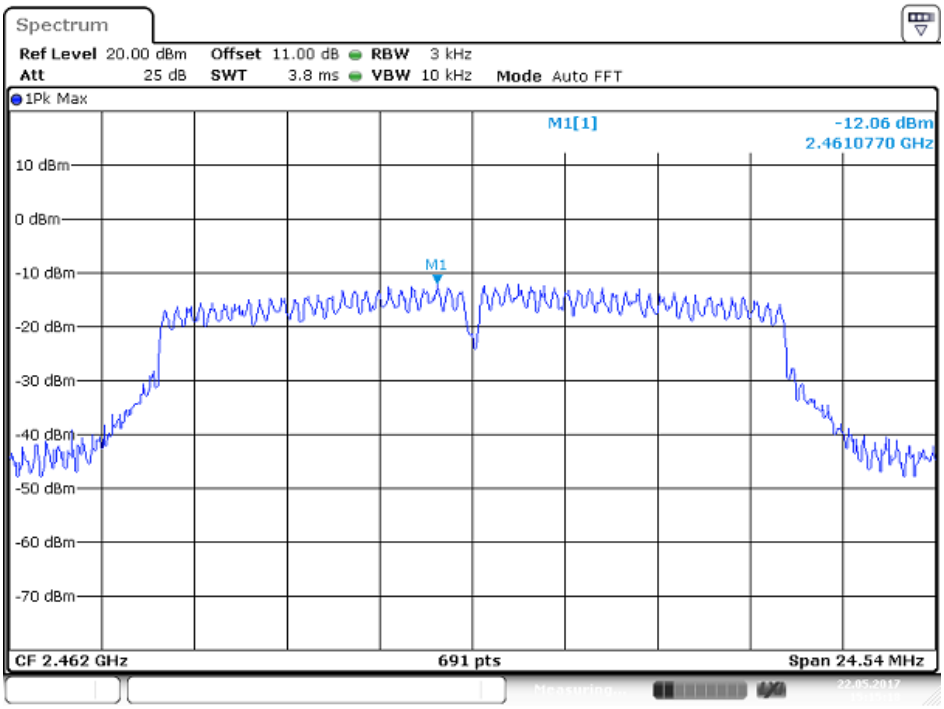
Date: 22MAY.2017 15:11:25

G Mode PPSD, Middle Channel



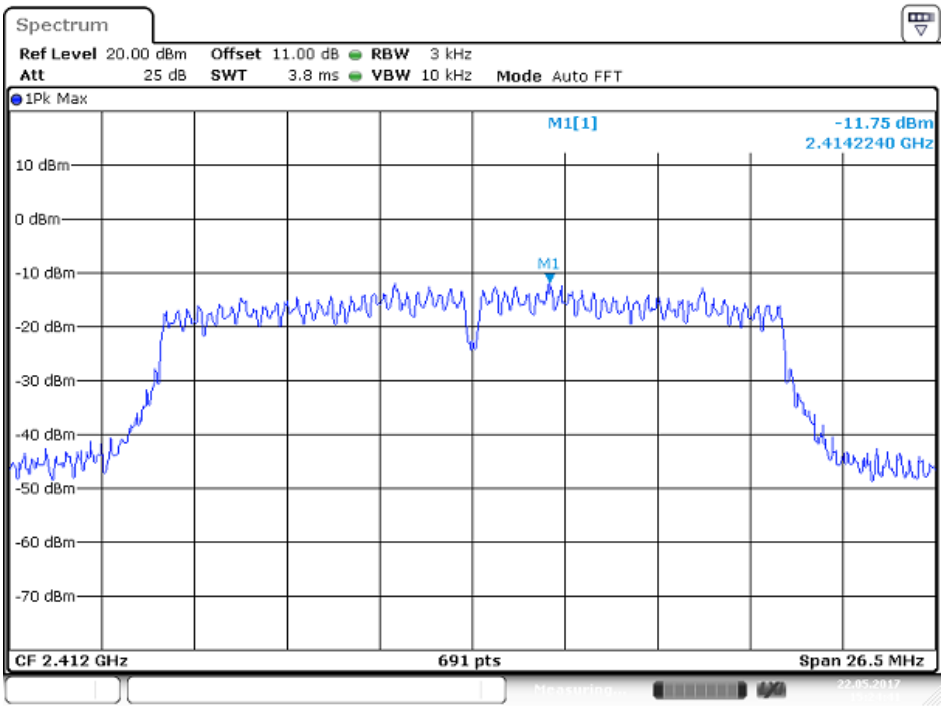
Date: 22MAY.2017 15:13:47

G Mode PPSD, High Channel



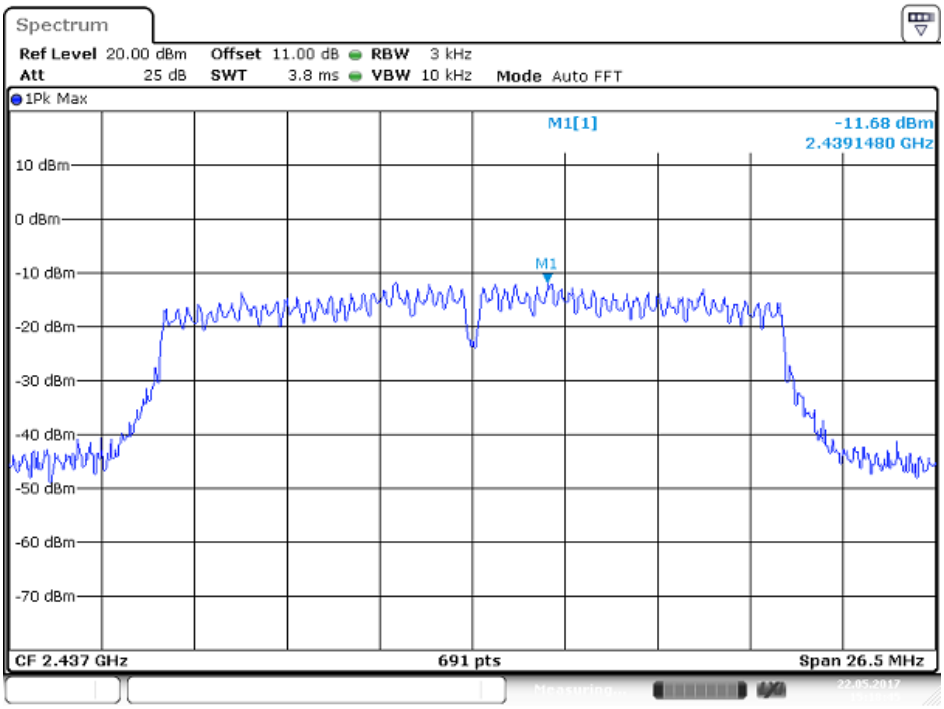
Date: 22MAY.2017 15:15:19

N20 Mode PPSD, Low Channel



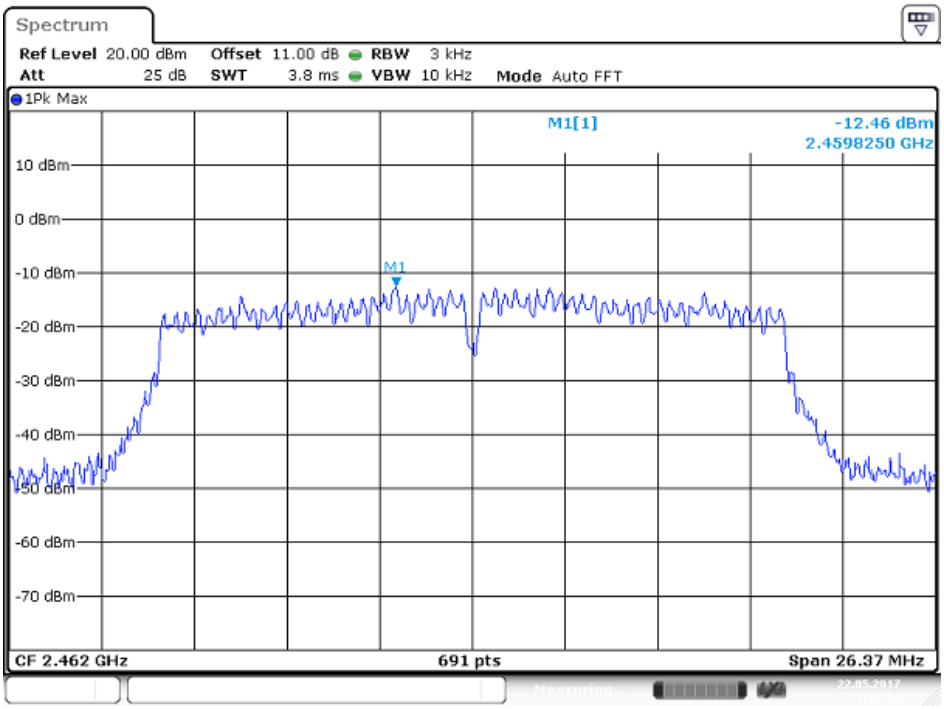
Date: 22MAY.2017 15:24:41

N20 Mode PPSD, Middle Channel



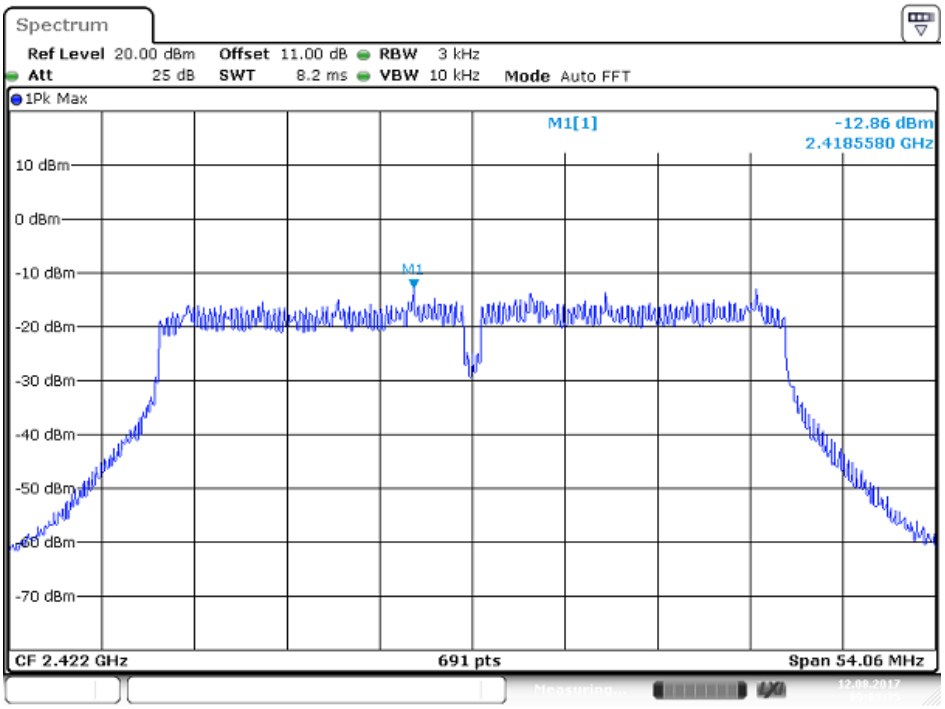
Date: 22MAY.2017 15:18:45

N20 Mode PPSD, High Channel



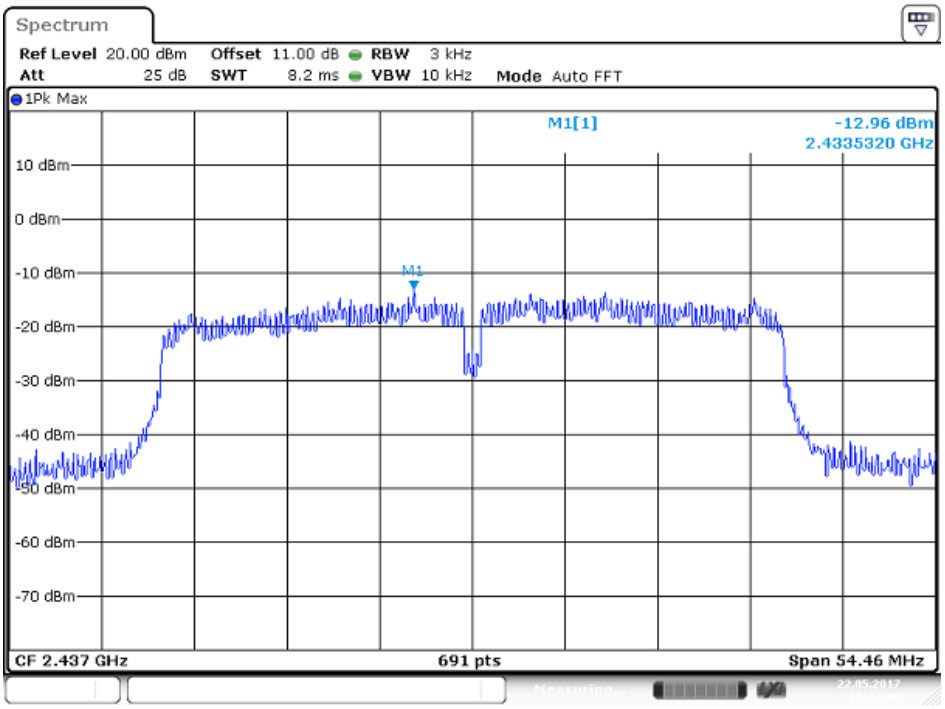
Date: 22MAY.2017 15:17:04

N40 Mode PPSD, Low Channel



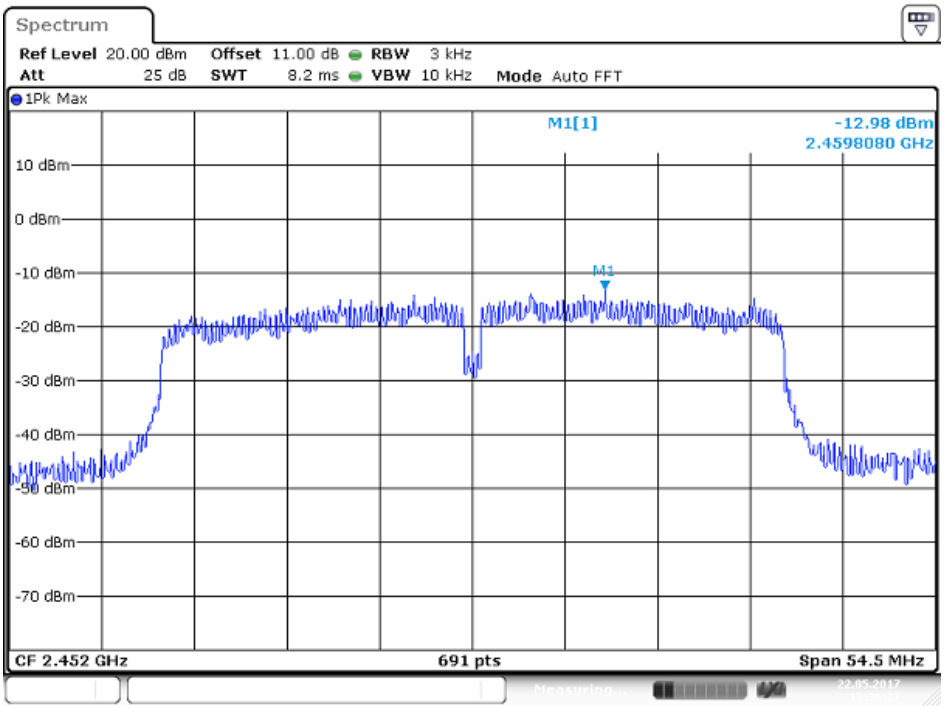
Date: 12.AUG.2017 09:08:36

N40 Mode PPSD, Middle Channel



Date: 22.MAY.2017 15:34:41

N40 Mode PPSD, High Channel



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