FCC Part 15.247

TEST REPORT

For

Draytek Corporation

No. 26, Fu shing Rd., Hukou County, Hsinchu Industrial Park Hsinchu, 303, Taiwan

FCC ID: VGYAP920

Report Type:	**Product Type:**
Original Report	Outdoor Extreme Power Wireless AP

Report Producer: Kaylee Chiang

Report Number: RTWA171117001-00D

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Reviewed By: Jerry Chang

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REVISION HISTORY

Revision	No.	Report Number	Issue Date	Description	Author/ Revised by
1.0	RTWA171117001	RTWA171117001-00D	2018.06.11	Original Report	Kaylee

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1 General Information

1.1 Product Description for Equipment Under Test (EUT)

Applicant:	Draytek Corporation No. 26, Fu shing Rd., Hukou County, Hsinchu Industrial Park Hsinchu, 303, Taiwan
Manufacturer:	Draytek Corporation No. 26, Fu shing Rd., Hukou County, Hsinchu Industrial Park Hsinchu, 303, Taiwan
Product:	Outdoor Extreme Power Wireless AP
Main Model:	VigorAP 920RPD
Series Mode:	VigorAP 920R, VigorAP 920RP, VigorAP 920RD
Trade Name:	DrayTek
Frequency Range:	IEEE 802.11b/g / IEEE 802.11n HT20 Mode: 2412 ~ 2462 MHz IEEE 802.11n HT40 Mode: 2422 ~ 2452 MHz
Transmit Power:	IEEE 802.11b Mode: 29.14 dBm (0.820W) IEEE 802.11g Mode: 29.67 dBm (0.927W) IEEE 802.11n HT20 Mode: 29.61 dBm (0.914W) IEEE 802.11n HT40 Mode: 29.27 dBm (0.845W)
Modulation Technique:	IEEE 802.11b: DSSS IEEE 802.11g: OFDM IEEE 802.11n HT20 Mode: OFDM IEEE 802.11n HT40 Mode: OFDM
Transmit Data Rate:	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 Mode: 6.5, 7.2, 13, 14.4, 14.44, 19.5, 21.7, 26, 28.89, 28.9, 39, 43.3, 43.33 52, 57.78, 57.8, 58.5, 65.0, 72.2, 78, 86.67, 104, 115.56, 117, 130, 144.44 Mbps IEEE 802.11n HT 40 Mode: 13.5, 15,27, 30, 40.5, 45, 54, 60, 81, 90, 108, 120, 121.5, 135, 150, 162, 180, 216, 240, 243, 270, 300 Mbps
Number of Channels:	IEEE 802.11b/g / IEEE 802.11n HT20 Mode: 11 Channels IEEE 802.11n HT40 Mode: 7 Channels
Antenna Specification:	Diploe Antenna/Gain: 3.12 dBi
Voltage Range:	56Vdc, 800mA
Date of Test:	Nov 27, 2017 ~ Jan 29, 2018

**All measurement and test data in this report was gathered from production sample serial number: 171117001 (Assigned by BACL, Taiwan). The EUT supplied by the applicant was received on 2017-11-17.*

PoE Information:

Model: GRT-560080A

Input: 100-240Vac, 50/60Hz

Output: 56Vdc, 800mA

Model Difference: The major electrical and mechanical constructions of series models are identical to the basic model, except different Market segmentation. Please refer to the Declaration of similarity letter for more detail.

1.2 Objective

This report is prepared on behalf of *Draytek Corporation* 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 15.407 UNII submission with FCC ID: VGYAP920

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

KDB 662911 D01 Multiple Transmitter Output v02r01

KDB 558074 D01 DTS Meas Guidance v04

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 FCC 2.948(e) by 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 tested with channel 1, 6 and 11.
For 802.11n40 Mode were tested with channel 3, 6 and 9.

SISO mode and MIMO mode have the same power level setting and base on output power testing, MIMO mode power than SISO mode large, MIMO mode was selected for full testing.

The device supports MIMO (CDD) at all modes.

2.2 Equipment Modifications

No modification was made to the EUT

2.3 EUT Exercise Software

Used "QCA Radio Control Toolkit" software.

Engineering Mode		Chain 0		
Test Frequency		Low	Mid	High
Power Level Setting	B Mode MIMO(CDD)	21.5	23.3	24.2
	G Mode MIMO(CDD)	16	18	18
	N20 Mode MIMO(CDD)	16	18	18
	N40 Mode MIMO(CDD)	13	17	17
Engineering Mode		Chain 1		
Test Frequency		Low	Mid	High
Power Level Setting	B Mode MIMO(CDD)	21.5	23.3	24.2
	G Mode MIMO(CDD)	16	18	18
	N20 Mode MIMO(CDD)	16	18	18
	N40 Mode MIMO(CDD)	13	17	17

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.

802.11b: 1Mbps
802.11g: 6Mbps
802.11n ht20 MIMO: MCS0
802.11n ht40 MIMO: MCS0

2.4 Test Mode

Pre-Scan
Mode 1: Full System (model: VigorAP 920RPD) for all test item.
Mode 2: Full System (model: VigorAP 920RD) for AC Line Conducted Emissions and Radiated Spurious Emissions.
Mode 3: Full System (model: VigorAP 920RP) for AC Line Conducted Emissions and Radiated Spurious Emissions.
Mode 4: Full System (model: VigorAP 920R) for AC Line Conducted Emissions and Radiated Spurious Emissions.

Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available.

Final Test
Mode 1: Full System (model: VigorAP 920RPD) for all test item.

2.5 Support Equipment List and Details

Description	Manufacturer	Model Number	S/N
NB	Dell	E6410	10912240367
NB	ASUS	N81V	N/A

2.6 External Cable List and Details

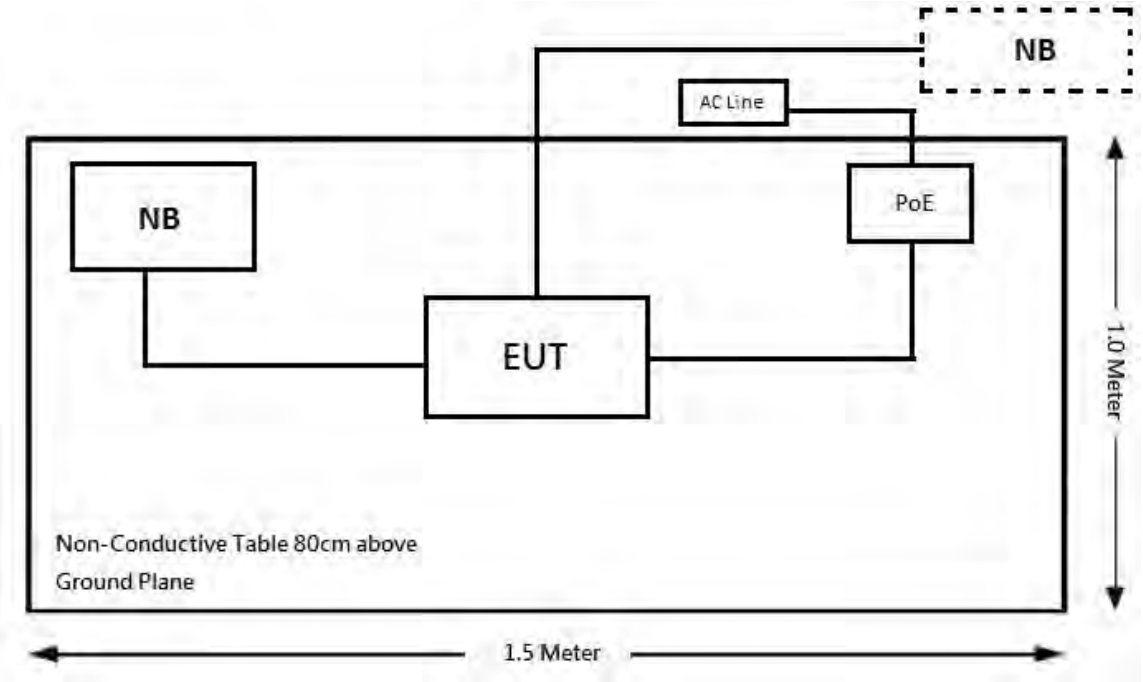
Cable Description	Length (m)	From	To
RJ45 Cable	2M	NB	EUT
RJ45 Cable	2M	NB	EUT

2.7 Block Diagram of Test Setup

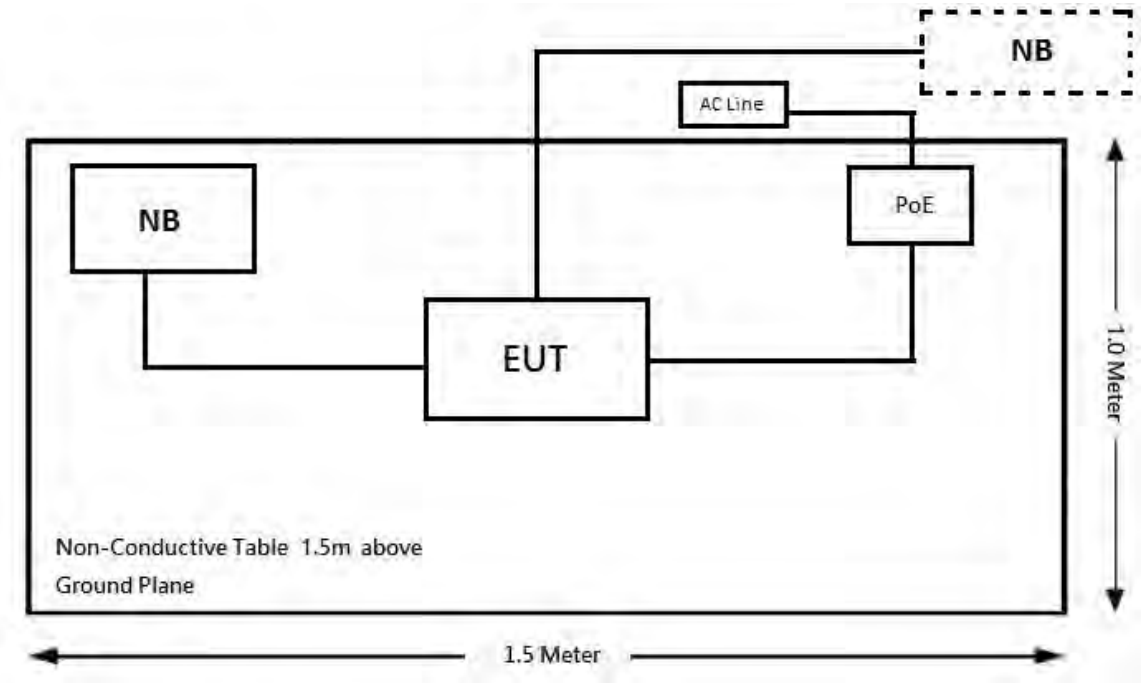
See test photographs attached in Exhibit A for the actual connections between EUT and support equipment.

Radiation:

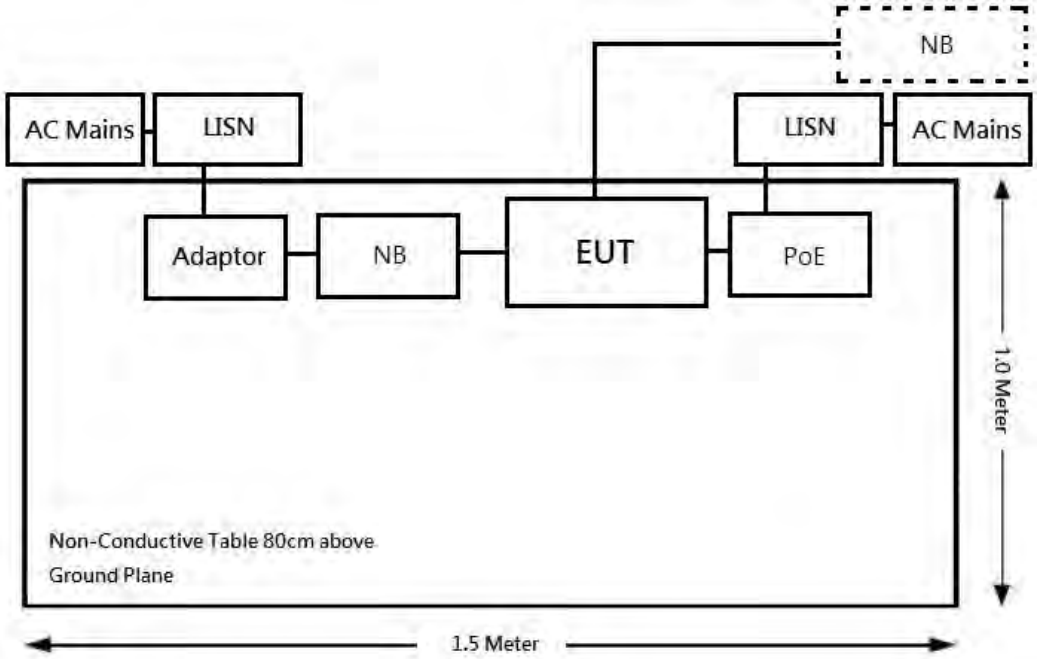
Below 1GHz:



Above 1GHz:



Conduction:


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

2.8 Duty Cycle

According to KDB 558074 D01 DTS Meas Guidance v04 section 6.0:

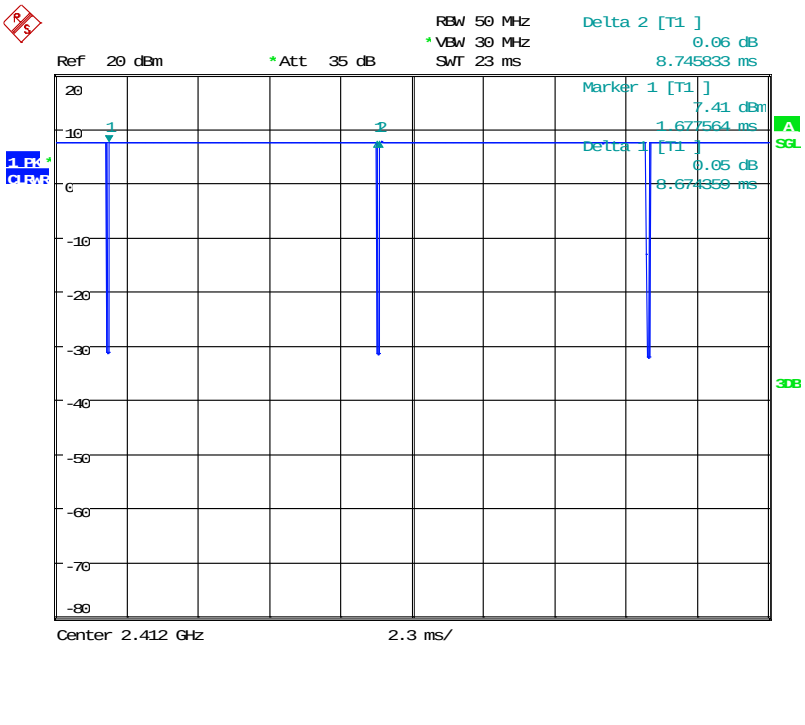
All measurements are to be performed with the EUT transmitting at 100% duty cycle at its maximum power control level; however, if 100% duty cycle cannot be achieved, measurements of duty cycle, x, and maximum power transmission duration, T, are required for each tested mode of operation.

Radio Mode	On Time (ms)	Period (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
802.11b	8.674	8.745	99	0.04
802.11g	1.413	1.521	93	0.32
802.11n20	1.300	1.417	92	0.36
802.11n40	0.664	0.789	84	0.76

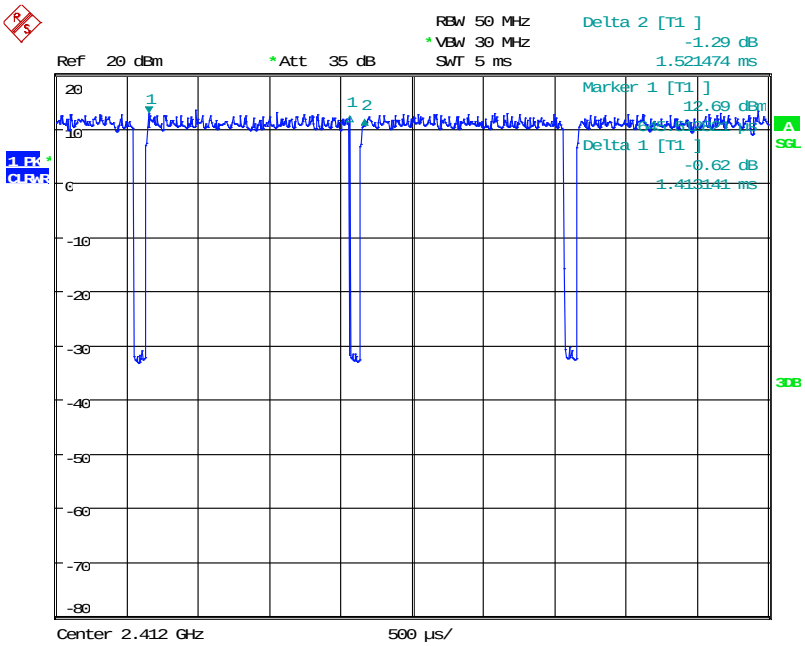
Note: Duty Cycle Correction Factor = 10*log(1/duty cycle)

Please refer to the following plots.

B Mode

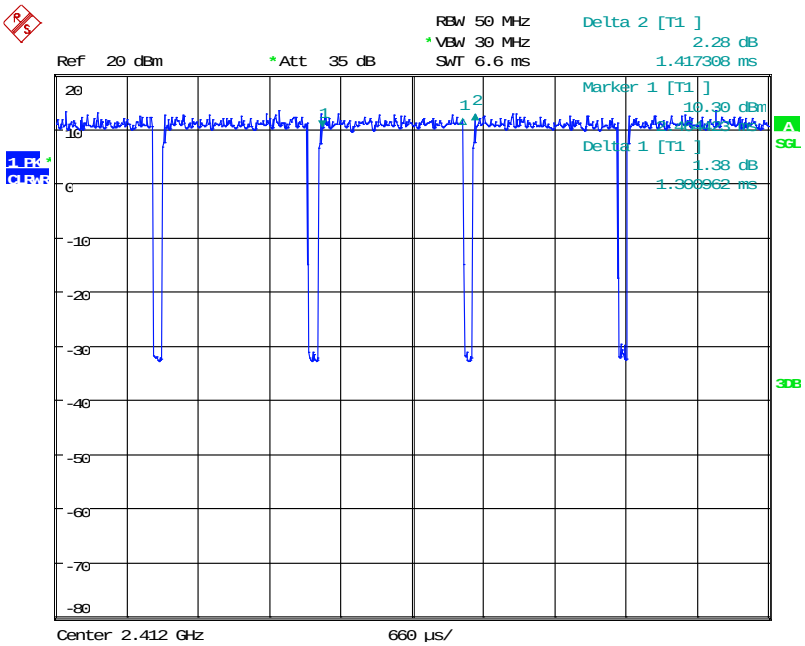


G Mode



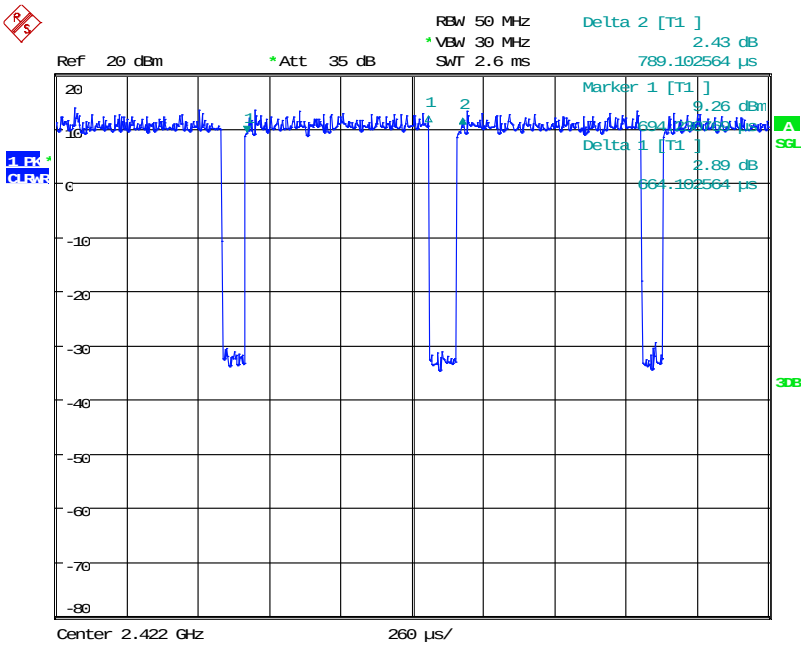
Date: 17.JAN.2018 19:24:18

N20 Mode



Date: 17.JAN.2018 19:23:23

N40 Mode



Date: 17.JAN.2018 19:27:14

3 Summary of Test Results

FCC Rules	Description of Test	Result
§15.247(i), §1.1310 ,§ 2.1091	Maximum Permissible Exposure (MPE)	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), §1.1310, § 2.1091 - Maximum Permissible Exposure (MPE)

4.1 Applicable Standard

According to subpart 15.247(i)and subpart §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (minutes)**
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f^2)	30
30–300	27.5	0.073	0.2	30
300–1500	/	/	f/1500	30
1500–100,000	/	/	1.0	30

f = frequency in MHz; * = Plane-wave equivalent power density;

According to §1.1310 and §2.1091 RF exposure is calculated.

Calculated Formulary:

Predication of MPE limit at a given distance
$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. mW/cm^2);
P = power input to the antenna (in appropriate units, e.g., mW);
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

For simultaneously transmit system, the calculated power density should comply with:

$$\sum_i \frac{S_i}{S_{Limit,i}} \leq 1$$

4.2 RF Exposure Evaluation Result

MPE evaluation for single transmission:

Mode	Frequency Range (MHz)	Antenna Gain		Target Power		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
		(dBi)	(numeric)	(dBm)	(mW)			
2.4G WIFI	2412-2462	3.12	2.05	27.5	562.34	20	0.23	1.0
5G WIFI B1	5180-5240	10.97	12.50	18.0	63.09	20	0.16	1.0
5G WIFI B4	5725-5825	13.21	20.94	22.5	177.83	20	0.74	1.0

Note: the maximum antenna gain was used for evaluation.

MPE evaluation for simultaneous transmission:

2.4G WIFI and 5G WIFI can transmit at the same time, MPE evaluation is as below formula:

PD1/Limit1+PD2/Limit2+……＜1, PD (Power Density)

MPE evaluation=
MPE of 2.4G WIFI/1 + MPE of 5G WIFI/1
= 0.23/1+0.74/1=0.97＜1.0

Result: MPE evaluation of single and simultaneous transmission meet 20cm the requirement of standard.

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	Antenna Type	Antenna Gain	Connector Type
DrayTek	600-1092000-00G	Dipole Antenna	3.12 dBi	N type

The EUT have 2 external antenna for 2.4GHz Band. Please refer to photos.

This product is a professional installation, detailed installation process reference user manual.

Result: 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

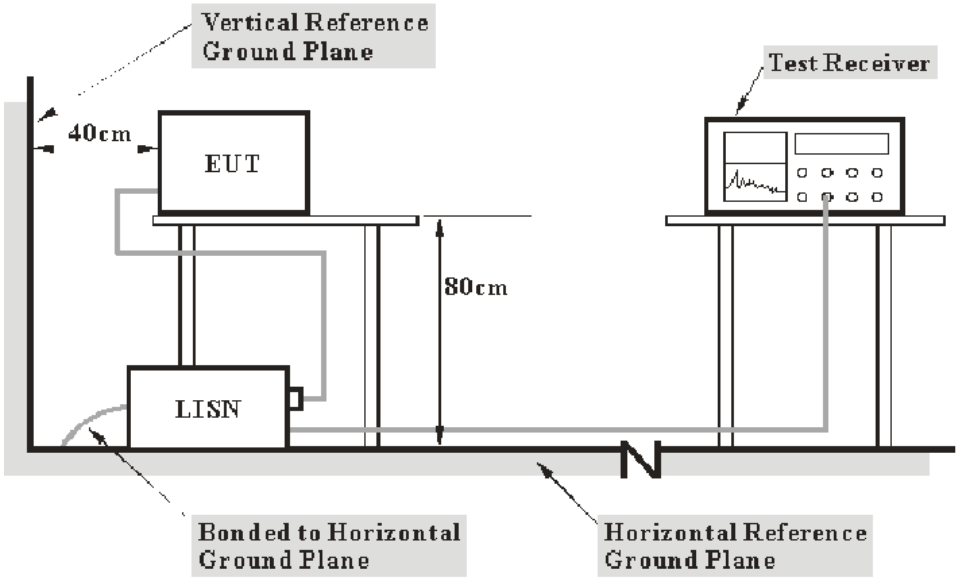
6.2 Measurement Uncertainty

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	Receiver RBW
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
EMI Test Receiver	Rohde & Schwarz	ESR7	101419	2017/11/06	2018/11/05
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

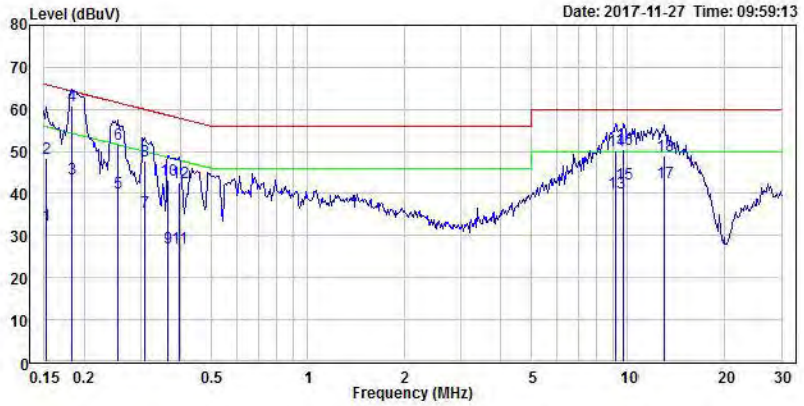
The testing was performed by Andy Shih on 2017-11-27.

6.9 Test Results

Mode: Transmitting Mode

Please refer to the following plots and tables.

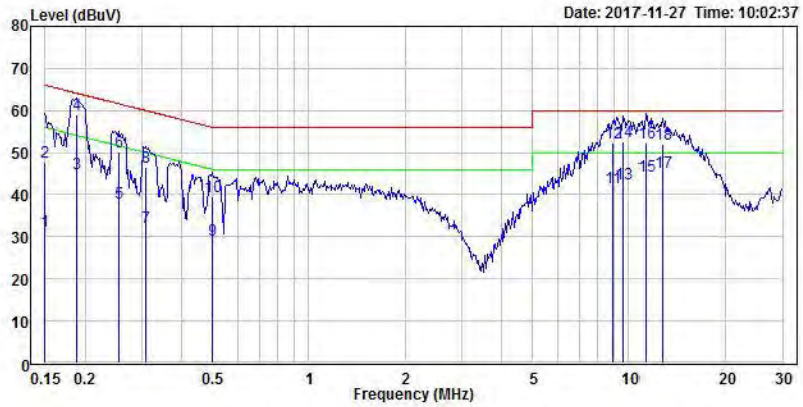
Main: AC 120V/60 Hz, Line



Condition: Line
EUT :
Mode :
Note : 120V/60Hz

	Freq	Level	Limit Line	Over Limit	Factor	Read Level	Remark	Pol/Phase
	MHz	dBuV	dBuV	dB	dB	dBuV		
1	0.152	32.64	55.87	-23.23	19.50	13.14	Average	Line
2	0.152	48.38	65.87	-17.49	19.50	28.88	QP	Line
3	0.183	43.50	54.35	-10.85	19.50	24.00	Average	Line
4	0.183	60.69	64.35	-3.66	19.50	41.19	QP	Line
5	0.256	40.00	51.57	-11.57	19.50	20.50	Average	Line
6	0.256	51.59	61.57	-9.98	19.50	32.09	QP	Line
7	0.310	35.69	49.98	-14.29	19.50	16.19	Average	Line
8	0.310	47.83	59.98	-12.15	19.50	28.33	QP	Line
9	0.366	27.03	48.59	-21.56	19.51	7.52	Average	Line
10	0.366	43.23	58.59	-15.36	19.51	23.72	QP	Line
11	0.396	26.96	47.93	-20.97	19.51	7.45	Average	Line
12	0.396	42.73	57.93	-15.20	19.51	23.22	QP	Line
13	9.153	40.26	50.00	-9.74	19.76	20.50	Average	Line
14	9.153	50.21	60.00	-9.79	19.76	30.45	QP	Line
15	9.678	42.23	50.00	-7.77	19.76	22.47	Average	Line
16	9.678	50.52	60.00	-9.48	19.76	30.76	QP	Line
17	12.893	42.67	50.00	-7.33	19.79	22.88	Average	Line
18	12.893	48.95	60.00	-11.05	19.79	29.16	QP	Line

Main: AC 120V/60 Hz, Neutral



Condition: Neutral
EUT :
Mode :
Note : 120V/60Hz

	Freq	Level	Limit Line	Over Limit	Factor	Read Level	Remark	Pol/Phase
	MHz	dBuV	dBuV	dB	dB	dBuV		
1	0.150	31.38	56.00	-24.62	19.63	11.75	Average	Neutral
2	0.150	47.73	66.00	-18.27	19.63	28.10	QP	Neutral
3	0.187	44.90	54.15	-9.25	19.63	25.27	Average	Neutral
4	0.187	58.86	64.15	-5.29	19.63	39.23	QP	Neutral
5	0.254	38.11	51.63	-13.52	19.63	18.48	Average	Neutral
6	0.254	50.24	61.63	-11.39	19.63	30.61	QP	Neutral
7	0.310	32.34	49.98	-17.64	19.63	12.71	Average	Neutral
8	0.310	46.51	59.98	-13.47	19.63	26.88	QP	Neutral
9	0.500	29.15	46.01	-16.86	19.64	9.51	Average	Neutral
10	0.500	39.63	56.01	-16.38	19.64	19.99	QP	Neutral
11	8.937	41.78	50.00	-8.22	19.89	21.89	Average	Neutral
12	8.937	52.34	60.00	-7.66	19.89	32.45	QP	Neutral
13	9.601	42.50	50.00	-7.50	19.91	22.59	Average	Neutral
14	9.601	52.53	60.00	-7.47	19.91	32.62	QP	Neutral
15	11.259	44.44	50.00	-5.56	19.93	24.51	Average	Neutral
16	11.259	52.43	60.00	-7.57	19.93	32.50	QP	Neutral
17	12.689	45.32	50.00	-4.68	19.95	25.37	Average	Neutral
18	12.689	51.94	60.00	-8.06	19.95	31.99	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 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

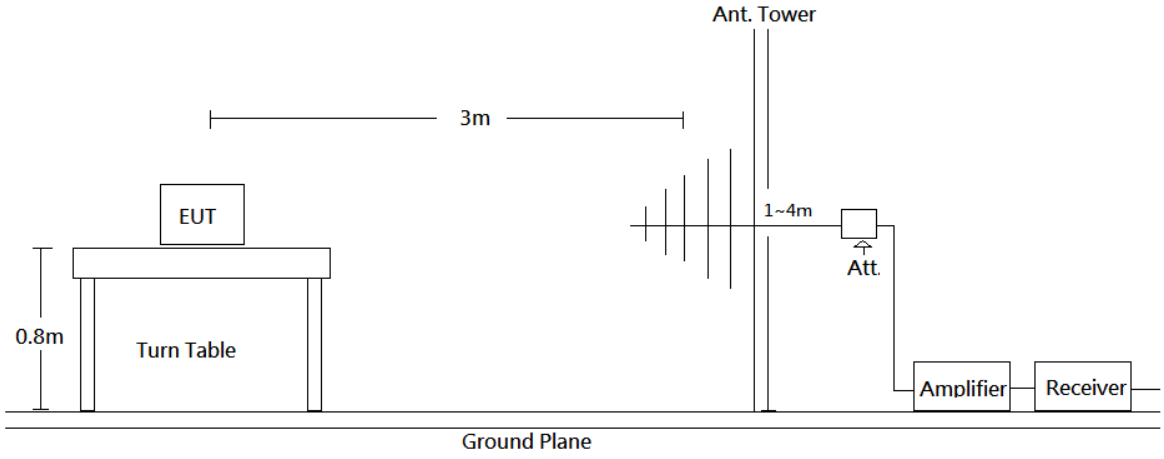
All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency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

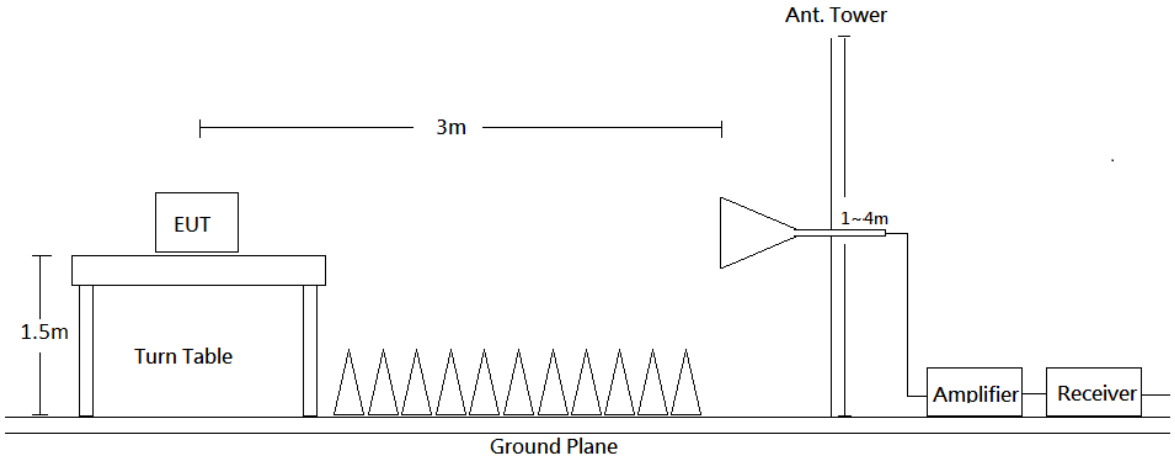
Frequency	Measurement uncertainty
30 MHz~200 MHz	3.76 dB (k=2, 95% level of confidence)
200 MHz~1 GHz	4.12 dB (k=2, 95% level of confidence)
1 GHz~6 GHz	4.84 dB (k=2, 95% level of confidence)
6 GHz~18 GHz	5.16 dB (k=2, 95% level of confidence)
18 GHz~26 GHz	4.84 dB (k=2, 95% level of confidence)
26 GHz~40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

7.3 EUT Setup

Blow 1 GHz:



Above 1 GHz:



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 for below 1GHz and spectrum analyzer for above 1GHz was set with the following configurations measurement method 6.3 in ANSI C63.10.

Frequency Range	RBW	VBW	Detector	Duty cycle	Measurement method
30-1000 MHz	120 kHz	/	QP		QP
Above 1 GHz	1 MHz	3 MHz	PK		PK
	1 MHz	3 MHz	RMS	>98%	Ave
	1 MHz	1/T	PK	<98%	Ave

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
966A Room					
Bilog Antenna	Sunol & Mini-Circuits	JB6/UNAT-6+	A050115/15542_01	2017/12/20	2018/12/19
Horn Antenna	EMCO	3115	9311-4158	2017/05/31	2018/05/30
Horn Antenna	ETS-Lindgren	3116	62638	2017/09/04	2018/09/03
Preamplifier	Sonoma	310N	130602	2017/07/03	2018/07/02
Preamplifier	EMEC	EM01G18G	60697	2017/04/14	2018/04/13
Preamplifier	EMEC	EM18G40G	060656	2018/01/15	2019/01/14
EMI Test Receiver	Rohde & Schwarz	ESR7	101419	2017/11/06	2018/11/05
Spectrum Analyzer	Rohde & Schwarz	FSV40	101203	2017/07/13	2018/07/12
Microflex Cable	UTIFLEX	UFB311A-Q-1440-300300	220490-006	2017/10/31	2018/10/30
Microflex Cable	UTIFLEX	UFA210A-1-3149-300300	MFR64639 226389-001	2017/11/10	2018/11/09
Microflex Cable	ROSNOL	K1K50-UP0264-K1K50-450CM	160309-1	2017/03/24	2018/03/23
Microflex Cable	ROSNOL	K1K50-UP0264-K1K50-80CM	160309-2	2018/01/29	2019/01/28
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	60772	N.C.R	N.C.R
Software	Farad	EZ_EMC	BACL-03A1	N.C.R	N.C.R
Conducted Room					
Spectrum Analyzer	Rohde & Schwarz	FSU26	200268	2017/05/08	2018/05/07
Cable	WOKEN	SFL402	S02-160323-07	2017/02/22	2018/02/21
Attenuator	MINI-CIRCUITS	BW-S10W5+	N/A	2017/12/14	2018/12/13

**** 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 Andy Shih on 2018-01-17 ~2018-01-18.

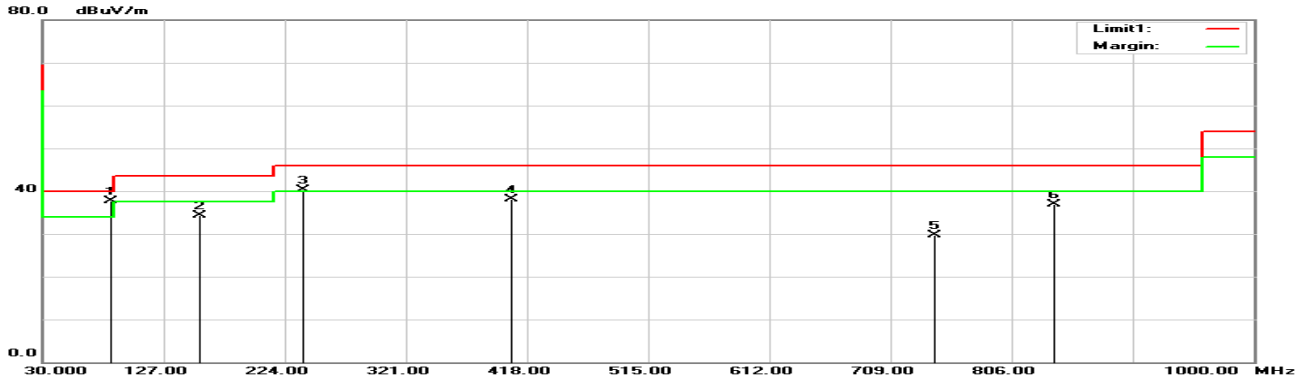
7.10 Test Results

Test Mode: *Transmitting Mode.*

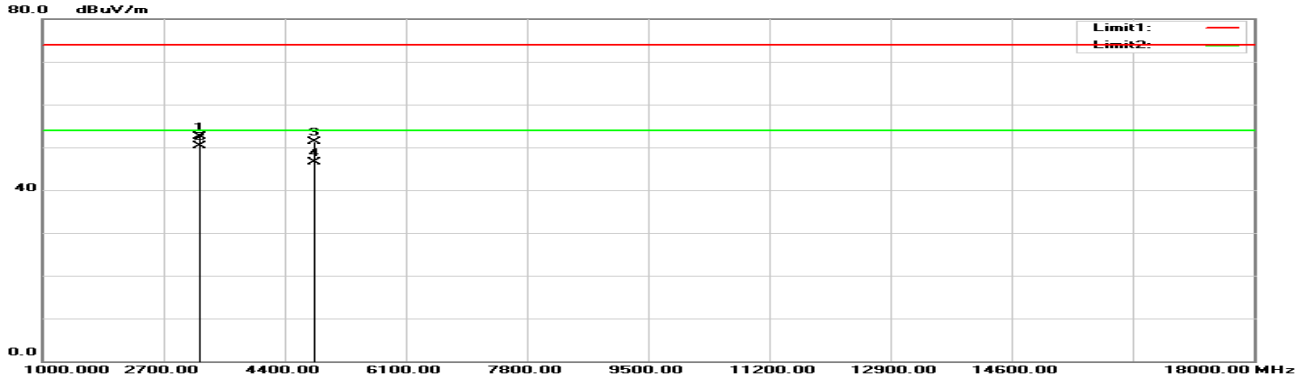
(Pre-scan with three orthogonal axis, and worse case as X axis.)

Horizontal
Wi-Fi mode: Worst case is 802.11b Low Channel

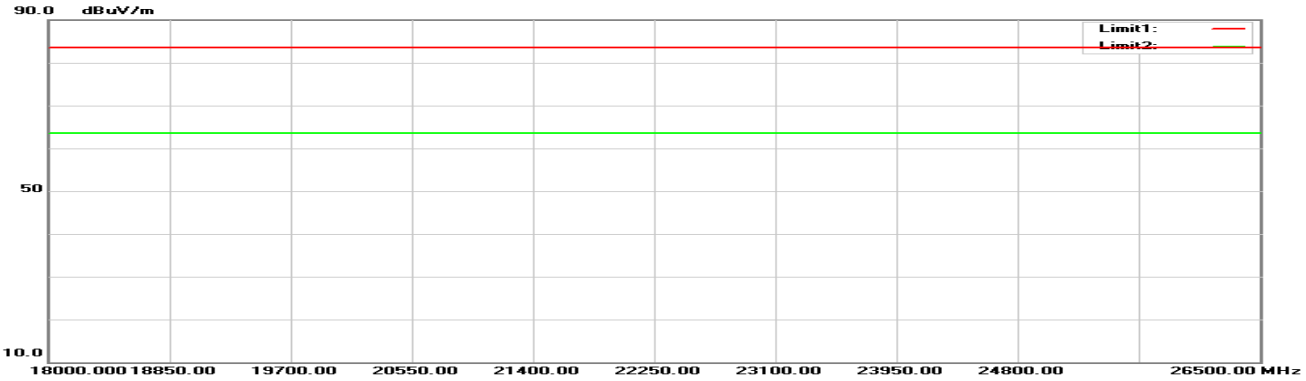
30MHz-1GHz



1GHz-18GHz

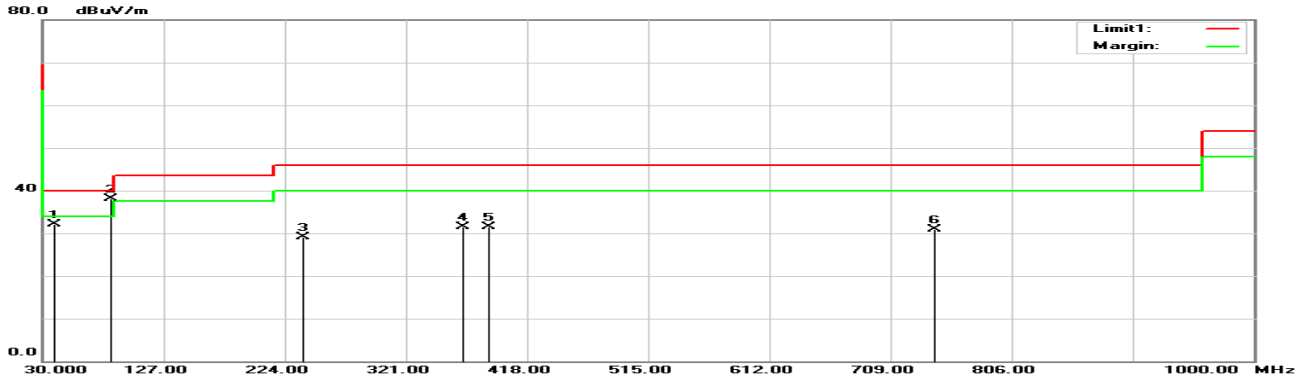


18GHz-26.5GHz

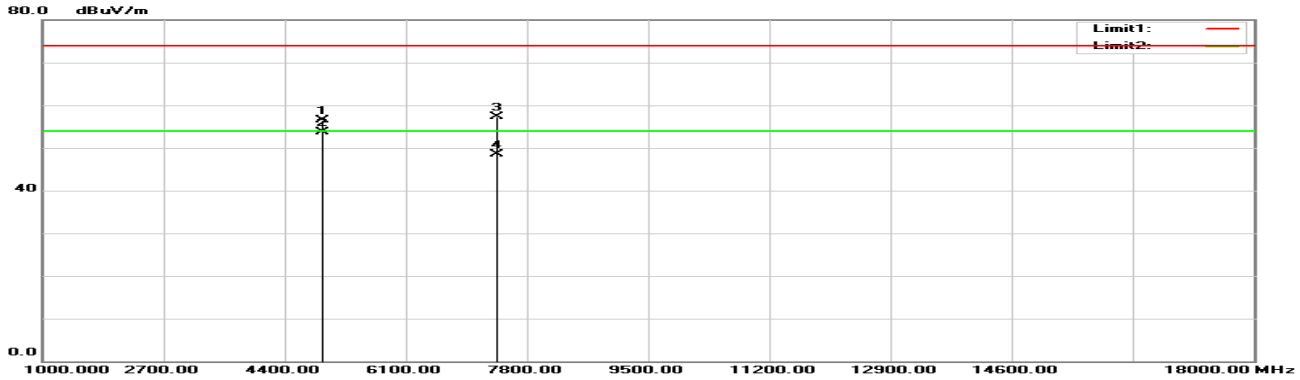


Vertical
Wi-Fi mode: Worst case is 802.11b High Channel

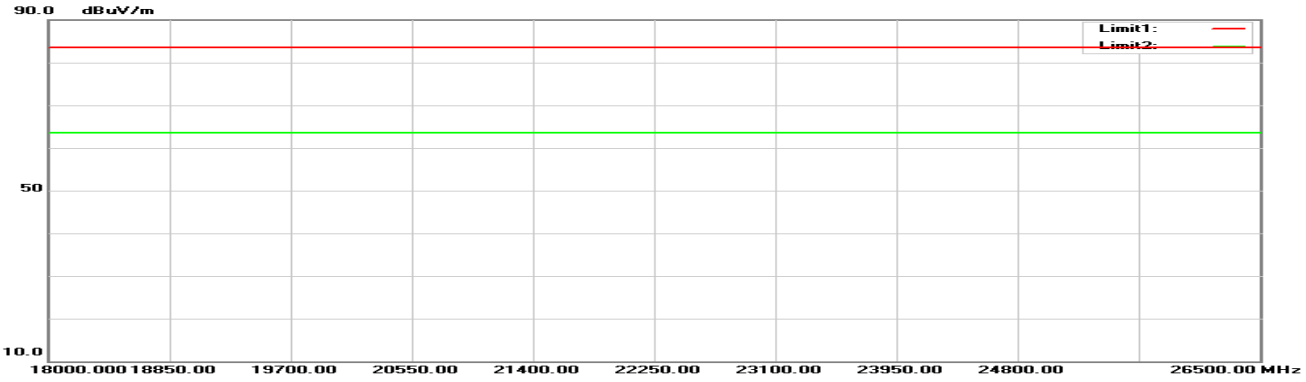
30MHz-1GHz



1GHz-18GHz



18GHz-26.5GHz



Vertical

Frequency (MHz)	Reading (dBµV)	Correct Factor(dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
B Mode, Low Channel								
85.2900	54.30	-16.57	37.73	40.00	-2.27	100	220	QP
156.1000	45.50	-11.16	34.34	43.50	-9.16	100	79	QP
238.5500	52.36	-12.07	40.29	46.00	-5.71	100	41	QP
405.3900	45.64	-7.47	38.17	46.00	-7.83	100	324	QP
743.9200	31.91	-2.19	29.72	46.00	-16.28	100	292	QP
839.9500	36.90	0.03	36.93	46.00	-9.07	100	230	QP
2386.780	68.99	-4.89	64.10	74.00	-9.90	100	282	peak
2386.780	58.43	-4.89	53.54	54.00	-0.46	100	282	AVG
2412.000	120.67	-4.84	115.83	N/A	N/A	100	101	peak
2412.000	116.50	-4.84	111.66	N/A	N/A	100	101	AVG
3210.000	54.62	-2.14	52.48	95.83	-43.35	117	266	peak
3210.000	52.42	-2.14	50.28	91.66	-41.38	117	266	AVG
4824.000	50.19	1.05	51.24	74.00	-22.76	199	145	peak
4824.000	45.42	1.05	46.47	54.00	-7.53	199	145	AVG
B Mode, Middle Channel								
88.2000	53.64	-16.60	37.04	43.50	-6.46	100	232	QP
163.8600	44.89	-11.59	33.30	43.50	-10.20	100	266	QP
241.4600	51.07	-12.02	39.05	46.00	-6.95	100	46	QP
389.8700	45.17	-7.79	37.38	46.00	-8.62	100	319	QP
402.4800	45.68	-7.53	38.15	46.00	-7.85	100	319	QP
839.9500	37.55	0.03	37.58	46.00	-8.42	100	140	QP
2437.000	125.25	-4.78	120.47	N/A	N/A	149	266	peak
2437.000	121.59	-4.78	116.81	N/A	N/A	149	266	AVG
3244.000	55.83	-2.04	53.79	100.47	-46.68	100	88	peak
3244.000	52.89	-2.04	50.85	96.81	-45.96	100	88	AVG
4874.000	50.77	1.23	52.00	74.00	-22.00	220	147	peak
4874.000	46.37	1.23	47.60	54.00	-6.40	220	147	AVG
B Mode, High Channel								
87.2300	53.64	-16.59	37.05	40.00	-2.95	100	249	QP
162.8900	44.78	-11.50	33.28	43.50	-10.22	100	288	QP
242.4300	50.85	-12.01	38.84	46.00	-7.16	100	46	QP
274.4400	48.31	-10.20	38.11	46.00	-7.89	100	53	QP
417.0300	44.77	-7.24	37.53	46.00	-8.47	100	329	QP
671.1700	32.34	-3.16	29.18	46.00	-16.82	100	314	QP
2462.000	122.32	-4.72	117.60	N/A	N/A	164	103	peak
2462.000	118.97	-4.72	114.25	N/A	N/A	164	103	AVG
2483.500	68.03	-4.69	63.34	74.00	-10.66	100	94	peak
2483.500	58.21	-4.69	53.52	54.00	-0.48	100	94	AVG
3278.000	52.49	-1.95	50.54	97.60	-47.06	100	325	peak
3278.000	49.16	-1.95	47.21	94.25	-47.04	100	325	AVG
4924.000	52.34	1.40	53.74	74.00	-20.26	208	146	peak
4924.000	48.14	1.40	49.54	54.00	-4.46	208	146	AVG

Note: 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.

Horizontal

Frequency (MHz)	Reading (dBµV)	Correct Factor(dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
B Mode, Low Channel								
39.7000	44.27	-10.31	33.96	40.00	-6.04	100	359	QP
86.2600	54.82	-16.58	38.24	40.00	-1.76	100	326	QP
244.3700	41.63	-11.98	29.65	46.00	-16.35	100	14	QP
373.3800	40.32	-8.13	32.19	46.00	-13.81	100	31	QP
696.3900	30.67	-2.79	27.88	46.00	-18.12	100	271	QP
888.4500	31.33	0.83	32.16	46.00	-13.84	100	247	QP
2390.000	64.03	-4.89	59.14	74.00	-14.86	100	58	peak
2390.000	49.52	-4.89	44.63	54.00	-9.37	100	58	AVG
2412.000	106.47	-4.84	101.63	N/A	N/A	100	114	peak
2412.000	103.36	-4.84	98.52	N/A	N/A	100	114	AVG
4824.000	53.85	1.05	54.90	74.00	-19.10	212	314	peak
4824.000	50.72	1.05	51.77	54.00	-2.23	212	314	AVG
B Mode, Middle Channel								
39.7000	43.33	-10.31	33.02	40.00	-6.98	100	350	QP
71.7100	54.89	-16.54	38.35	40.00	-1.65	100	292	QP
86.2600	54.87	-16.58	38.29	40.00	-1.71	100	326	QP
240.4900	41.75	-12.04	29.71	46.00	-16.29	100	5	QP
372.4100	39.77	-8.15	31.62	46.00	-14.38	100	32	QP
839.9500	37.66	0.03	37.69	46.00	-8.31	100	249	QP
2437.000	108.02	-4.78	103.24	N/A	N/A	100	127	peak
2437.000	104.12	-4.78	99.34	N/A	N/A	100	127	AVG
4874.000	54.14	1.23	55.37	74.00	-18.63	205	354	peak
4874.000	51.79	1.23	53.02	54.00	-0.98	205	354	AVG
B Mode, High Channel								
39.7000	42.36	-10.31	32.05	40.00	-7.95	100	360	QP
85.2900	54.67	-16.57	38.10	40.00	-1.90	100	304	QP
238.5500	41.10	-12.07	29.03	46.00	-16.97	100	1	QP
366.5900	39.77	-8.28	31.49	46.00	-14.51	100	32	QP
386.9600	39.43	-7.85	31.58	46.00	-14.42	100	222	QP
743.9200	33.13	-2.19	30.94	46.00	-15.06	100	103	QP
2462.000	108.86	-4.72	104.14	N/A	N/A	105	162	peak
2462.000	105.21	-4.72	100.49	N/A	N/A	105	162	AVG
2483.500	64.29	-4.69	59.60	74.00	-14.40	100	174	peak
2483.500	51.64	-4.69	46.95	54.00	-7.05	100	174	AVG
4924.000	55.14	1.40	56.54	74.00	-17.46	261	215	peak
4924.000	52.37	1.40	53.77	54.00	-0.23	261	215	AVG
7386.000	49.94	7.28	57.22	74.00	-16.78	100	161	peak
7386.000	41.13	7.28	48.41	54.00	-5.59	100	161	AVG

Note: 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 (dBµV)	Correct Factor(dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
G Mode, Low Channel								
86.2600	53.96	-16.58	37.38	40.00	-2.62	100	237	QP
159.0100	45.81	-11.21	34.60	43.50	-8.90	100	254	QP
237.5800	51.72	-12.10	39.62	46.00	-6.38	100	41	QP
274.4400	47.68	-10.20	37.48	46.00	-8.52	100	53	QP
417.0300	45.50	-7.24	38.26	46.00	-7.74	100	323	QP
839.9500	33.69	0.03	33.72	46.00	-12.28	100	112	QP
2390.000	77.61	-4.89	72.72	74.00	-1.28	100	269	peak
2390.000	58.03	-4.89	53.14	54.00	-0.86	100	269	AVG
2412.000	119.94	-4.84	115.10	N/A	N/A	100	253	peak
2412.000	107.93	-4.84	103.09	N/A	N/A	100	253	AVG
3210.000	56.15	-2.14	54.01	95.10	-41.09	116	265	peak
3210.000	54.57	-2.14	52.43	83.09	-30.66	116	265	AVG
4824.000	41.76	1.05	42.81	74.00	-31.19	100	189	peak
4824.000	41.76	1.05	42.81	54.00	-11.19	100	189	AVG
G Mode, Middle Channel								
87.2300	53.76	-16.59	37.17	40.00	-2.83	100	237	QP
162.8900	45.70	-11.50	34.20	43.50	-9.30	100	114	QP
241.4600	52.50	-12.02	40.48	46.00	-5.52	100	41	QP
274.4400	48.70	-10.20	38.50	46.00	-7.50	100	41	QP
409.2700	46.46	-7.39	39.07	46.00	-6.93	100	323	QP
573.2000	34.23	-4.62	29.61	46.00	-16.39	100	335	QP
2437.000	122.23	-4.78	117.45	N/A	N/A	100	270	peak
2437.000	110.59	-4.78	105.81	N/A	N/A	100	270	AVG
3244.000	58.63	-2.04	56.59	97.45	-40.86	100	94	peak
3244.000	57.31	-2.04	55.27	95.81	-40.54	100	94	AVG
4874.000	45.94	1.23	47.17	74.00	-26.83	185	203	peak
4874.000	32.40	1.23	33.63	54.00	-20.37	185	203	AVG
G Mode, High Channel								
85.2900	54.13	-16.57	37.56	40.00	-2.44	100	249	QP
157.0700	45.45	-11.18	34.27	43.50	-9.23	100	103	QP
238.5500	51.54	-12.07	39.47	46.00	-6.53	100	58	QP
274.4400	48.25	-10.20	38.05	46.00	-7.95	100	36	QP
402.4800	45.01	-7.53	37.48	46.00	-8.52	100	319	QP
839.9500	37.53	0.03	37.56	46.00	-8.44	100	50	QP
2462.000	121.41	-4.72	116.69	N/A	N/A	100	252	peak
2462.000	109.97	-4.72	105.25	N/A	N/A	100	252	AVG
2483.500	75.78	-4.69	71.09	74.00	-2.91	100	259	peak
2483.500	55.55	-4.69	50.86	54.00	-3.14	100	259	AVG
3278.000	55.78	-1.95	53.83	96.69	-42.86	126	328	peak
3278.000	53.99	-1.95	52.04	85.25	-33.21	126	328	AVG
4924.000	46.41	1.40	47.81	74.00	-26.19	207	175	peak
4924.000	32.54	1.40	33.94	54.00	-20.06	207	175	AVG

Note: 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.

Horizontal

Frequency (MHz)	Reading (dBµV)	Correct Factor(dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
G Mode, Low Channel								
40.6700	43.13	-11.02	32.11	40.00	-7.89	100	354	QP
82.3800	55.28	-16.53	38.75	40.00	-1.25	100	316	QP
242.4300	42.17	-12.01	30.16	46.00	-15.84	100	9	QP
372.4100	39.84	-8.15	31.69	46.00	-14.31	100	25	QP
476.2000	35.62	-6.08	29.54	46.00	-16.46	100	234	QP
888.4500	29.50	0.83	30.33	46.00	-15.67	100	74	QP
2390.000	64.16	-4.89	59.27	74.00	-14.73	100	97	peak
2390.000	49.91	-4.89	45.02	54.00	-8.98	100	97	AVG
2412.000	105.09	-4.84	100.25	N/A	N/A	100	109	peak
2412.000	93.26	-4.84	88.42	N/A	N/A	100	109	AVG
3210.000	52.18	-2.14	50.04	80.25	-30.21	100	29	peak
3210.000	49.29	-2.14	47.15	68.42	-20.27	100	29	AVG
4824.000	48.77	1.05	49.82	74.00	-24.18	214	355	peak
4824.000	38.70	1.05	39.75	54.00	-14.25	214	355	AVG
G Mode, Middle Channel								
39.7000	42.73	-10.31	32.42	40.00	-7.58	100	360	QP
70.7400	53.55	-16.55	37.00	40.00	-3.00	100	67	QP
80.4400	54.35	-16.50	37.85	40.00	-2.15	100	333	QP
241.4600	41.47	-12.02	29.45	46.00	-16.55	100	5	QP
364.6500	40.19	-8.32	31.87	46.00	-14.13	100	32	QP
696.3900	31.65	-2.79	28.86	46.00	-17.14	100	47	QP
2437.000	108.06	-4.78	103.28	N/A	N/A	103	134	peak
2437.000	96.19	-4.78	91.41	N/A	N/A	103	134	AVG
3244.000	54.68	-2.04	52.64	83.28	-30.64	100	195	peak
3244.000	52.37	-2.04	50.33	71.41	-21.08	100	195	AVG
4874.000	50.54	1.23	51.77	74.00	-22.23	181	353	peak
4874.000	38.13	1.23	39.36	54.00	-14.64	181	353	AVG
G Mode, High Channel								
39.7000	42.91	-10.31	32.60	40.00	-7.40	100	360	QP
69.7700	51.95	-16.57	35.38	40.00	-4.62	100	135	QP
87.2300	55.51	-16.59	38.92	40.00	-1.08	100	304	QP
241.4600	41.04	-12.02	29.02	46.00	-16.98	100	180	QP
376.2900	40.53	-8.07	32.46	46.00	-13.54	100	32	QP
839.9500	39.23	0.03	39.26	46.00	-6.74	100	316	QP
2462.000	107.36	-4.72	102.64	N/A	N/A	100	132	peak
2462.000	95.23	-4.72	90.51	N/A	N/A	100	132	AVG
2483.500	64.00	-4.69	59.31	74.00	-14.69	100	24	peak
2483.500	50.15	-4.69	45.46	54.00	-8.54	100	24	AVG
3278.000	53.28	-1.95	51.33	82.64	-31.31	100	195	peak
3278.000	50.64	-1.95	48.69	70.51	-21.82	100	195	AVG
4924.000	49.35	1.40	50.75	74.00	-23.25	100	215	peak
4924.000	35.61	1.40	37.01	54.00	-16.99	100	215	AVG

Note: 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 (dBµV)	Correct Factor(dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
N20 Mode, Low Channel								
87.2300	53.74	-16.59	37.15	40.00	-2.85	100	225	QP
160.9500	45.83	-11.31	34.52	43.50	-8.98	100	254	QP
237.5800	51.69	-12.10	39.59	46.00	-6.41	100	29	QP
274.4400	48.45	-10.20	38.25	46.00	-7.75	100	58	QP
417.0300	45.77	-7.24	38.53	46.00	-7.47	100	330	QP
696.3900	33.61	-2.79	30.82	46.00	-15.18	100	325	QP
2390.000	76.74	-4.89	71.85	74.00	-2.15	100	281	peak
2390.000	57.94	-4.89	53.05	54.00	-0.95	100	281	AVG
2412.000	120.77	-4.84	115.93	N/A	N/A	118	270	peak
2412.000	108.03	-4.84	103.19	N/A	N/A	118	270	AVG
3210.000	56.04	-2.14	53.90	95.93	-42.03	100	128	peak
3210.000	54.48	-2.14	52.34	83.19	-30.85	100	128	AVG
4824.000	47.41	1.05	48.46	74.00	-25.54	100	153	peak
4824.000	39.46	1.05	40.51	54.00	-13.49	100	153	AVG
N20 Mode, Middle Channel								
85.2900	53.81	-16.57	37.24	40.00	-2.76	100	225	QP
159.0100	46.95	-11.21	35.74	43.50	-7.76	100	278	QP
242.4300	52.34	-12.01	40.33	46.00	-5.67	100	41	QP
274.4400	47.90	-10.20	37.70	46.00	-8.30	100	53	QP
417.0300	45.72	-7.24	38.48	46.00	-7.52	100	335	QP
600.3600	32.72	-4.18	28.54	46.00	-17.46	100	342	QP
2437.000	121.11	-4.78	116.33	N/A	N/A	119	268	peak
2437.000	110.99	-4.78	106.21	N/A	N/A	119	268	AVG
3244.000	59.12	-2.04	57.08	96.33	-39.25	100	93	peak
3244.000	57.94	-2.04	55.90	86.21	-30.31	100	93	AVG
4874.000	48.26	1.23	49.49	74.00	-24.51	100	153	peak
4874.000	37.29	1.23	38.52	54.00	-15.48	100	153	AVG
N20 Mode, High Channel								
86.2600	53.69	-16.58	37.11	40.00	-2.89	100	237	QP
162.8900	45.72	-11.50	34.22	43.50	-9.28	100	102	QP
238.5500	52.78	-12.07	40.71	46.00	-5.29	100	46	QP
274.4400	48.83	-10.20	38.63	46.00	-7.37	100	46	QP
409.2700	44.61	-7.39	37.22	46.00	-8.78	100	318	QP
839.9500	36.50	0.03	36.53	46.00	-9.47	100	0	QP
2462.000	122.84	-4.72	118.12	N/A	N/A	100	252	peak
2462.000	109.93	-4.72	105.21	N/A	N/A	100	252	AVG
2483.500	78.04	-4.69	73.35	74.00	-0.65	100	256	peak
2483.500	57.79	-4.69	53.10	54.00	-0.90	100	256	AVG
3278.000	54.23	-1.95	52.28	98.12	-45.84	108	327	peak
3278.000	52.58	-1.95	50.63	85.21	-34.58	108	327	AVG
4924.000	51.84	1.40	53.24	74.00	-20.76	244	359	peak
4924.000	35.34	1.40	36.74	54.00	-17.26	244	359	AVG

Note: 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.

Horizontal

Frequency (MHz)	Reading (dBµV)	Correct Factor(dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
N20 Mode, Low Channel								
39.7000	42.59	-10.31	32.28	40.00	-7.72	100	350	QP
69.7700	52.79	-16.57	36.22	40.00	-3.78	100	67	QP
86.2600	55.24	-16.58	38.66	40.00	-1.34	100	326	QP
238.5500	41.19	-12.07	29.12	46.00	-16.88	100	258	QP
376.2900	40.52	-8.07	32.45	46.00	-13.55	100	24	QP
743.9200	32.88	-2.19	30.69	46.00	-15.31	100	254	QP
2390.000	64.44	-4.89	59.55	74.00	-14.45	100	295	peak
2390.000	50.64	-4.89	45.75	54.00	-8.25	100	295	AVG
2412.000	106.35	-4.84	101.51	N/A	N/A	100	109	peak
2412.000	94.25	-4.84	89.41	N/A	N/A	100	109	AVG
3210.000	52.87	-2.14	50.73	81.51	-30.78	100	21	peak
3210.000	51.20	-2.14	49.06	69.41	-20.35	100	21	AVG
4824.000	51.19	1.05	52.24	74.00	-21.76	252	199	peak
4824.000	43.89	1.05	44.94	54.00	-9.06	252	199	AVG
N20 Mode, Middle Channel								
39.7000	42.36	-10.31	32.05	40.00	-7.95	100	1	QP
86.2600	55.13	-16.58	38.55	40.00	-1.45	100	343	QP
238.5500	41.03	-12.07	28.96	46.00	-17.04	100	263	QP
369.5000	40.06	-8.21	31.85	46.00	-14.15	100	25	QP
484.9300	33.56	-5.92	27.64	46.00	-18.36	100	244	QP
524.7000	32.73	-5.33	27.40	46.00	-18.60	100	217	QP
2437.000	109.09	-4.78	104.31	N/A	N/A	100	134	peak
2437.000	96.30	-4.78	91.52	N/A	N/A	100	134	AVG
3244.000	54.64	-2.04	52.60	94.31	-41.71	115	119	peak
3244.000	52.95	-2.04	50.91	71.52	-20.61	115	119	AVG
4874.000	50.55	1.23	51.78	74.00	-22.22	265	2	peak
4874.000	39.62	1.23	40.85	54.00	-13.15	265	2	AVG
N20 Mode, High Channel								
40.6700	43.46	-11.02	32.44	40.00	-7.56	100	350	QP
74.6200	54.75	-16.52	38.23	40.00	-1.77	100	270	QP
85.2900	55.16	-16.57	38.59	40.00	-1.41	100	299	QP
238.5500	41.13	-12.07	29.06	46.00	-16.94	100	2	QP
367.5600	40.66	-8.26	32.40	46.00	-13.60	100	32	QP
839.9500	36.53	0.03	36.56	46.00	-9.44	100	266	QP
2462.000	108.69	-4.72	103.97	N/A	N/A	103	183	peak
2462.000	97.38	-4.72	92.66	N/A	N/A	103	183	AVG
2483.500	65.86	-4.69	61.17	74.00	-12.83	100	118	peak
2483.500	51.87	-4.69	47.18	54.00	-6.82	100	118	AVG
3278.000	52.39	-1.95	50.44	83.97	-33.53	100	192	peak
3278.000	50.20	-1.95	48.25	72.66	-24.41	100	192	AVG
4924.000	57.29	1.40	58.69	74.00	-15.31	251	208	peak
4924.000	44.02	1.40	45.42	54.00	-8.58	251	208	AVG

Note: 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 (dBµV)	Correct Factor(dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
N40 Mode, Low Channel								
86.2600	53.72	-16.58	37.14	40.00	-2.86	100	242	QP
155.1300	45.33	-11.15	34.18	43.50	-9.32	100	113	QP
241.4600	51.39	-12.02	39.37	46.00	-6.63	100	29	QP
274.4400	48.31	-10.20	38.11	46.00	-7.89	100	41	QP
390.8400	46.65	-7.77	38.88	46.00	-7.12	100	319	QP
839.9500	41.05	0.03	41.08	46.00	-4.92	100	32	QP
2390.000	73.75	-4.89	68.86	74.00	-5.14	100	275	peak
2390.000	58.13	-4.89	53.24	54.00	-0.76	100	275	AVG
2422.000	114.75	-4.81	109.94	N/A	N/A	100	267	peak
2422.000	106.50	-4.81	101.69	N/A	N/A	100	267	AVG
3227.000	54.79	-2.10	52.69	89.94	-37.25	100	326	peak
3227.000	53.01	-2.10	50.91	81.69	-30.78	100	326	AVG
4844.000	44.15	1.12	45.27	74.00	-28.73	100	158	peak
4844.000	35.76	1.12	36.88	54.00	-17.12	100	158	AVG
N40 Mode, Middle Channel								
85.2900	53.35	-16.57	36.78	40.00	-3.22	100	215	QP
158.0400	46.62	-11.19	35.43	43.50	-8.07	100	266	QP
241.4600	53.00	-12.02	40.98	46.00	-5.02	100	41	QP
274.4400	48.51	-10.20	38.31	46.00	-7.69	100	41	QP
414.1200	44.95	-7.29	37.66	46.00	-8.34	100	319	QP
743.9200	33.52	-2.19	31.33	46.00	-14.67	100	348	QP
2437.000	117.81	-4.78	113.03	N/A	N/A	100	264	peak
2437.000	106.73	-4.78	101.95	N/A	N/A	100	264	AVG
3244.000	59.46	-2.04	57.42	93.03	-35.61	219	94	peak
3244.000	58.87	-2.04	56.83	81.95	-25.12	219	94	AVG
4874.000	47.78	1.23	49.01	74.00	-24.99	225	359	peak
4874.000	38.92	1.23	40.15	54.00	-13.85	225	359	AVG
N40 Mode, High Channel								
86.2600	53.06	-16.58	36.48	40.00	-3.52	100	254	QP
154.1600	45.89	-11.14	34.75	43.50	-8.75	100	266	QP
241.4600	51.99	-12.02	39.97	46.00	-6.03	100	29	QP
274.4400	48.51	-10.20	38.31	46.00	-7.69	100	70	QP
402.4800	45.51	-7.53	37.98	46.00	-8.02	100	318	QP
793.3900	32.82	-0.78	32.04	46.00	-13.96	100	94	QP
2452.000	116.89	-4.75	112.14	N/A	N/A	100	101	peak
2452.000	104.89	-4.75	100.14	N/A	N/A	100	101	AVG
2483.500	75.81	-4.69	71.12	74.00	-2.88	100	268	peak
2483.500	57.75	-4.69	53.06	54.00	-0.94	100	268	AVG
3269.000	57.45	-1.97	55.48	92.14	-36.66	151	326	peak
3269.000	56.00	-1.97	54.03	80.14	-26.11	151	326	AVG
4904.000	48.44	1.33	49.77	74.00	-24.23	220	1	peak
4904.000	38.77	1.33	40.10	54.00	-13.90	220	1	AVG

Note: 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.

Horizontal

Frequency (MHz)	Reading (dBµV)	Correct Factor(dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
N40 Mode, Low Channel								
39.7000	42.51	-10.31	32.20	40.00	-7.80	100	359	QP
71.7100	55.12	-16.54	38.58	40.00	-1.42	100	299	QP
84.3200	55.19	-16.55	38.64	40.00	-1.36	100	315	QP
238.5500	41.91	-12.07	29.84	46.00	-16.16	100	353	QP
368.5300	41.08	-8.23	32.85	46.00	-13.15	100	19	QP
839.9500	38.11	0.03	38.14	46.00	-7.86	100	276	QP
2390.000	62.59	-4.89	57.70	74.00	-16.30	100	66	peak
2390.000	50.24	-4.89	45.35	54.00	-8.65	100	66	AVG
2422.000	98.89	-4.81	94.08	N/A	N/A	100	123	peak
2422.000	89.92	-4.81	85.11	N/A	N/A	100	123	AVG
3227.000	51.70	-2.10	49.60	74.08	-24.48	117	25	peak
3227.000	49.46	-2.10	47.36	65.11	-17.75	117	25	AVG
4844.000	48.84	1.12	49.96	74.00	-24.04	220	204	peak
4844.000	44.47	1.12	45.59	54.00	-8.41	220	204	AVG
N40 Mode, Middle Channel								
40.6700	43.27	-11.02	32.25	40.00	-7.75	100	338	QP
87.2300	55.31	-16.59	38.72	40.00	-1.28	100	304	QP
245.3400	41.56	-11.96	29.60	46.00	-16.40	100	14	QP
373.3800	39.94	-8.13	31.81	46.00	-14.19	100	19	QP
792.4200	35.13	-0.81	34.32	46.00	-11.68	100	232	QP
839.9500	41.23	0.03	41.26	46.00	-4.74	100	102	QP
2437.000	104.83	-4.78	100.05	N/A	N/A	104	133	peak
2437.000	92.10	-4.78	87.32	N/A	N/A	104	133	AVG
3244.000	54.96	-2.04	52.92	80.05	-27.13	215	196	peak
3244.000	53.36	-2.04	51.32	67.32	-16.00	215	196	AVG
4874.000	47.78	1.23	49.01	74.00	-24.99	218	1	peak
4874.000	39.33	1.23	40.56	54.00	-13.44	218	1	AVG
N40 Mode, High Channel								
40.6700	43.46	-11.02	32.44	40.00	-7.56	100	360	QP
88.2000	55.38	-16.60	38.78	43.50	-4.72	100	321	QP
183.2600	38.65	-12.89	25.76	43.50	-17.74	100	353	QP
242.4300	41.02	-12.01	29.01	46.00	-16.99	100	5	QP
372.4100	40.54	-8.15	32.39	46.00	-13.61	100	37	QP
784.6600	33.22	-1.05	32.17	46.00	-13.83	100	57	QP
2452.000	104.28	-4.75	99.53	N/A	N/A	100	314	peak
2452.000	92.37	-4.75	87.62	N/A	N/A	100	314	AVG
2483.500	63.89	-4.69	59.20	74.00	-14.80	100	170	peak
2483.500	50.60	-4.69	45.91	54.00	-8.09	100	170	AVG
3269.000	54.96	-1.97	52.99	79.53	-26.54	100	192	peak
3269.000	53.38	-1.97	51.41	67.62	-16.21	100	192	AVG
4904.000	48.63	1.33	49.96	74.00	-24.04	235	349	peak
4904.000	40.53	1.33	41.86	54.00	-12.14	235	349	AVG

Note: 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.

Test Mode: simultaneous transmissions (2.4G WIFI+5G WIFI)

Mode 1 (Patch Antenna)

Horizontal

Frequency (MHz)	Reading (dBµV)	Correct Factor(dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
85.2900	47.62	-16.57	31.05	40.00	-8.95	100	225	QP
145.4300	44.15	-11.00	33.15	43.50	-10.35	100	48	QP
171.6200	45.51	-12.31	33.20	43.50	-10.30	100	53	QP
327.7900	49.06	-9.14	39.92	46.00	-6.08	100	19	QP
407.3300	49.72	-7.43	42.29	46.00	-3.71	100	7	QP
672.1400	39.06	-3.14	35.92	46.00	-10.08	100	17	QP
4824.000	46.46	1.05	47.51	74.00	-26.49	144	329	peak
4824.000	39.14	1.05	40.19	54.00	-13.81	144	329	AVG
11490.000	49.94	13.17	63.11	74.00	-10.89	100	218	peak
11490.000	36.23	13.17	49.40	54.00	-4.60	100	218	AVG

Vertical

Frequency (MHz)	Reading (dBµV)	Correct Factor(dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
32.9100	43.00	-5.27	37.73	40.00	-2.27	100	302	QP
61.0400	54.61	-17.33	37.28	40.00	-2.72	100	48	QP
84.3200	51.89	-16.55	35.34	40.00	-4.66	100	103	QP
373.3800	48.69	-8.13	40.56	46.00	-5.44	100	70	QP
442.2500	46.58	-6.73	39.85	46.00	-6.15	100	341	QP
935.9800	31.36	2.07	33.43	46.00	-12.57	100	39	QP
4824.000	50.65	1.05	51.70	74.00	-22.30	121	324	peak
4824.000	43.03	1.05	44.08	54.00	-9.92	100	324	AVG
11490.000	51.24	13.17	64.41	74.00	-9.59	100	58	peak
11490.000	37.56	13.17	50.73	54.00	-3.27	100	58	AVG

Note: Result = Reading + 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 2 (Dipole Antenna)

Horizontal

Frequency (MHz)	Reading (dBµV)	Correct Factor(dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
62.9800	45.99	-17.16	28.83	40.00	-11.17	100	90	QP
158.0400	44.51	-11.19	33.32	43.50	-10.18	100	270	QP
263.7700	38.78	-10.88	27.90	46.00	-18.10	100	75	QP
398.6000	44.32	-7.61	36.71	46.00	-9.29	100	111	QP
600.3600	38.15	-4.18	33.97	46.00	-12.03	100	121	QP
696.3900	36.52	-2.79	33.73	46.00	-12.27	100	66	QP
4824.000	49.55	1.05	50.60	74.00	-23.40	195	155	peak
4824.000	44.95	1.05	46.00	54.00	-8.00	195	155	AVG
10420.000	35.23	12.44	47.67	68.23	-20.56	100	145	peak

Vertical

Frequency (MHz)	Reading (dBµV)	Correct Factor(dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
30.9700	41.58	-3.93	37.65	40.00	-2.35	100	352	QP
81.4100	54.99	-16.51	38.48	40.00	-1.52	100	348	QP
439.3400	40.73	-6.78	33.95	46.00	-12.05	100	154	QP
551.8600	35.96	-4.98	30.98	46.00	-15.02	100	137	QP
838.0100	31.44	-0.01	31.43	46.00	-14.57	100	145	QP
900.0900	31.09	1.03	32.12	46.00	-13.88	100	93	QP
4824.000	52.79	1.05	53.84	74.00	-20.16	210	311	peak
4824.000	49.74	1.05	50.79	54.00	-3.21	210	311	AVG
10420.000	35.44	12.44	47.88	68.23	-20.35	100	152	peak

Note: Result = Reading + Factor

Margin = Result – Limit

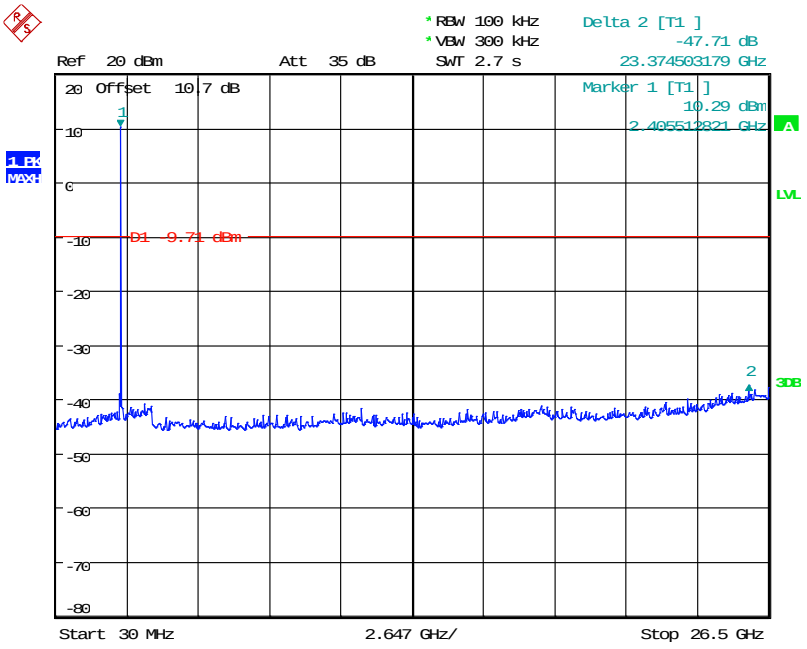
Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

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

Conducted Spurious Emissions:

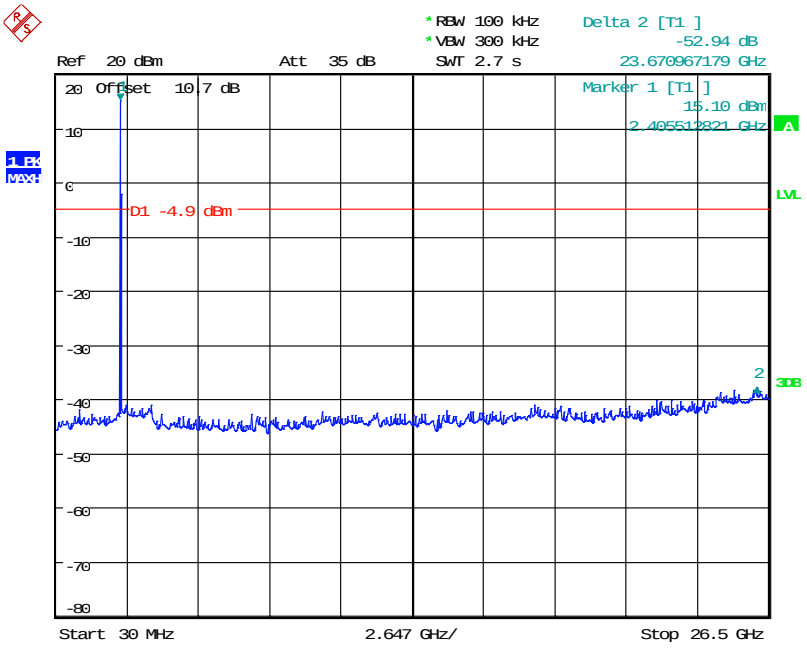
Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)		Limit (dBc)	RESULT
		Chain 0	Chain 1		
B Mode					
Low	2412	47.71	46.24	≥ 20	PASS
Mid	2437	52.94	50.94	≥ 20	PASS
High	2462	51.48	49.73	≥ 20	PASS
G Mode					
Low	2412	39.18	36.64	≥ 20	PASS
Mid	2437	41.13	39.17	≥ 20	PASS
High	2462	41.02	38.13	≥ 20	PASS
N20 Mode					
Low	2412	37.87	36.13	≥ 20	PASS
Mid	2437	40.46	40.07	≥ 20	PASS
High	2462	42.43	40.84	≥ 20	PASS
N40 Mode					
Low	2422	34.20	31.73	≥ 20	PASS
Mid	2437	37.78	35.79	≥ 20	PASS
High	2452	36.38	37.08	≥ 20	PASS

B Mode Low Channel (Chain 0)



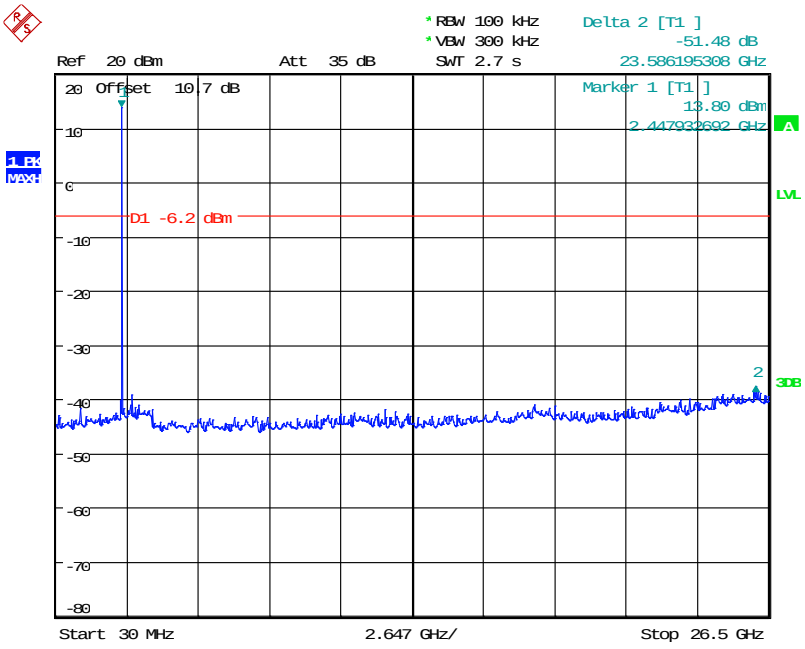
Date: 17.JAN.2018 16:12:43

B Mode Middle Channel (Chain 0)



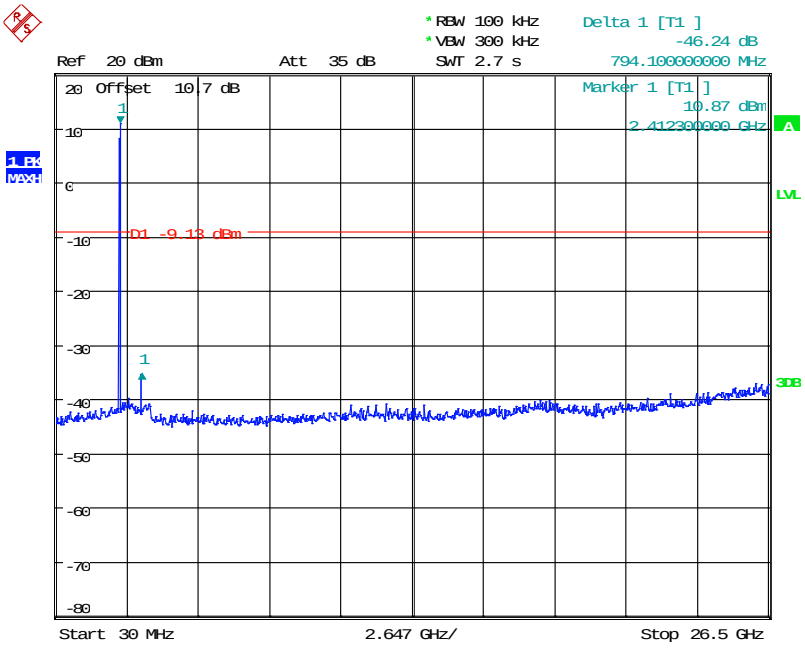
Date: 17.JAN.2018 16:14:10

B Mode High Channel (Chain 0)



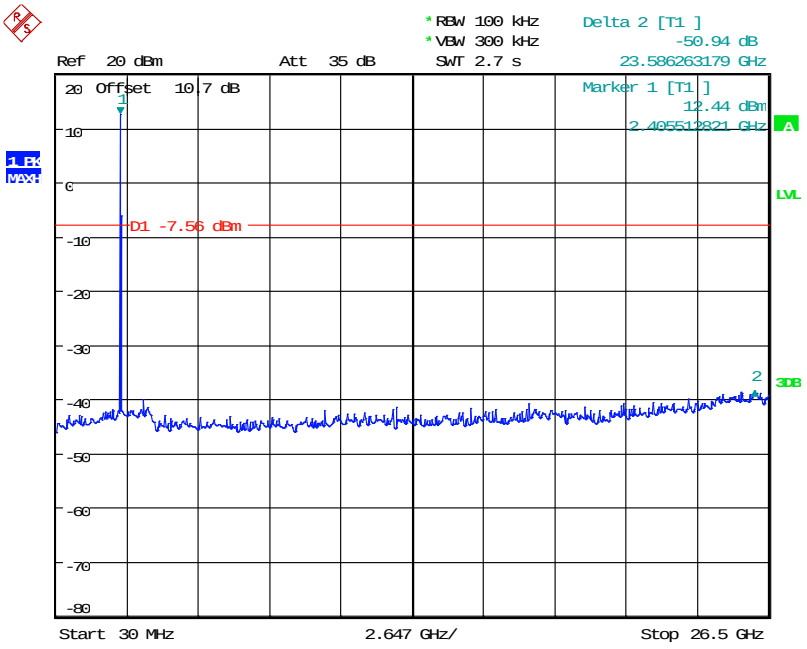
Date: 17.JAN.2018 16:15:36

B Mode Low Channel (Chain 1)



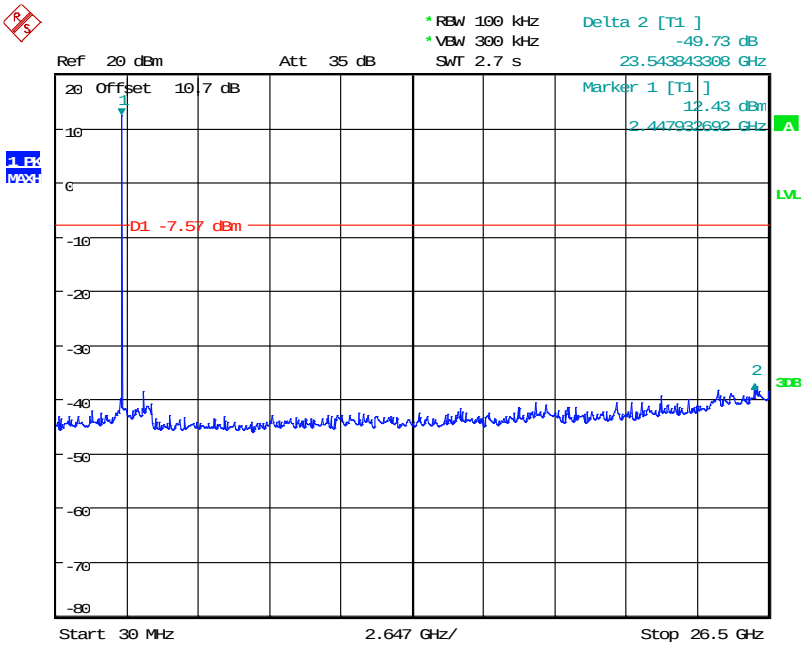
Date: 17.JAN.2018 18:21:14

B Mode Middle Channel (Chain 1)



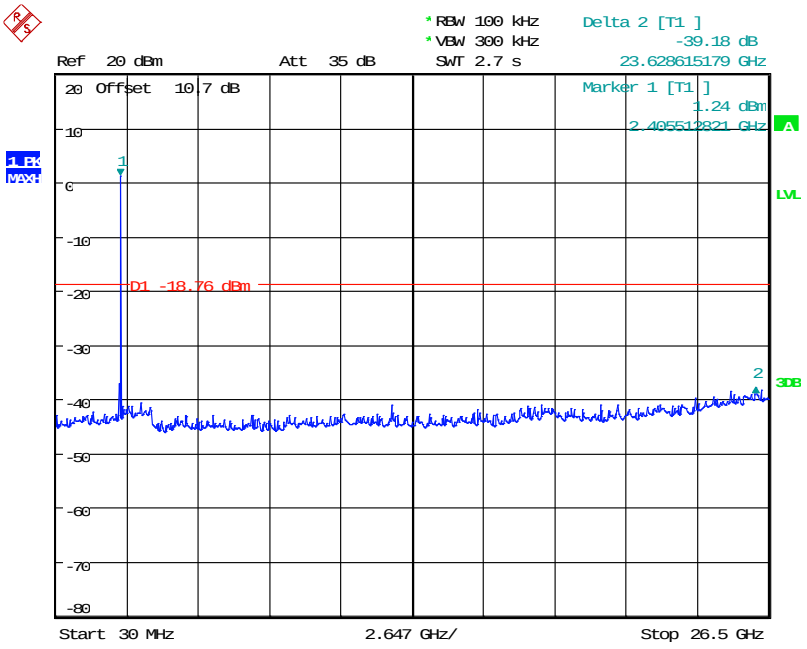
Date: 17.JAN.2018 18:13:37

B Mode High Channel (Chain 1)



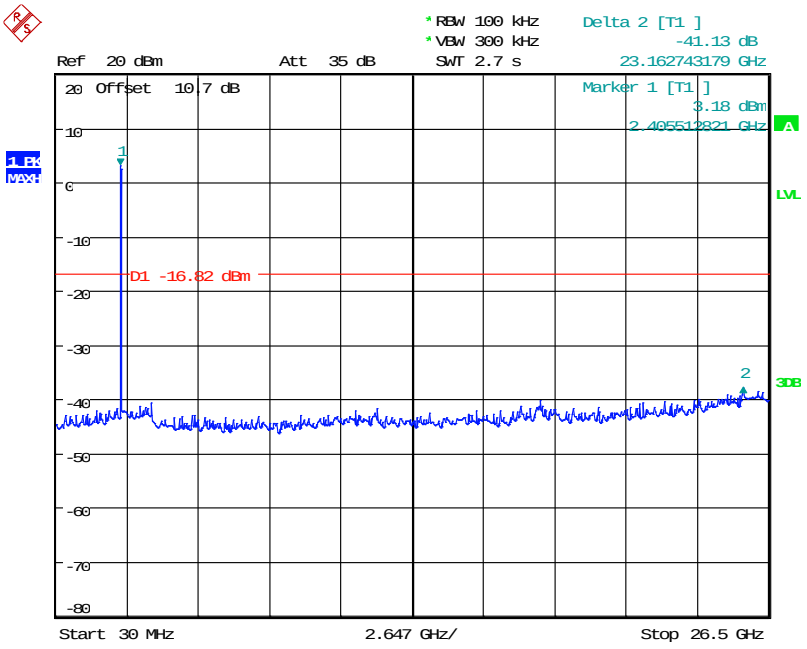
Date: 17.JAN.2018 18:15:03

G Mode Low Channel (Chain 0)



Date: 17.JAN.2018 16:19:30

G Mode Middle Channel (Chain 0)



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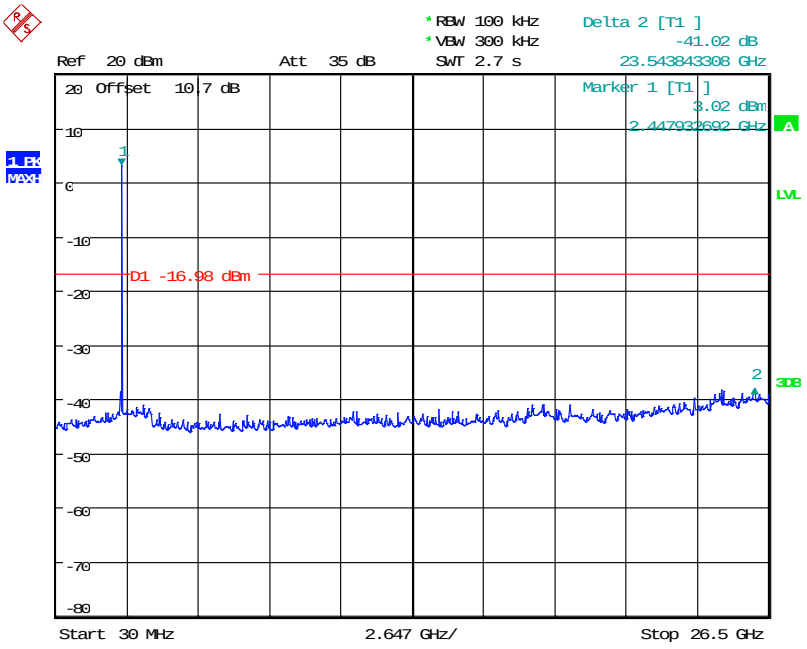
G Mode High Channel (Chain 0)



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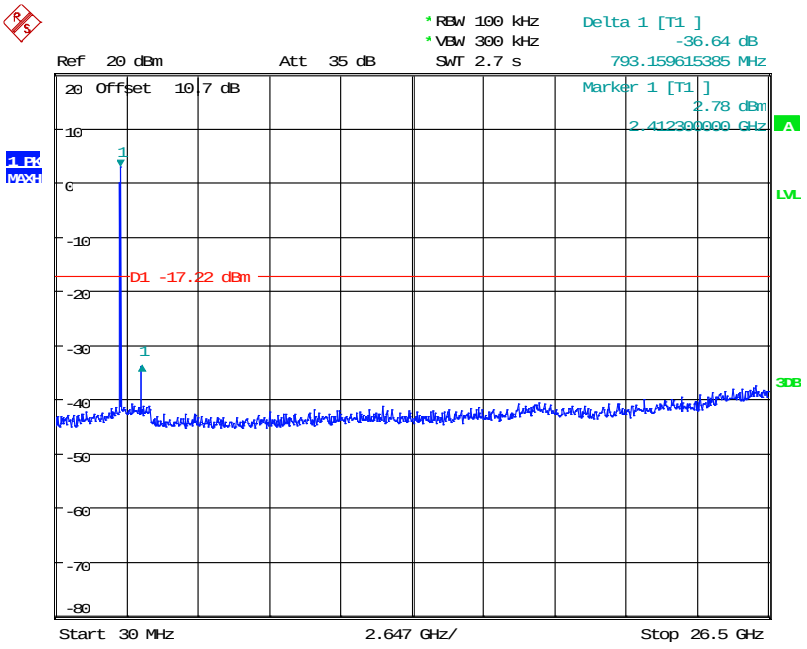
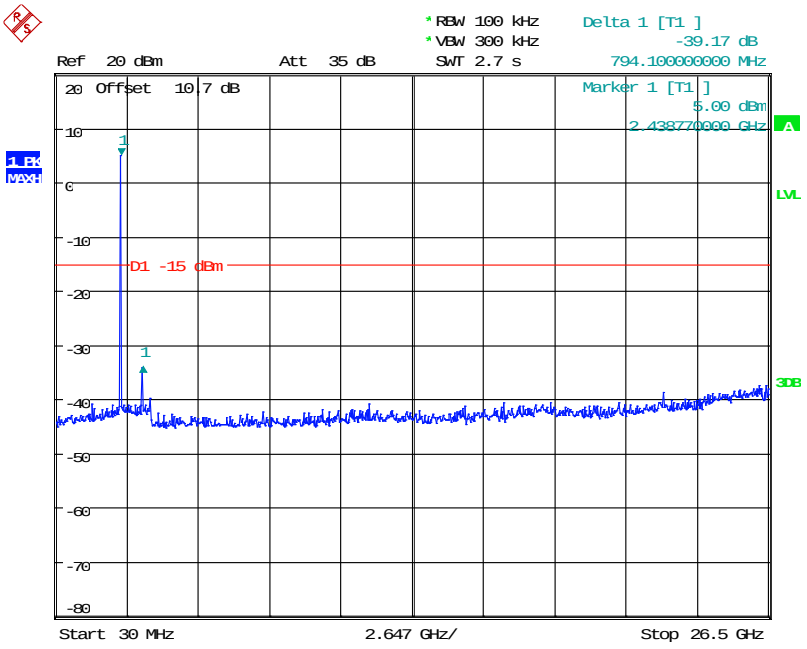
G Mode Low Channel (Chain 1)



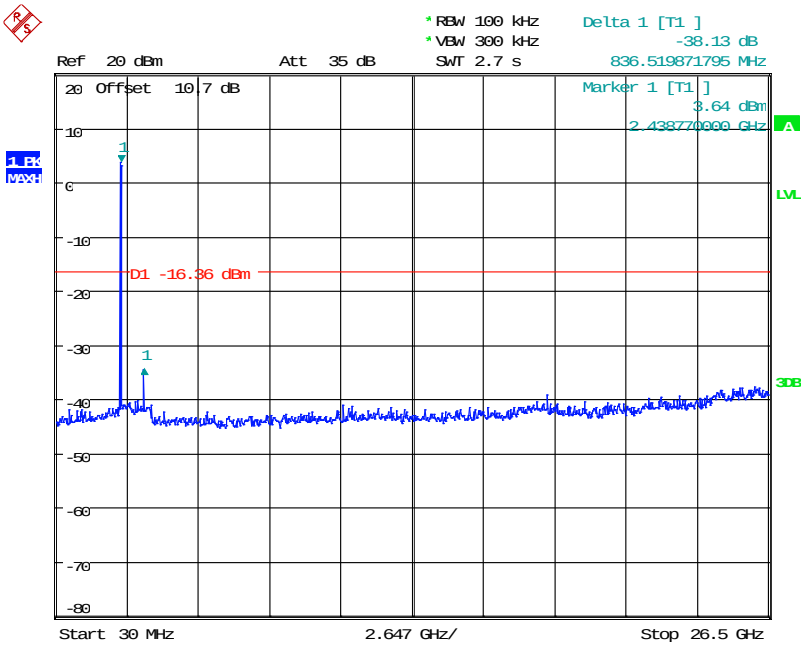
Date: 17.JAN.2018 18:34:17

G Mode Middle Channel (Chain 1)



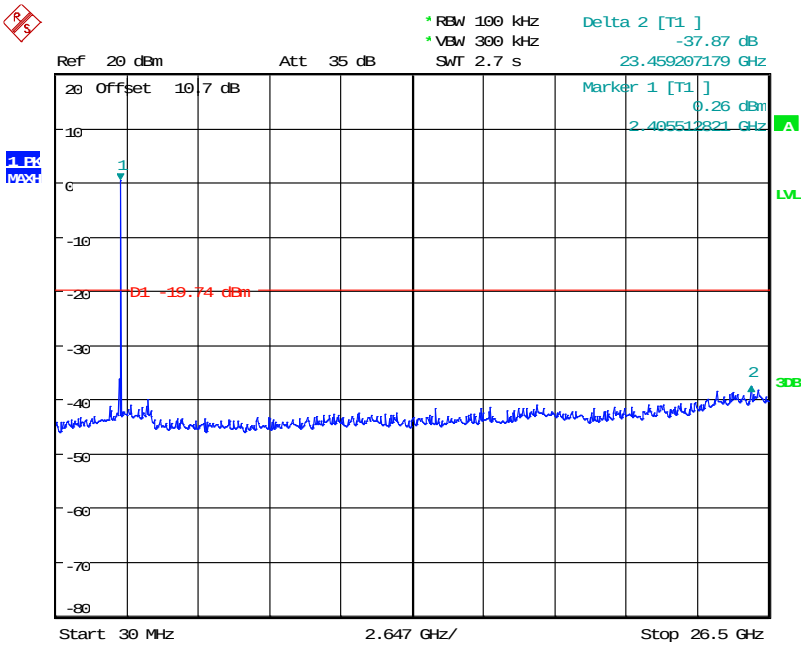
Date: 17.JAN.2018 18:35:29

G Mode High Channel (Chain 1)



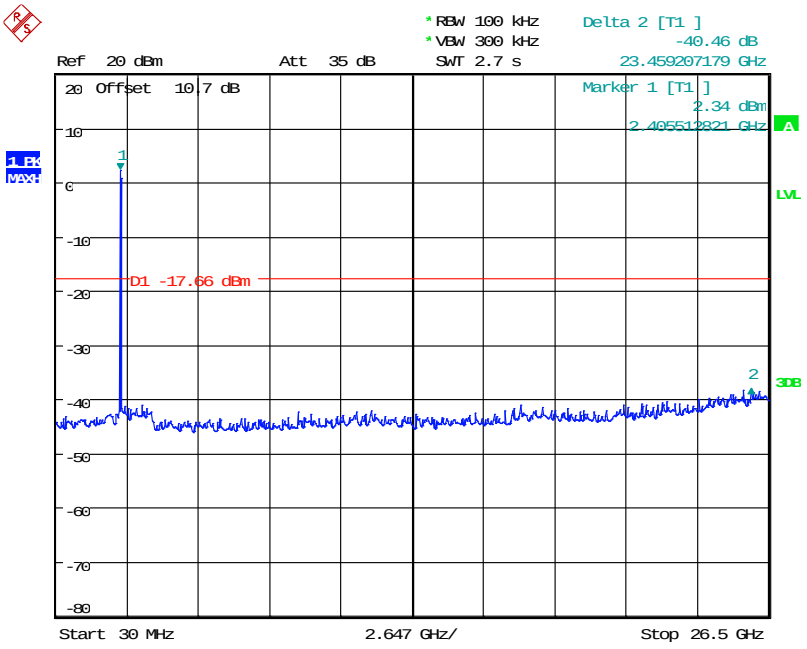
Date: 17.JAN.2018 18:36:58

N20 Mode Low Channel (Chain 0)



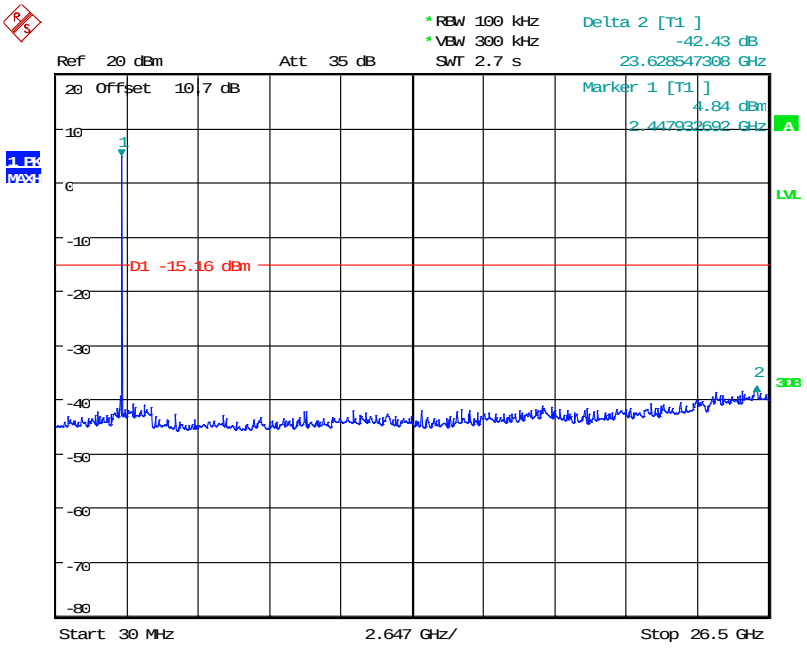
Date: 17.JAN.2018 16:37:39

N20 Mode Middle Channel (Chain 0)



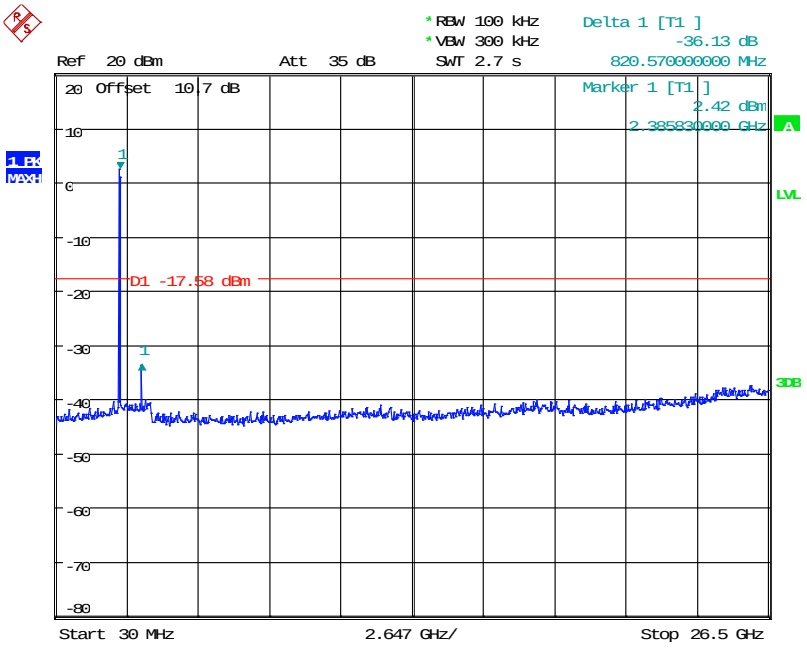
Date: 17.JAN.2018 16:39:19

N20 Mode High Channel (Chain 0)



Date: 17.JAN.2018 16:40:40

N20 Mode Low Channel (Chain 1)



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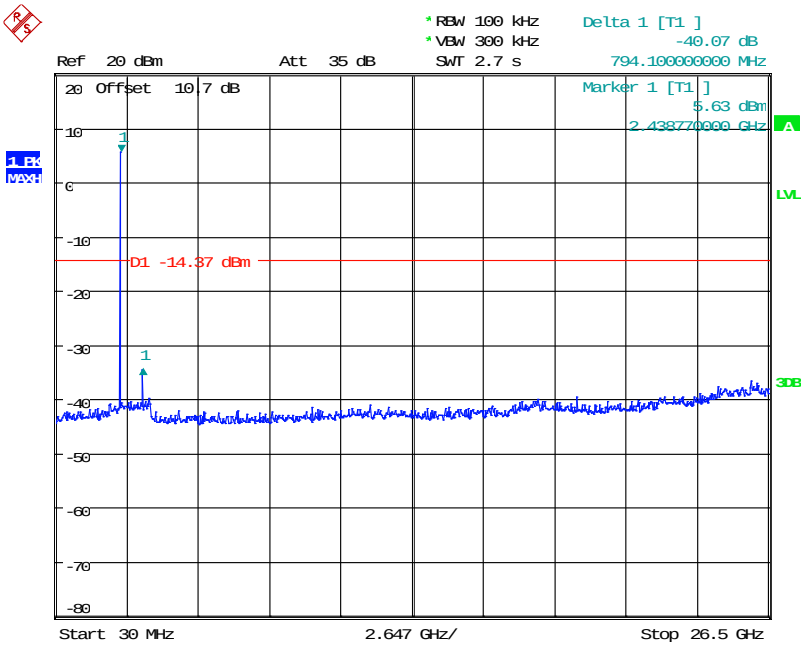
N20 Mode Middle Channel (Chain 1)



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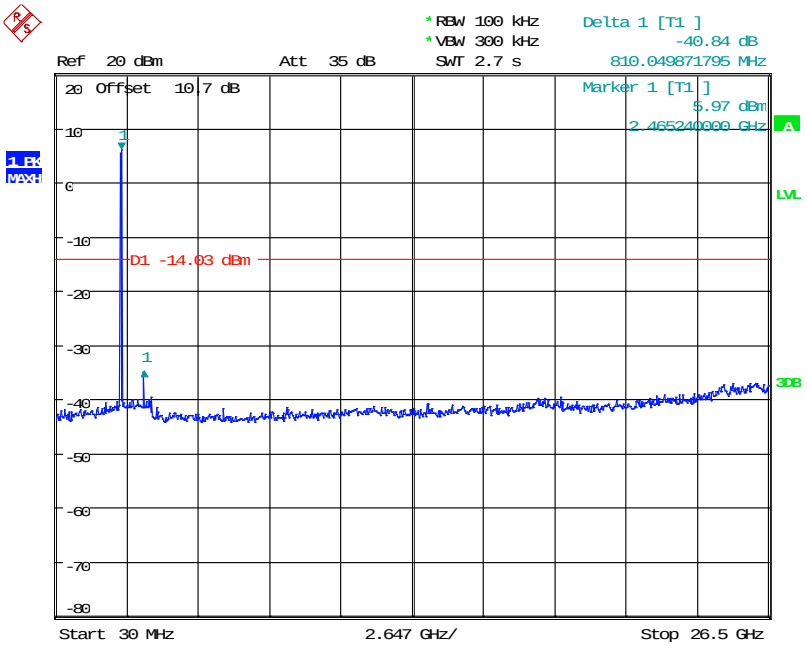
N20 Mode High Channel (Chain 1)



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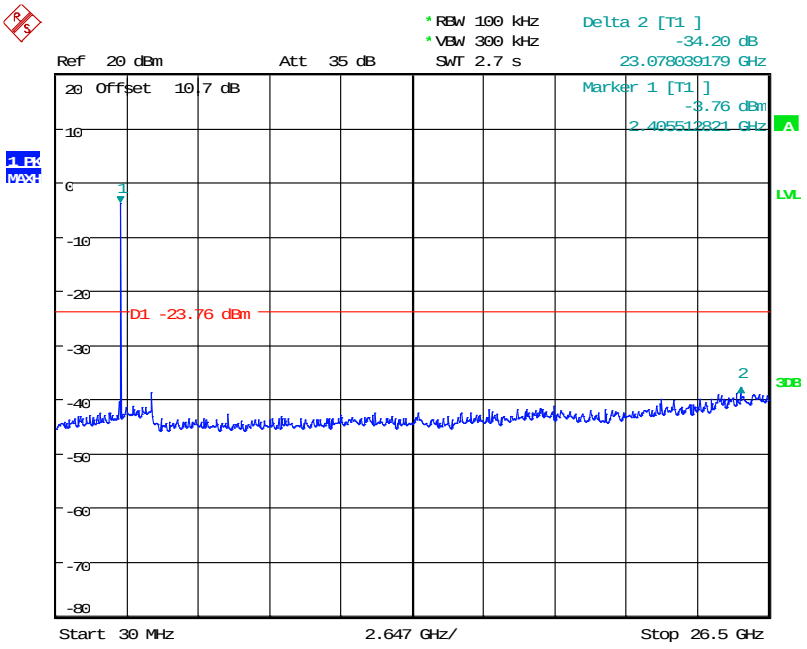
N40 Mode Low Channel (Chain 0)



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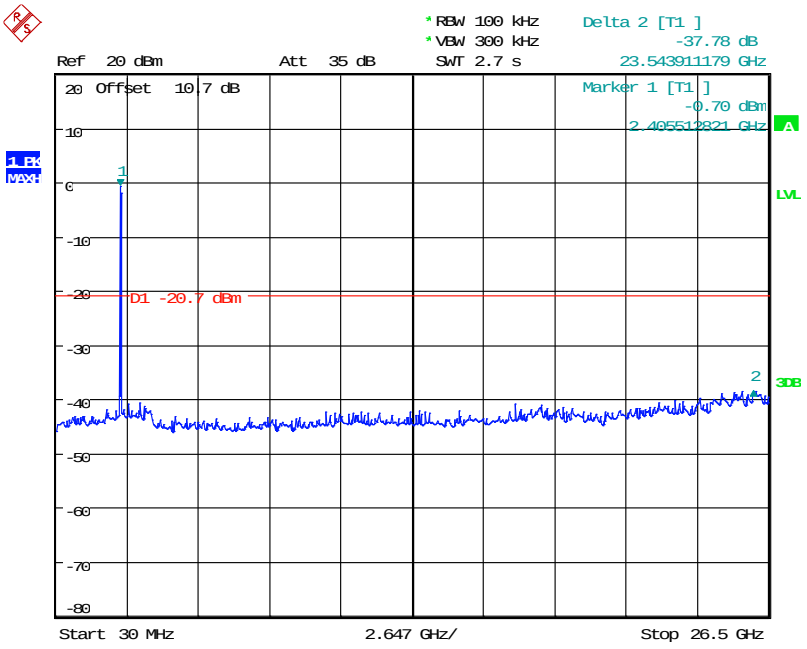
N40 Mode Middle Channel (Chain 0)



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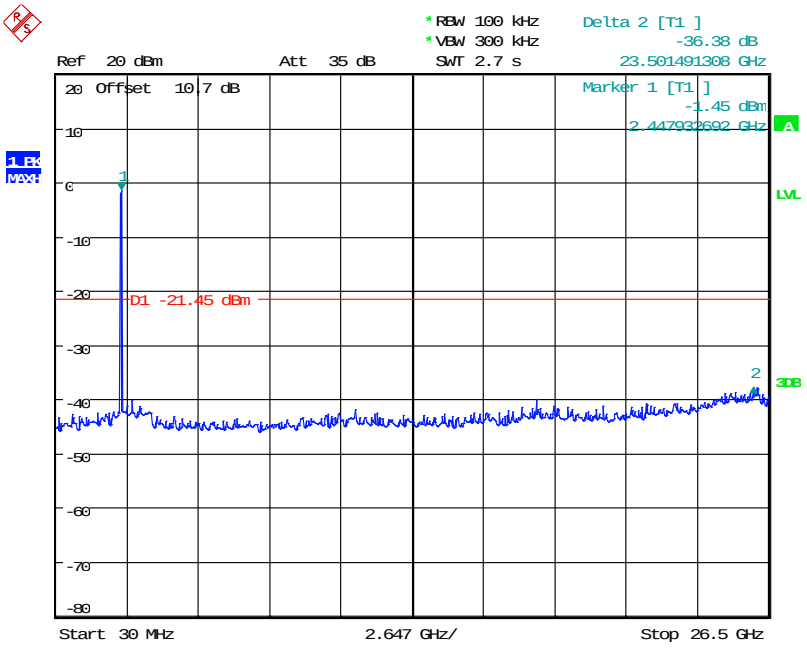
N40 Mode High Channel (Chain 0)



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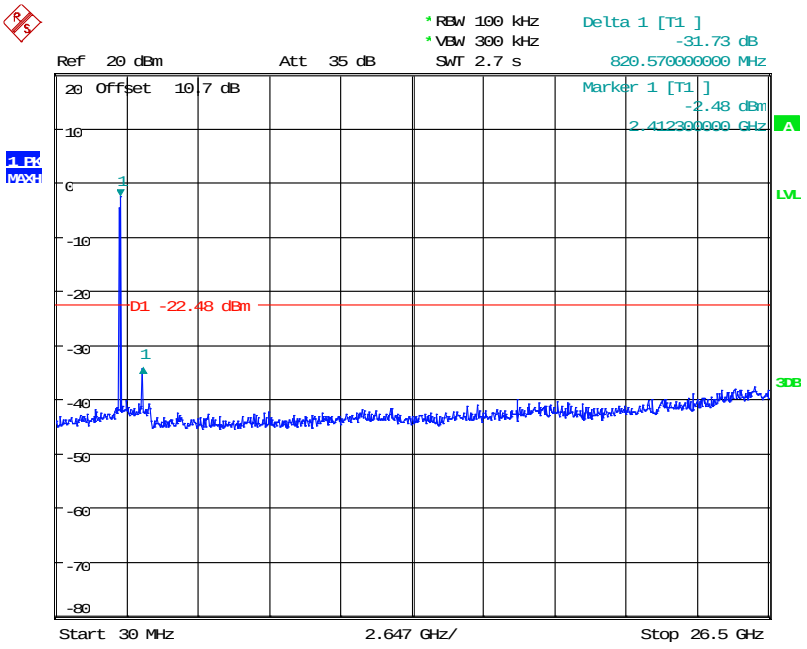
N40 Mode Low Channel (Chain 1)



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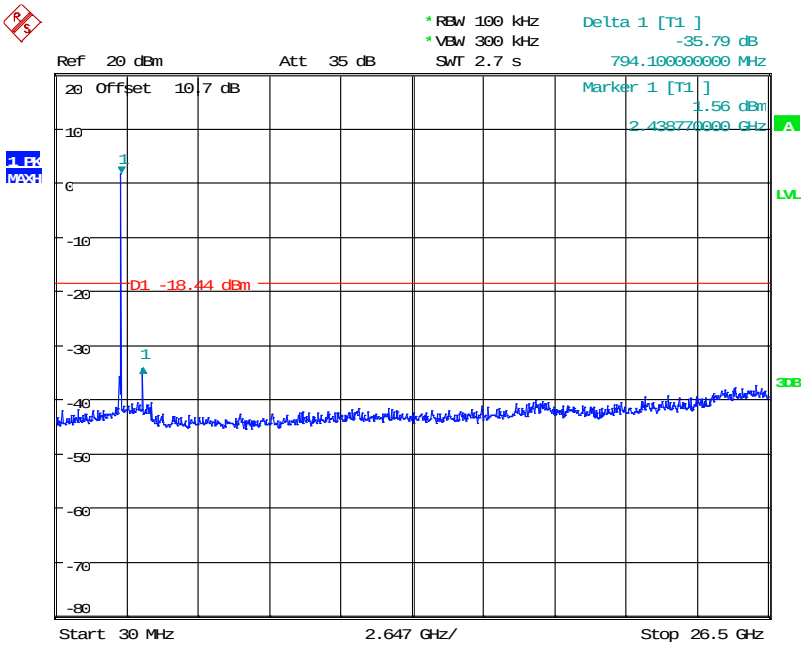
N40 Mode Middle Channel (Chain 1)



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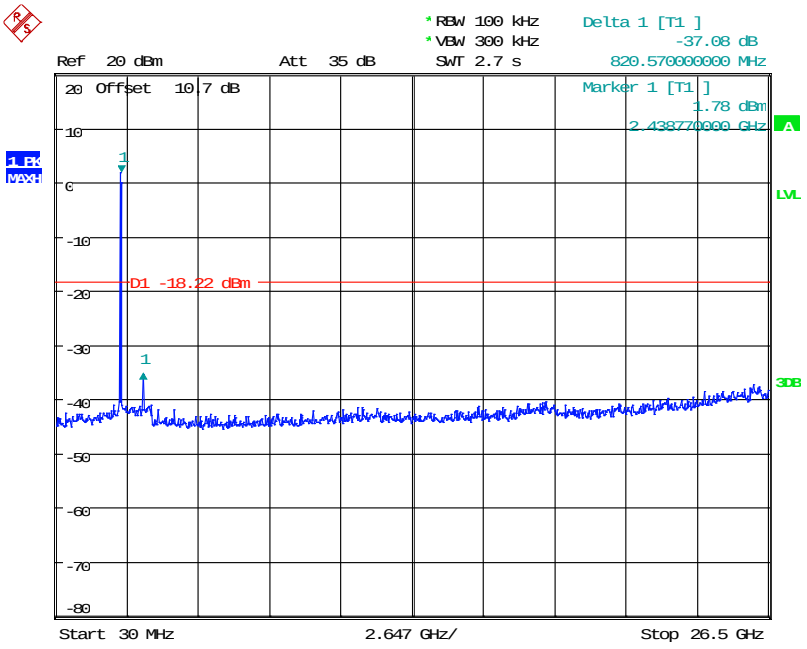
N40 Mode High Channel (Chain 1)



Date: 17.JAN.2018 18:07:35

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

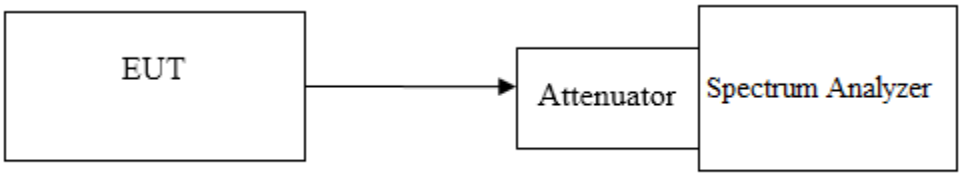
8.1 Applicable Standard

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	FSU26	200268	2017/05/08	2018/05/07
Cable	WOKEN	SFL402	S02-160323-07	2017/02/22	2018/02/21
Attenuator	MINI-CIRCUITS	BW-S10W5+	N/A	2017/12/14	2018/12/13

**** 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

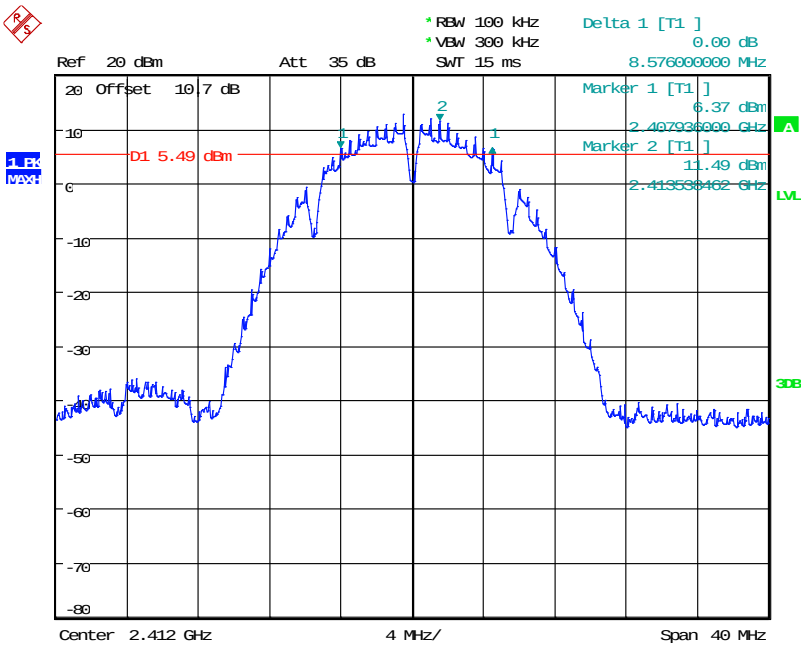
The testing was performed by Andy Shih on 2018-01-17.

8.5 Test Results

Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)		Limit (kHz)	Result
		Chain 0	Chain 1		
B Mode					
Low	2412	8.57	9.02	>500	PASS
Mid	2437	8.96	8.00	>500	PASS
High	2462	8.96	8.00	>500	PASS
G Mode					
Low	2412	16.32	16.38	>500	PASS
Mid	2437	16.25	16.25	>500	PASS
High	2462	16.38	16.25	>500	PASS
N20 Mode					
Low	2412	17.53	17.53	>500	PASS
Mid	2437	17.53	17.47	>500	PASS
High	2462	17.53	17.53	>500	PASS
N40 Mode					
Low	2422	35.07	35.71	>500	PASS
Mid	2437	34.81	34.94	>500	PASS
High	2452	34.81	34.43	>500	PASS

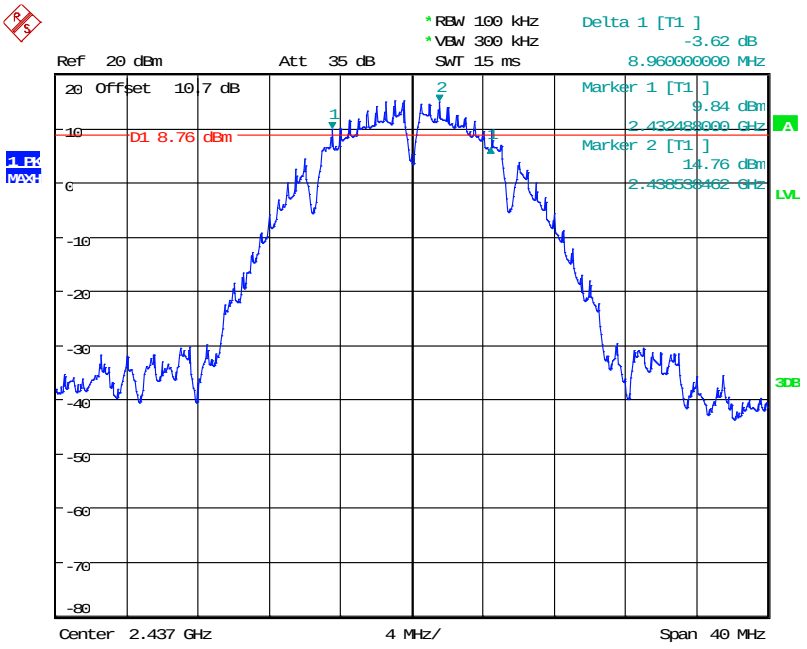
6 dB Emission Bandwidth

B Mode Low Channel (Chain 0)



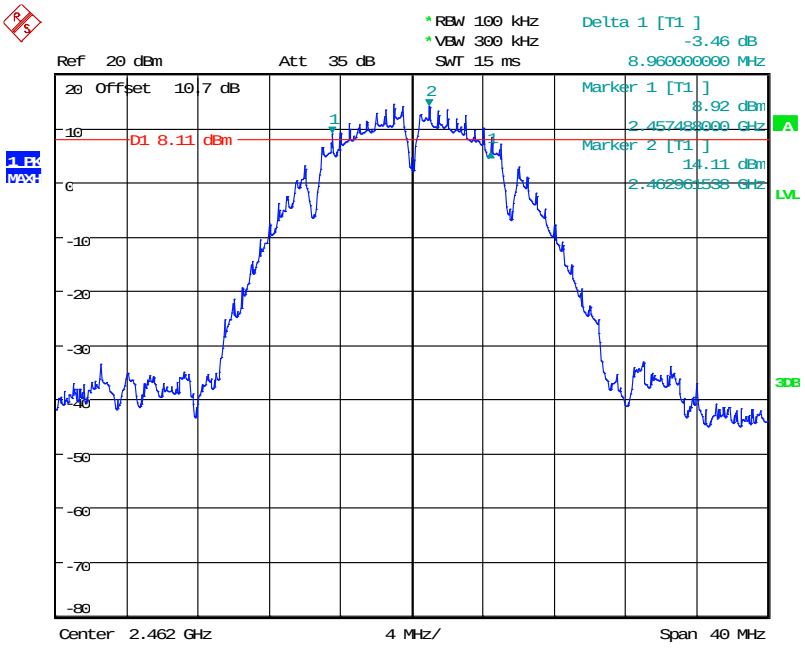
Date: 17.JAN.2018 16:12:09

B Mode Middle Channel (Chain 0)



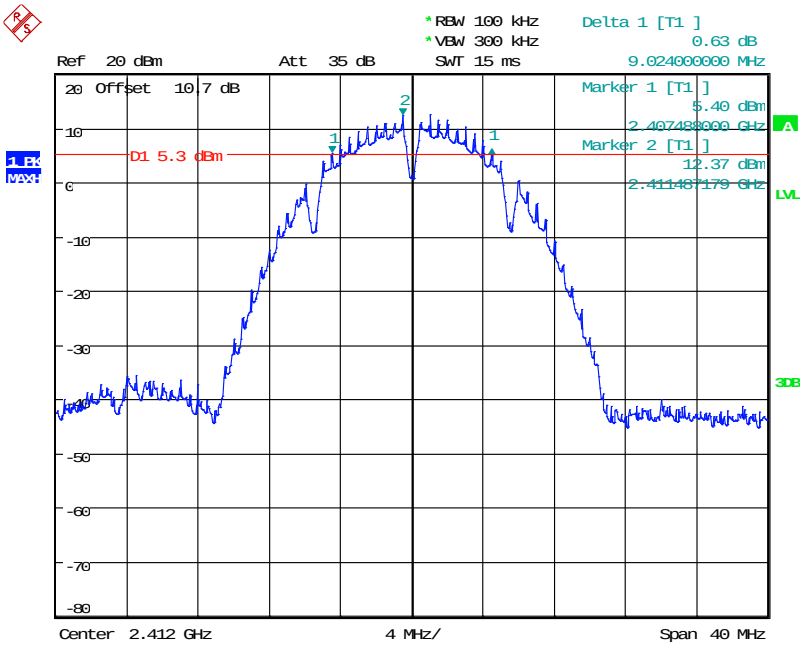
Date: 17.JAN.2018 16:13:38

B Mode High Channel (Chain 0)



Date: 17.JAN.2018 16:14:54

B Mode Low Channel (Chain 1)



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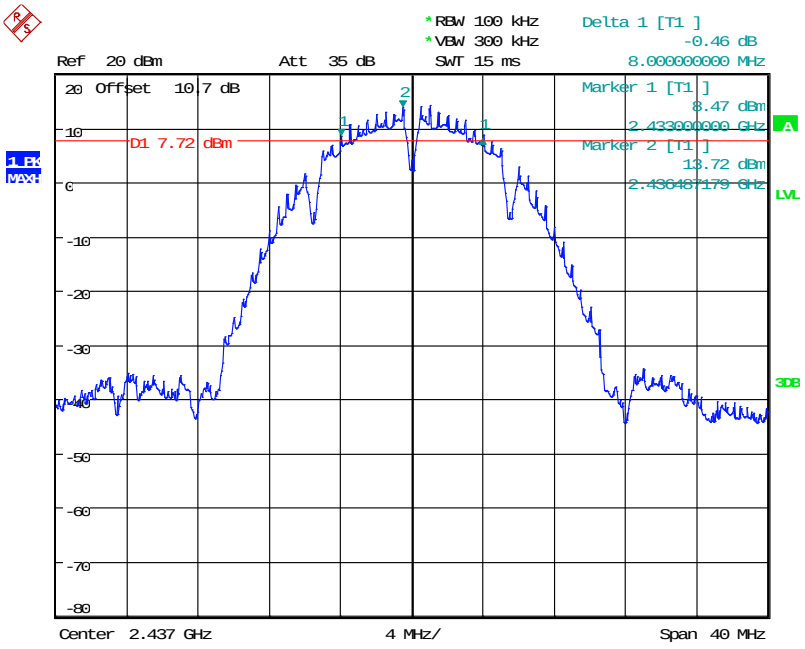
B Mode Middle Channel (Chain 1)



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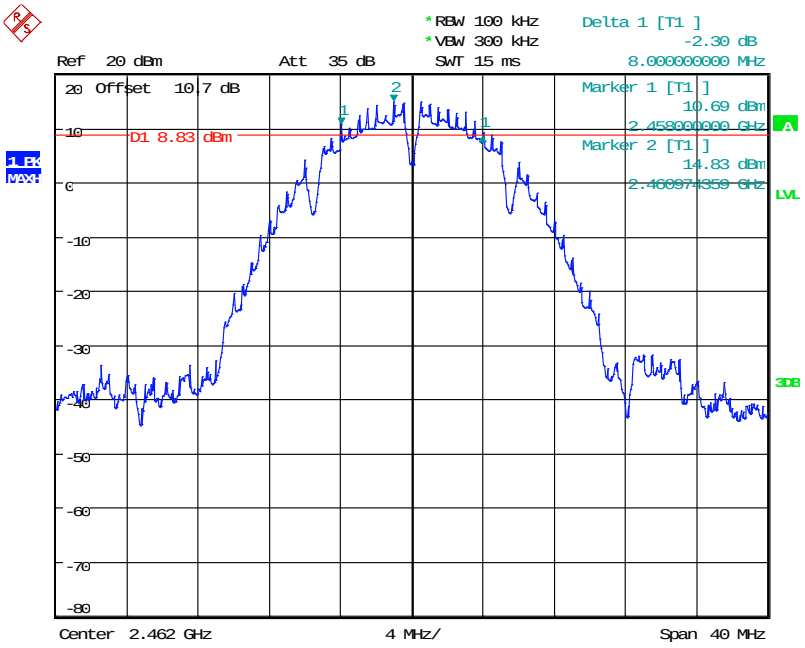
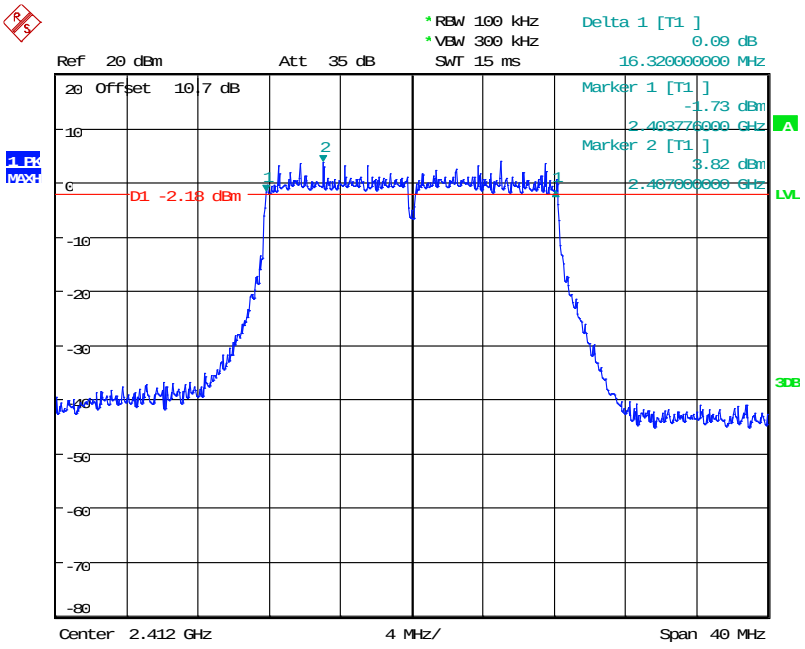
B Mode High Channel (Chain 1)



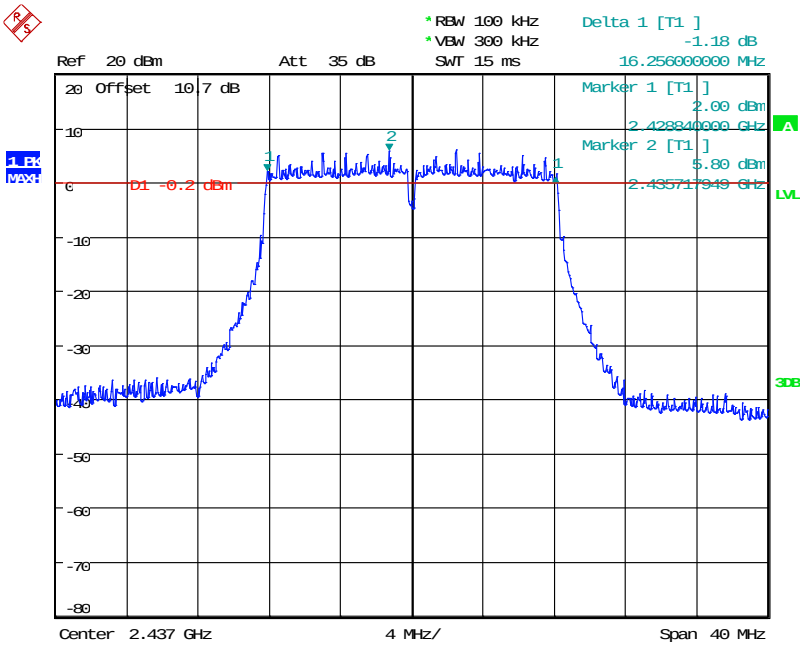
Date: 17.JAN.2018 18:14:22

G Mode Low Channel (Chain 0)



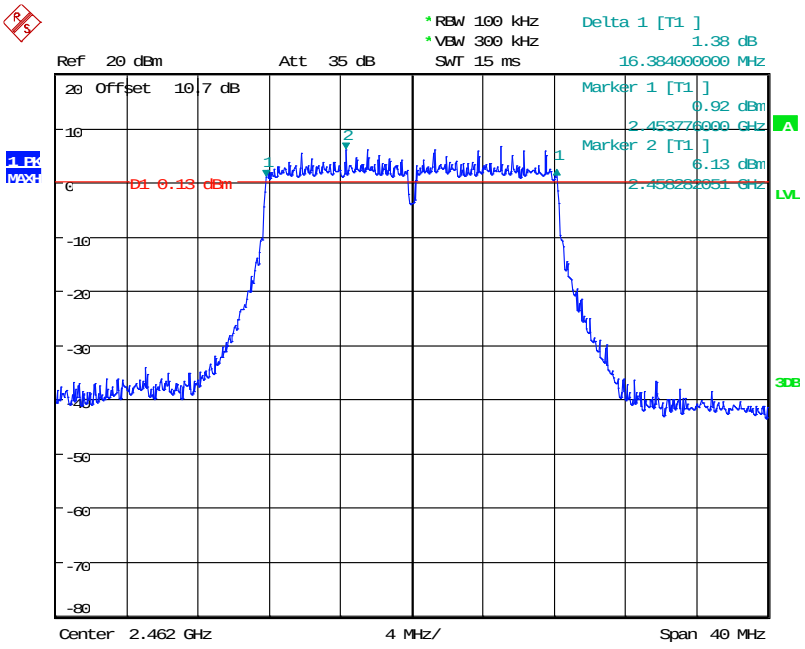
Date: 17.JAN.2018 16:18:57

G Mode Middle Channel (Chain 0)



Date: 17.JAN.2018 16:20:17

G Mode High Channel (Chain 0)



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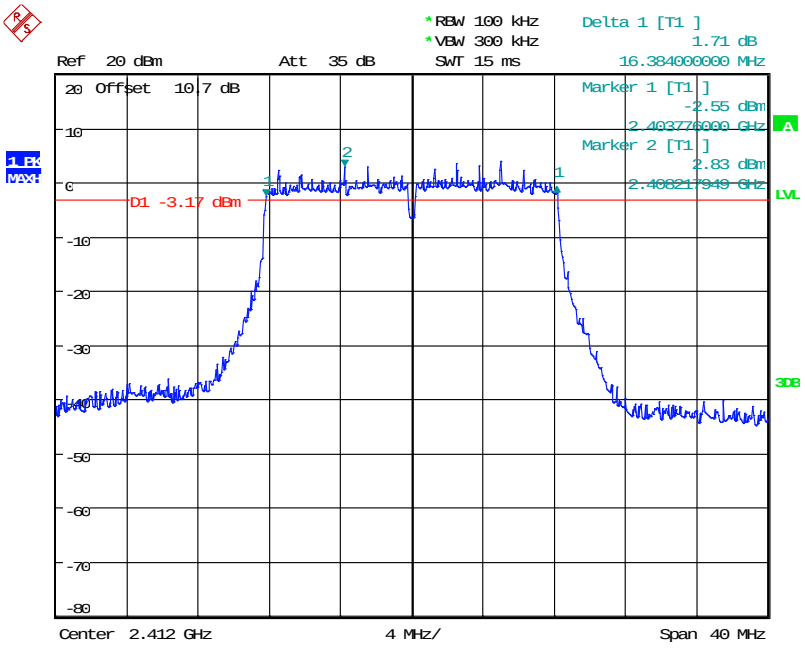
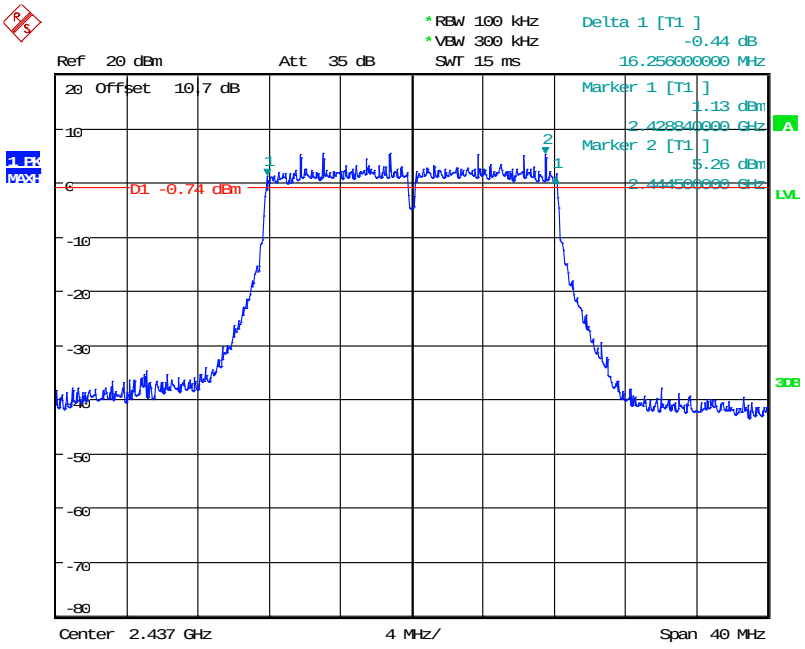
G Mode Low Channel (Chain 1)



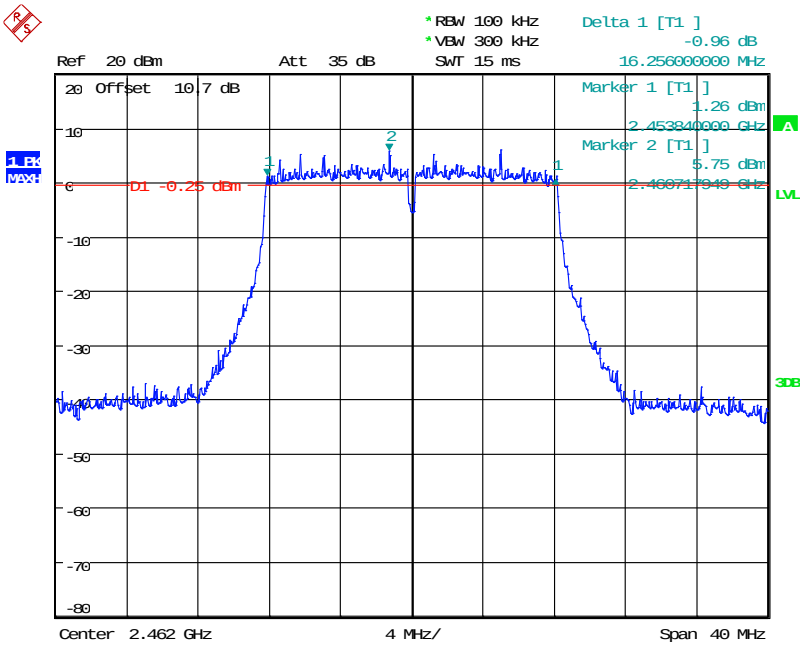
Date: 17.JAN.2018 18:23:54

G Mode Middle Channel (Chain 1)



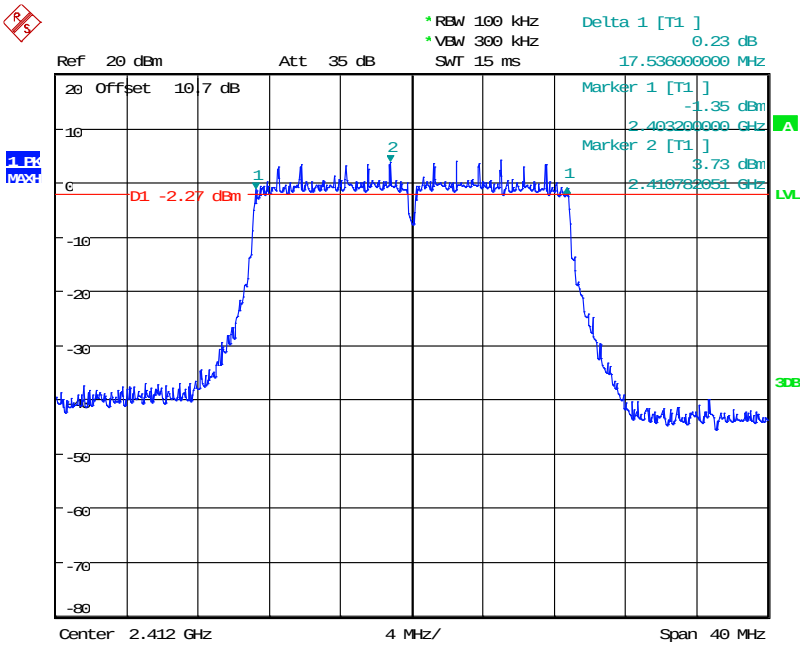
Date: 17.JAN.2018 18:25:03

G Mode High Channel (Chain 1)



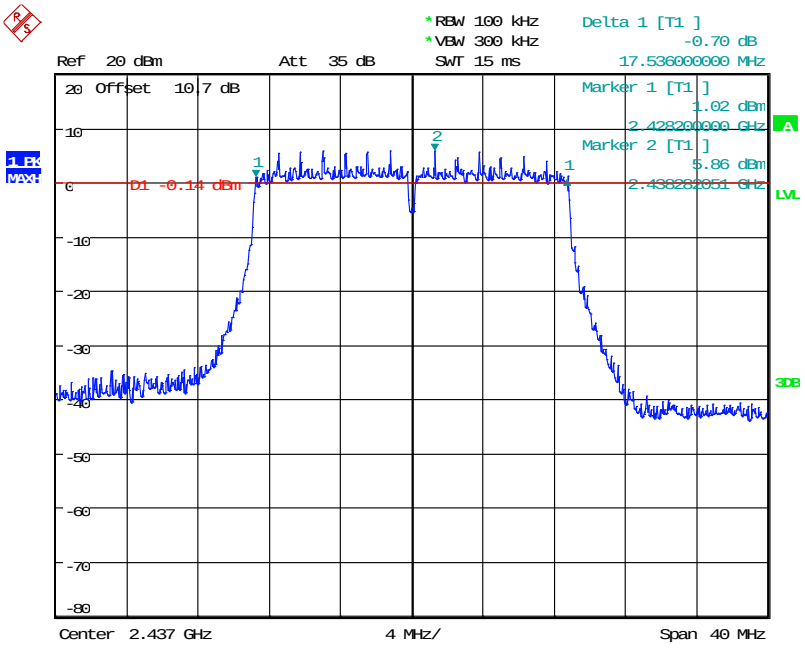
Date: 17.JAN.2018 18:27:08

N20 Mode Low Channel (Chain 0)



Date: 17.JAN.2018 16:37:06

N20 Mode Middle Channel (Chain 0)



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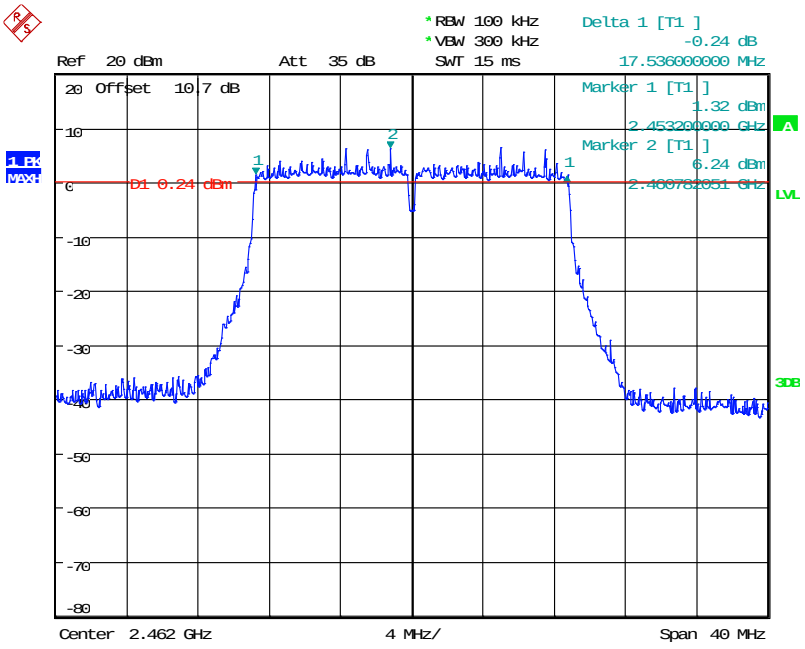
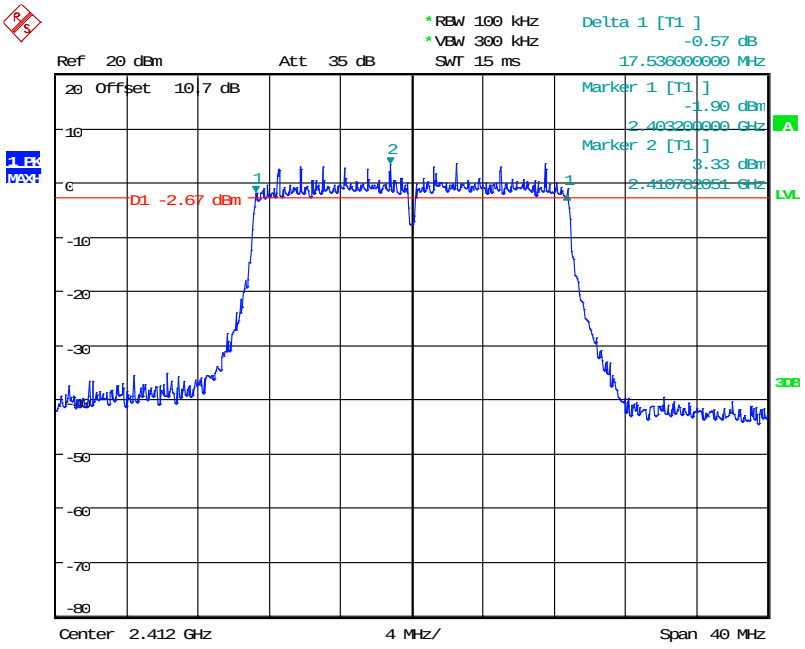
N20 Mode High Channel (Chain 0)



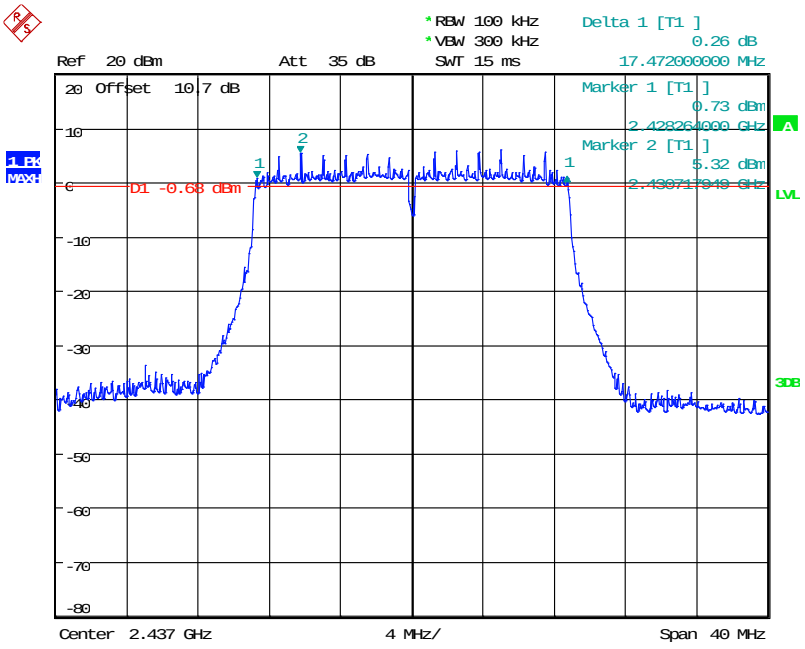
Date: 17.JAN.2018 16:39:58

N20 Mode Low Channel (Chain 1)



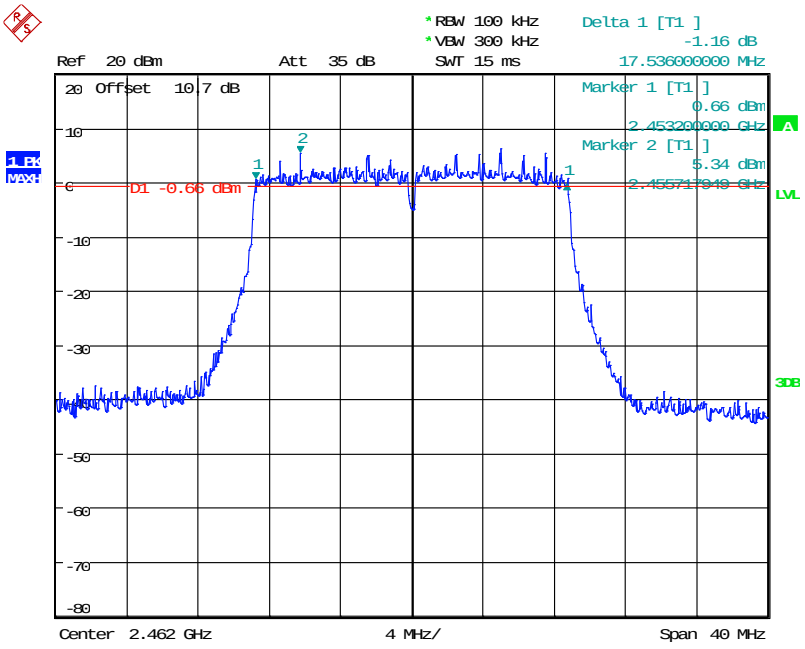
Date: 17.JAN.2018 18:38:15

N20 Mode Middle Channel (Chain 1)



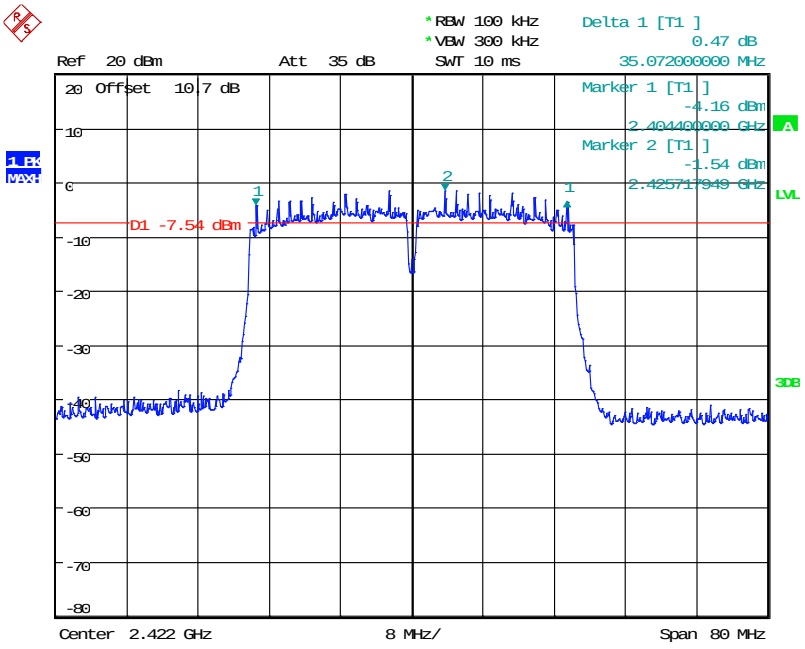
Date: 17.JAN.2018 18:41:44

N20 Mode High Channel (Chain 1)



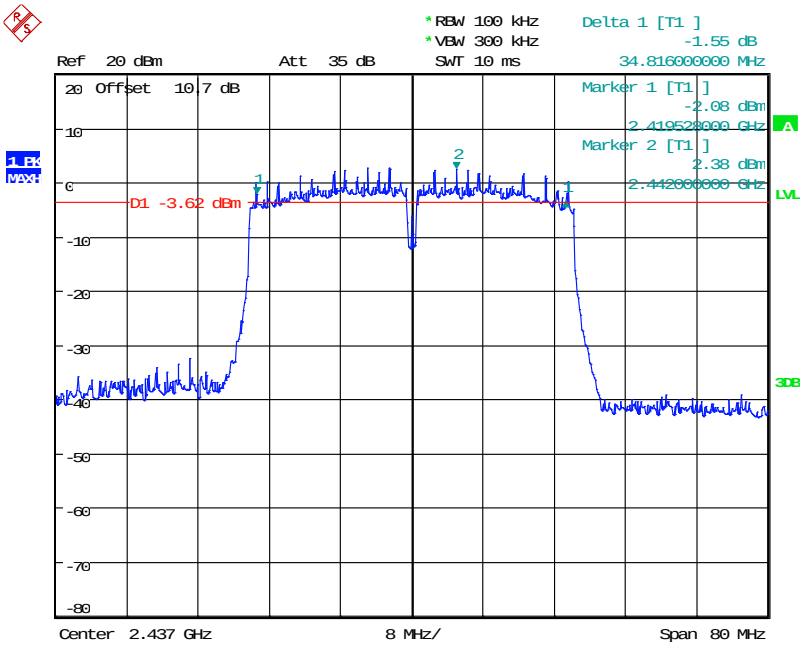
Date: 17.JAN.2018 18:42:58

N40 Mode Low Channel (Chain 0)



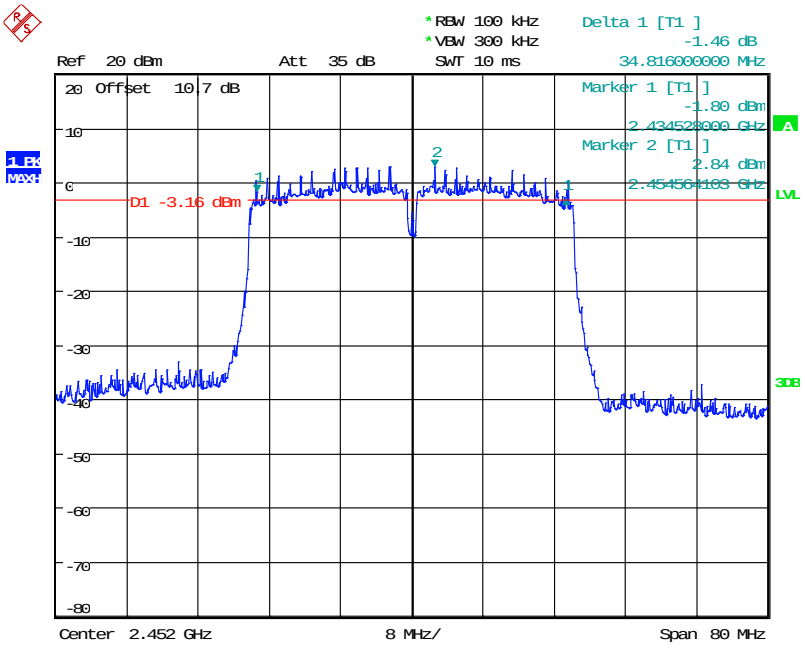
Date: 17.JAN.2018 16:45:42

N40 Mode Middle Channel (Chain 0)



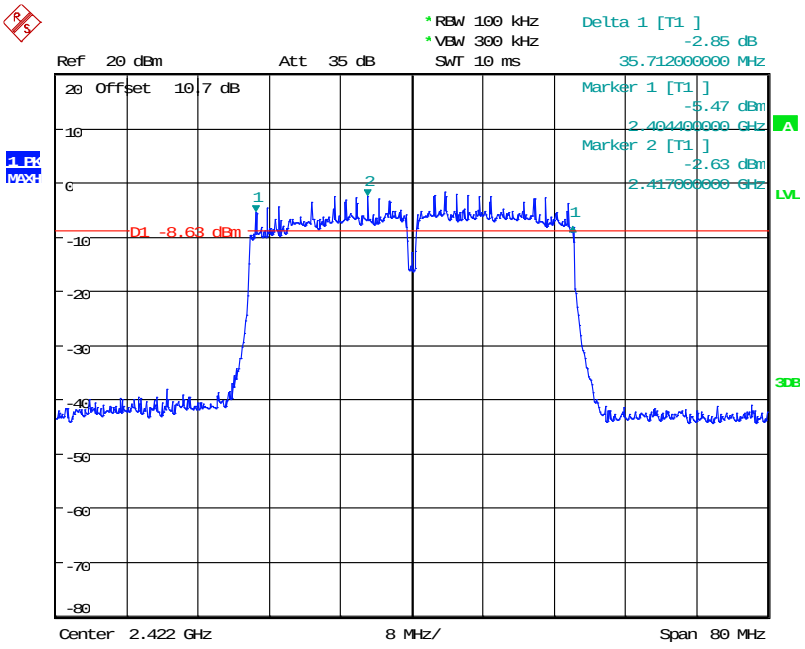
Date: 17.JAN.2018 16:47:00

N40 Mode High Channel (Chain 0)



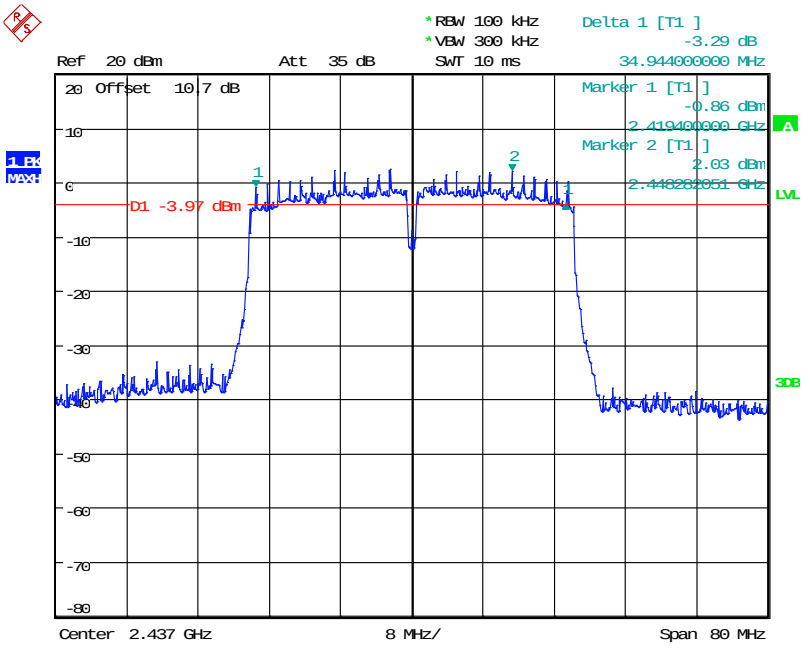
Date: 17.JAN.2018 16:58:04

N40 Mode Low Channel (Chain 1)



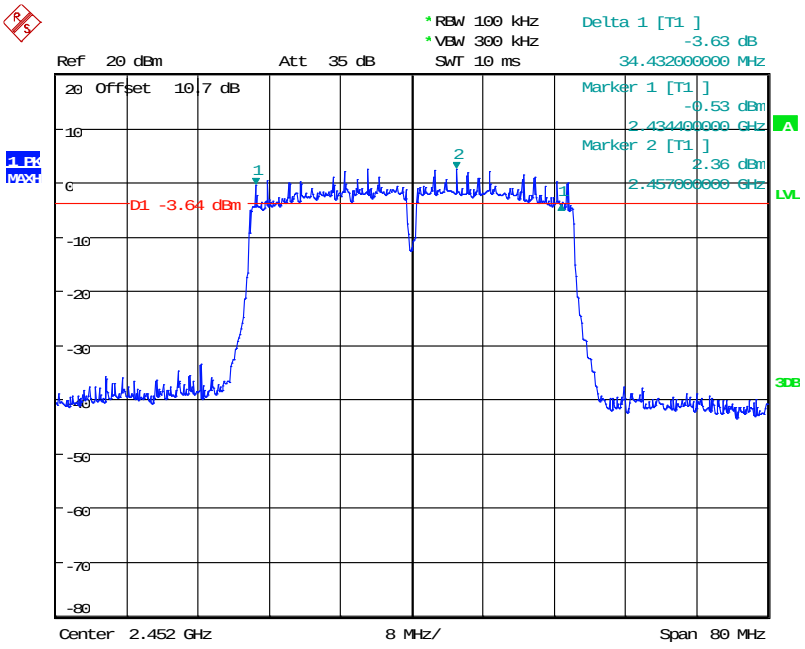
Date: 17.JAN.2018 17:56:29

N40 Mode Middle Channel (Chain 1)



Date: 17.JAN.2018 17:58:13

N40 Mode High Channel (Chain 1)



Date: 17.JAN.2018 18:03:33

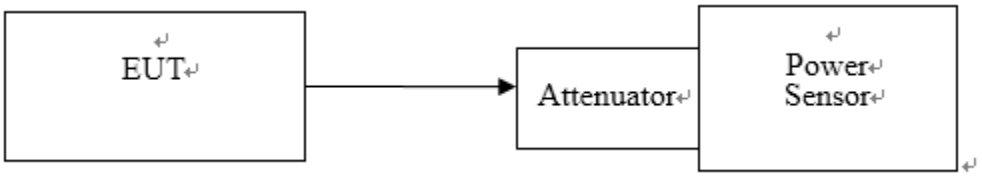
9 FCC §15.247(b) (3) – Maximum Output Power

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 measuring equipment.



9.3 Test Equipment List and Details

Descriptions	Manufacturers	Models	Serial Numbers	Calibration Date	Calibration Due Date
Power Sensor	KEYSIGHT	U2021XA	MY54080018	2017/03/21	2018/03/20
Attenuator	MINI-CIRCUITS	BW-S10W5+	N/A	2017/12/14	2018/12/13
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 Andy Shih on 2018-01-29.

9.5 Test Results

SISO mode and MIMO mode have the same power level setting, so every port measure power is same.

MIMO (CDD) Mode:

Channel	Frequency (MHz)	Conducted Peak Output Power				Limit (W)	RESULT
		Chain 0 (dBm)	Chain 1 (dBm)	Total Power (dBm)	Total (W)		
B Mode							
Low	2412	23.12	23.32	26.23	0.420	1	PASS
Mid	2437	25.85	26.39	29.14	0.820	1	PASS
High	2462	26.30	25.80	29.07	0.807	1	PASS
G Mode							
Low	2412	24.80	25.15	27.99	0.630	1	PASS
Mid	2437	26.64	26.67	29.67	0.927	1	PASS
High	2462	25.57	26.88	29.28	0.847	1	PASS
N20 Mode							
Low	2412	24.96	25.38	28.19	0.659	1	PASS
Mid	2437	26.72	26.47	29.61	0.914	1	PASS
High	2462	26.33	26.78	29.57	0.906	1	PASS
N40 Mode							
Low	2422	22.03	22.46	25.26	0.336	1	PASS
Mid	2437	26.08	26.43	29.27	0.845	1	PASS
High	2452	25.97	26.31	29.15	0.822	1	PASS

Channel	Frequency (MHz)	Conducted Average Output Power						Limit (W)	RESULT
		Chain 0 (dBm)	Chain 1 (dBm)	Total (dBm)	Duty Factor (dB)	Total Maximum Conducted Average (dBm)	Total (W)		
B Mode									
Low	2412	21.75	21.44	24.61	0.04	24.65	0.292	1	PASS
Mid	2437	22.67	23.84	26.30	0.04	26.34	0.431	1	PASS
High	2462	24.52	24.08	27.32	0.04	27.36	0.545	1	PASS
G Mode									
Low	2412	15.77	16.20	19.00	0.32	19.32	0.086	1	PASS
Mid	2437	17.92	18.29	21.12	0.32	21.44	0.139	1	PASS
High	2462	18.02	18.88	21.48	0.32	21.80	0.151	1	PASS
N20 Mode									
Low	2412	15.70	16.07	18.90	0.36	19.26	0.084	1	PASS
Mid	2437	17.84	18.21	21.04	0.36	21.40	0.138	1	PASS
High	2462	17.88	18.78	21.36	0.36	21.72	0.149	1	PASS
N40 Mode									
Low	2422	12.45	12.92	15.70	0.76	16.46	0.044	1	PASS
Mid	2437	16.76	17.04	19.91	0.76	20.67	0.117	1	PASS
High	2452	16.74	17.31	20.04	0.76	20.80	0.120	1	PASS

According to FCC KDB 662911 D01 Multiple Transmitter Output v02r01

For power measurements on IEEE 802.11 devices, Array Gain = 0 dB (i.e., no array gain) for NANT ≤ 4.

The device have two antenna, so array gain is 0 dB.

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

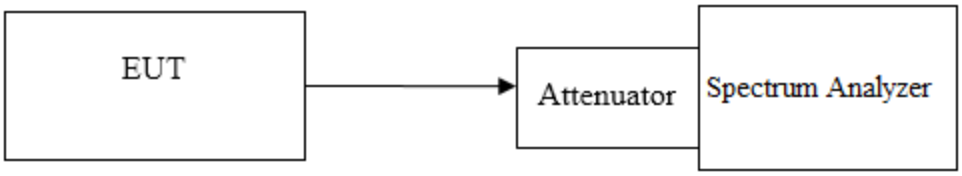
10.1 Applicable Standard

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	FSU26	200268	2017/05/08	2018/05/07
Cable	WOKEN	SFL402	S02-160323-07	2017/02/22	2018/02/21
Attenuator	MINI-CIRCUITS	BW-S10W5+	N/A	2017/12/14	2018/12/13

**** 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

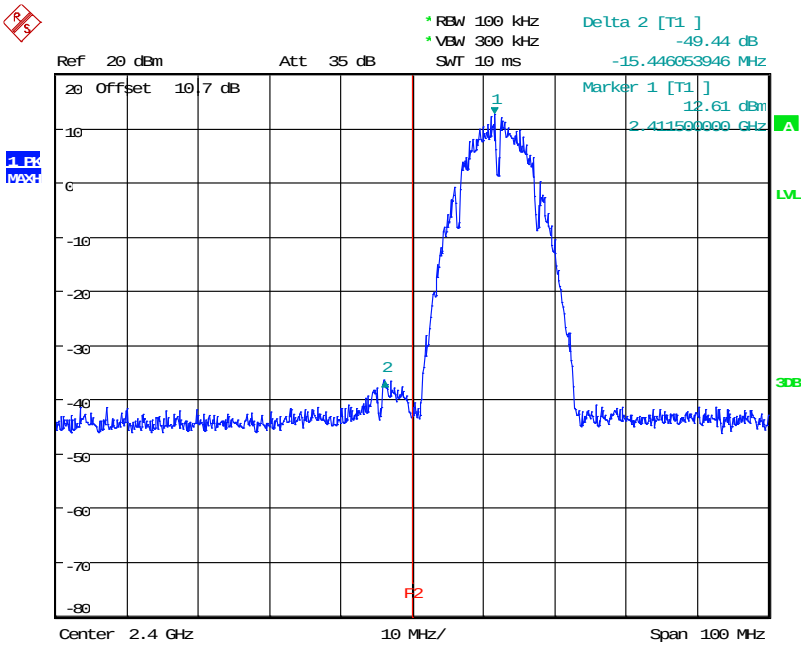
The testing was performed by Andy Shih on 2018-01-17.

10.5 Test Results

Please refer to the following plots

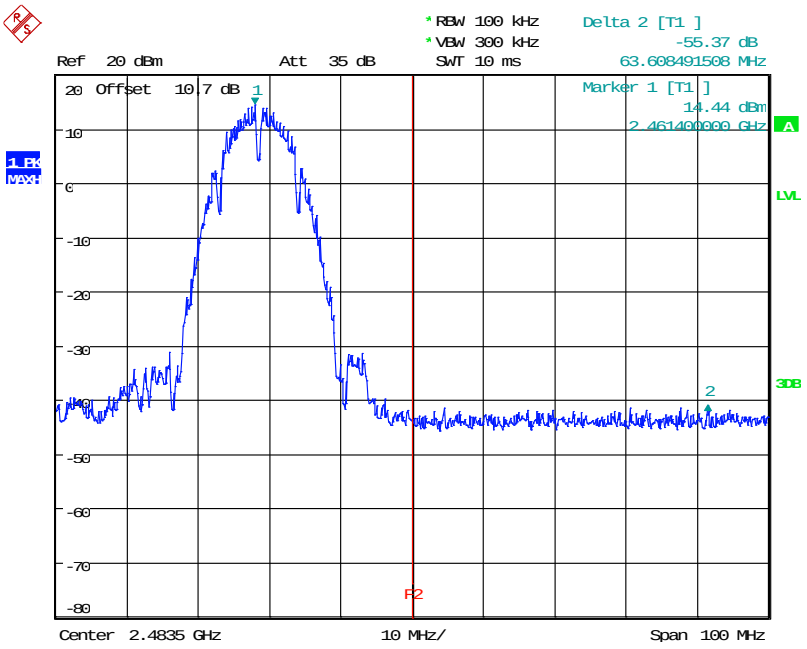
Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)		Limit (dBc)	RESULT
		Chain 0	Chain 1		
B Mode					
Low	2412	49.44	49.64	≥ 20	PASS
High	2462	55.37	54.19	≥ 20	PASS
G Mode					
Low	2412	39.98	39.21	≥ 20	PASS
High	2462	46.34	46.18	≥ 20	PASS
N20 Mode					
Low	2412	39.34	38.82	≥ 20	PASS
High	2462	46.22	44.97	≥ 20	PASS
N40 Mode					
Low	2422	36.33	37.05	≥ 20	PASS
High	2452	40.80	41.57	≥ 20	PASS

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



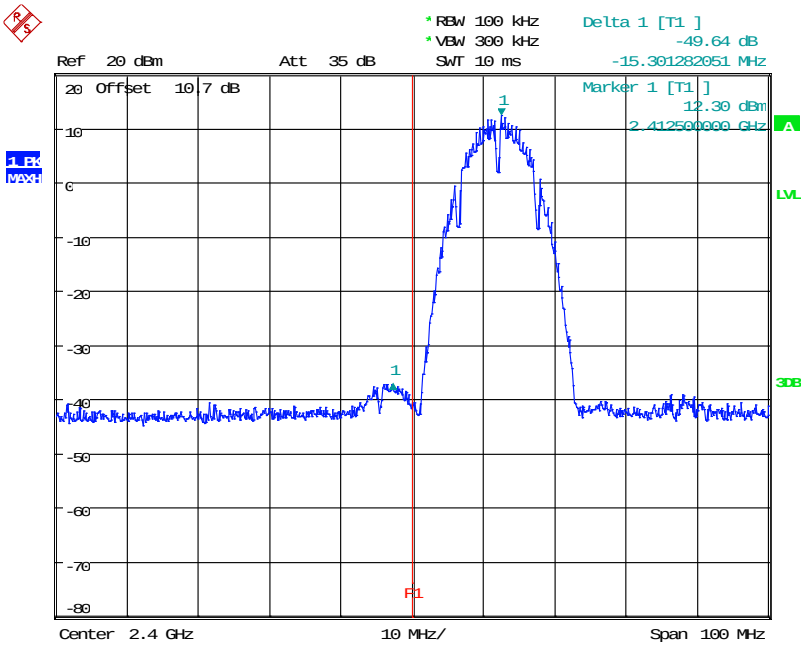
Date: 17.JAN.2018 16:12:31

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



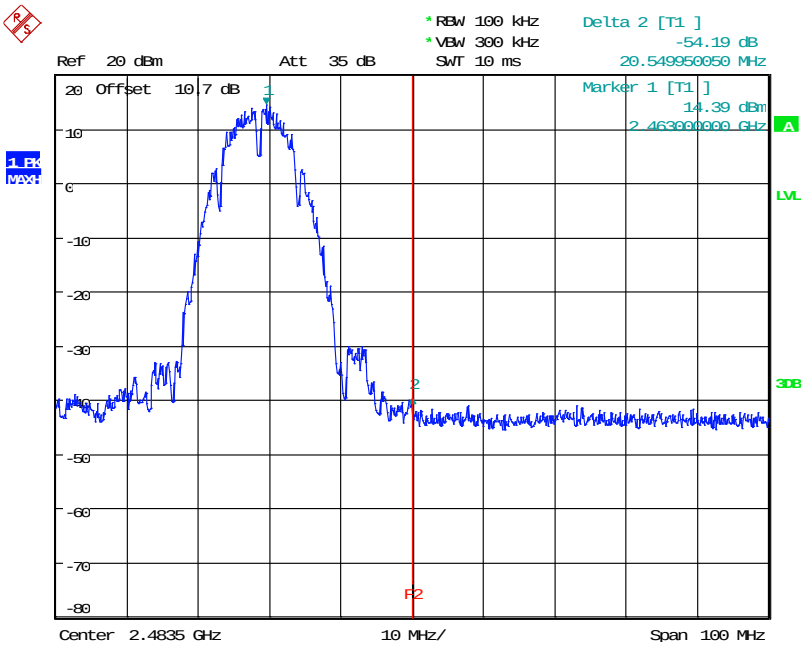
Date: 17.JAN.2018 16:15:23

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



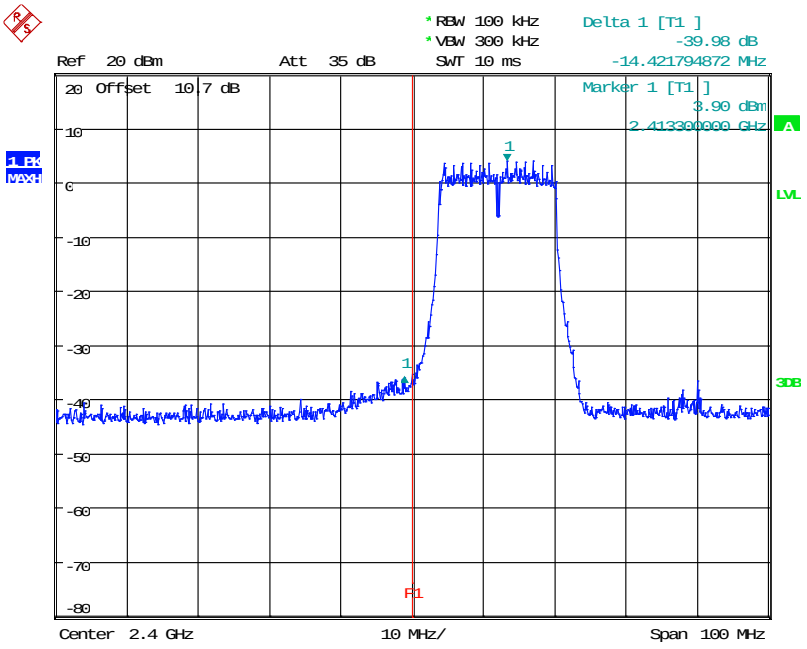
Date: 17.JAN.2018 18:17:34

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



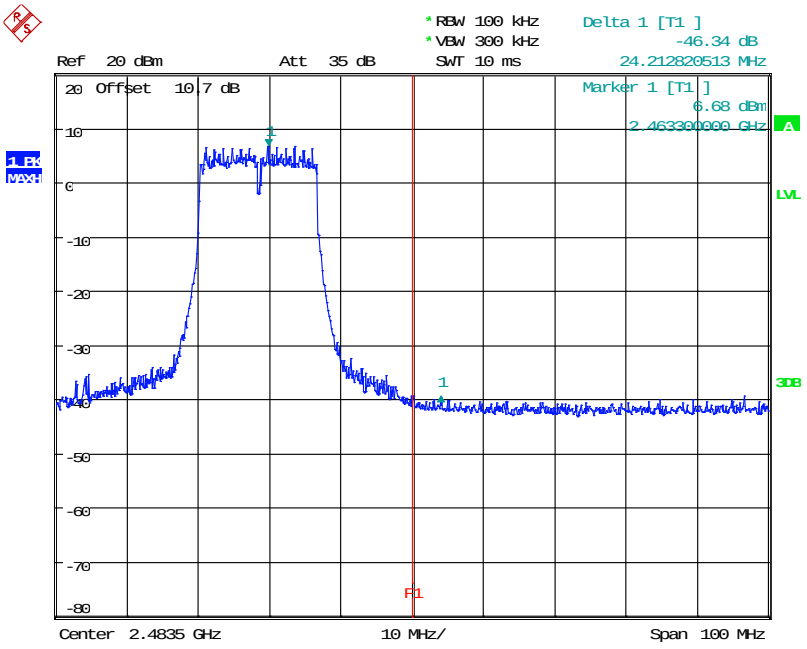
Date: 17.JAN.2018 18:14:51

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



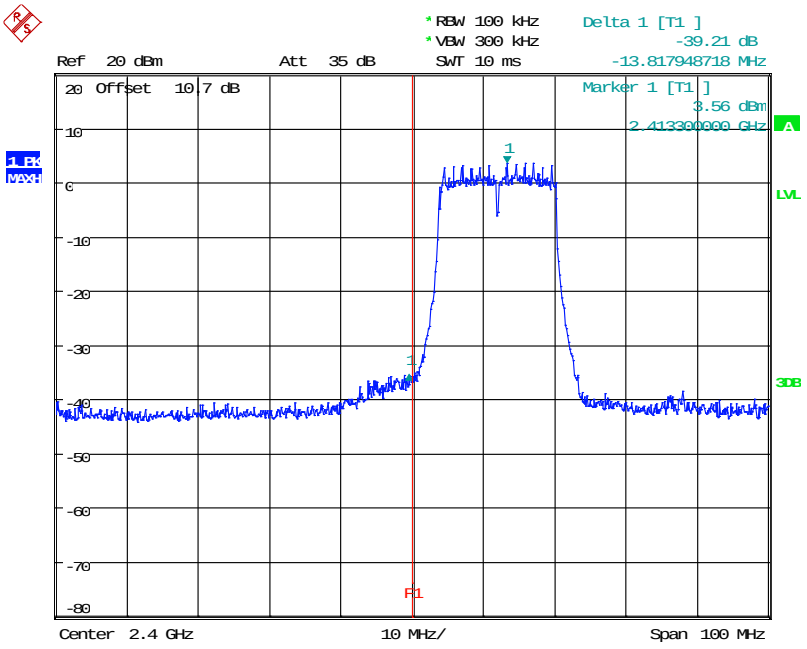
Date: 17.JAN.2018 16:34:44

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



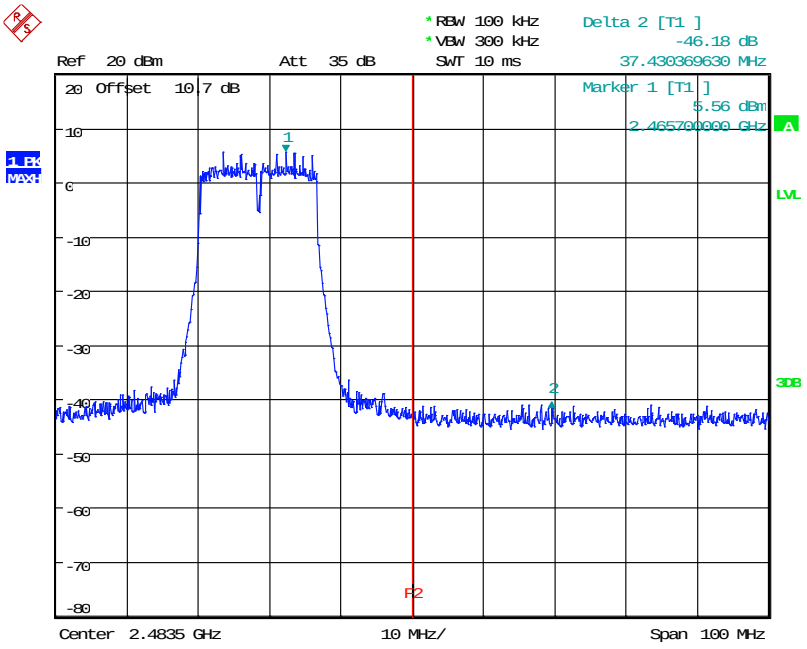
Date: 17.JAN.2018 16:32:58

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



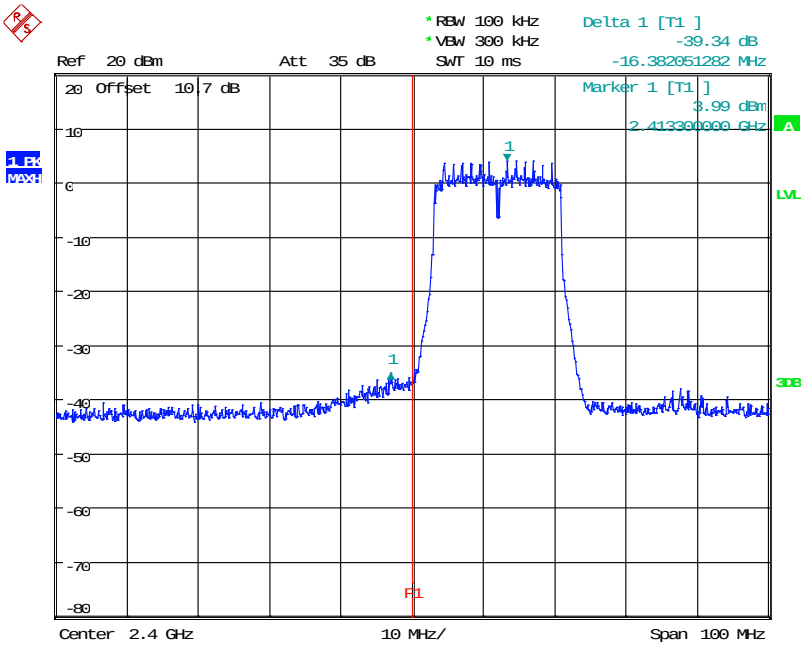
Date: 17.JAN.2018 18:31:55

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



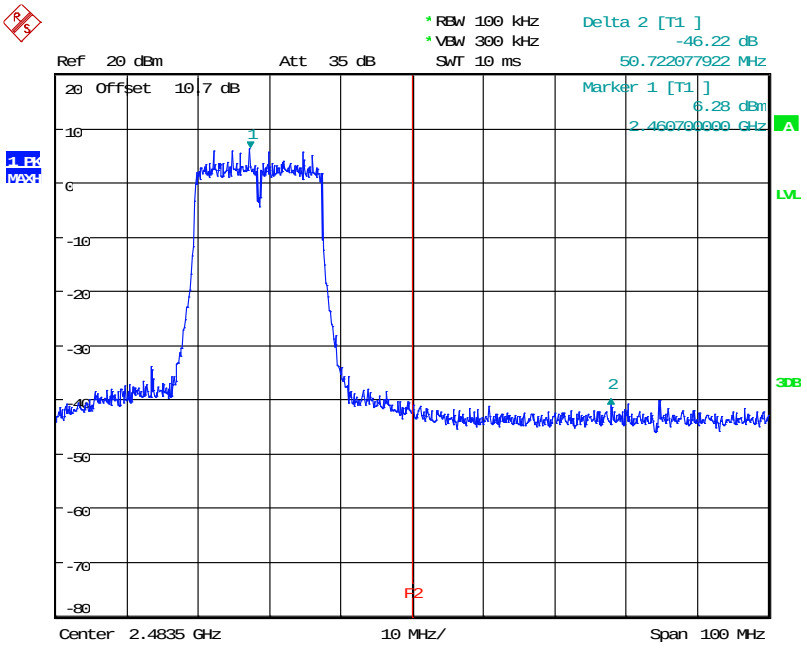
Date: 17.JAN.2018 18:27:40

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



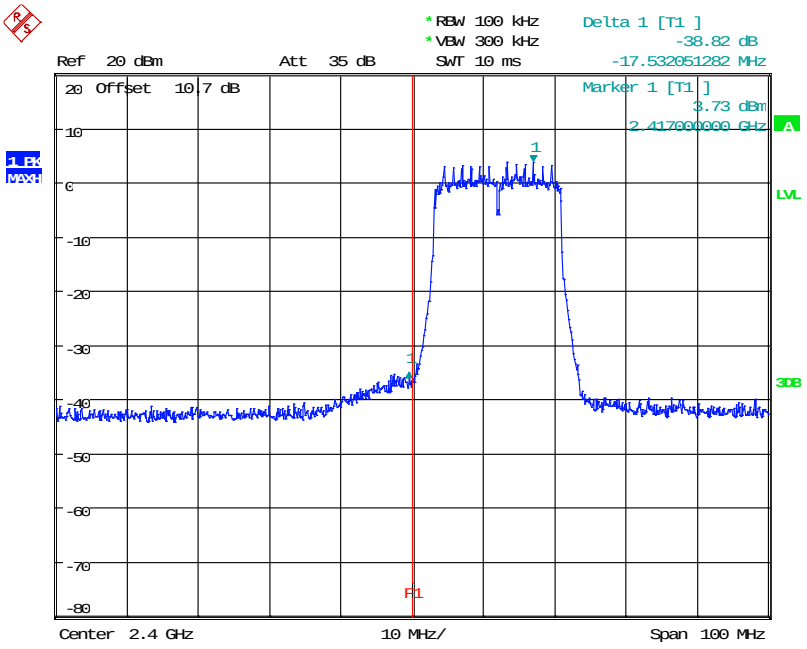
Date: 17.JAN.2018 16:44:12

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



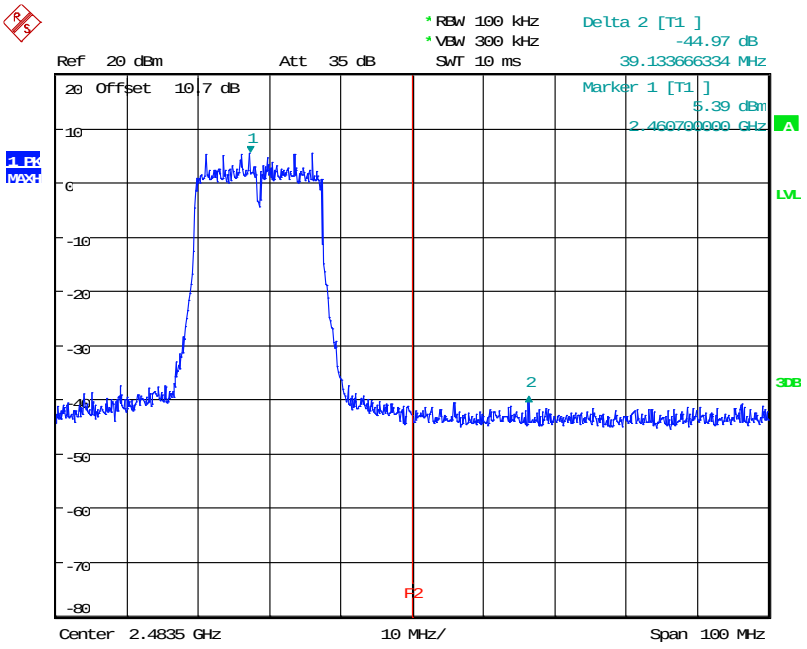
Date: 17.JAN.2018 16:40:27

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



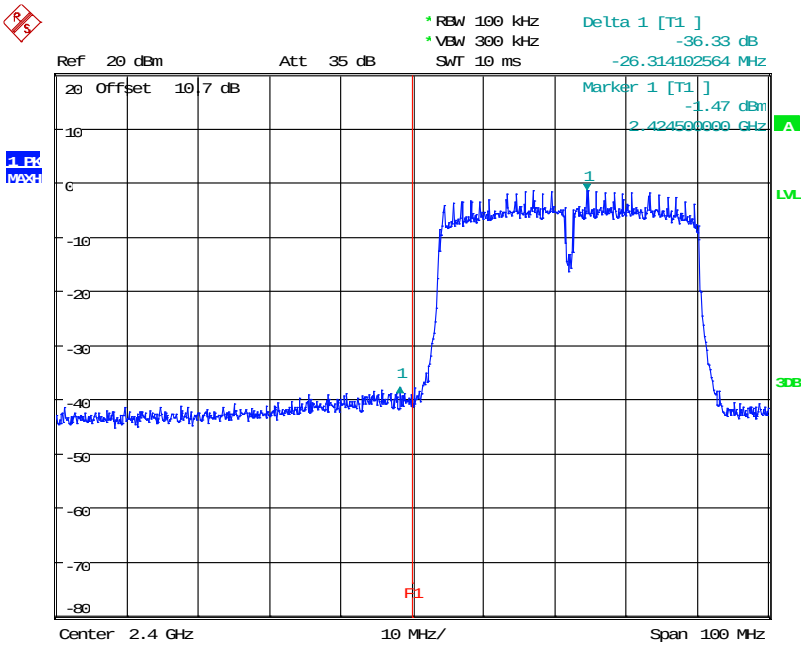
Date: 17.JAN.2018 18:46:16

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



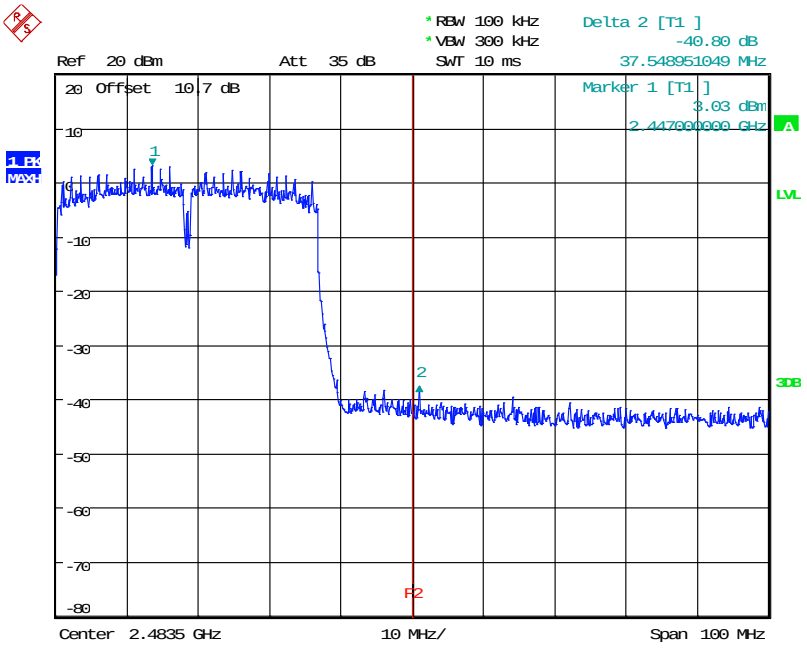
Date: 17.JAN.2018 18:43:28

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



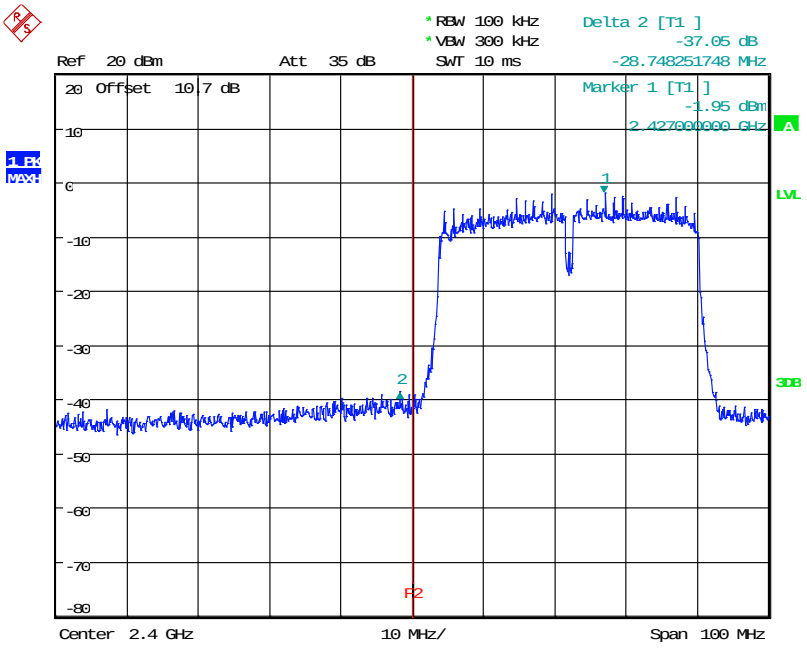
Date: 17.JAN.2018 17:05:21

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



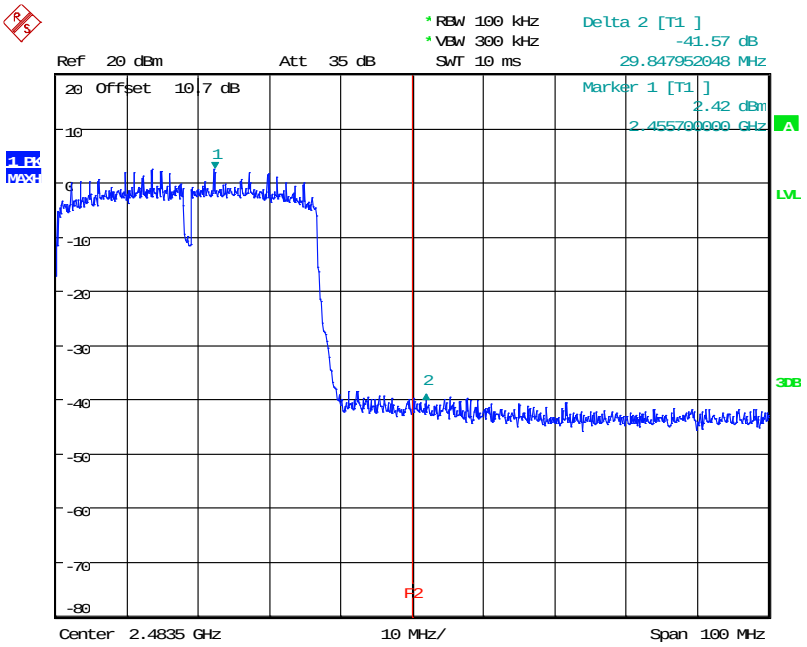
Date: 17.JAN.2018 16:58:33

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



Date: 17.JAN.2018 17:56:51

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



Date: 17.JAN.2018 18:00:17

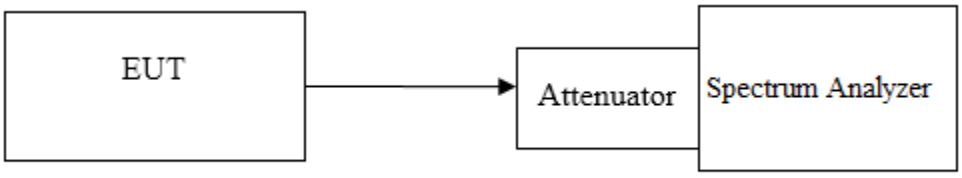
11 FCC §15.247(e) – Power Spectral Density

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	FSU26	200268	2017/05/08	2018/05/07
Cable	WOKEN	SFL402	S02-160323-07	2017/02/22	2018/02/21
Attenuator	MINI-CIRCUITS	BW-S10W5+	N/A	2017/12/14	2018/12/13

**** 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 Andy Shih on 2018-01-17.

11.5 Test Results

MIMO (CDD):

Channel	Frequency (MHz)	Power Spectral Density			Limit (dBm/3kHz)	RESULT
		Chain 0 (dBm/3kHz)	Chain 1 (dBm/3kHz)	Total (dBm/3kHz)		
B Mode						
Low	2412	-1.29	-1.91	1.42	7.87	PASS
Mid	2437	0.74	0.21	3.49	7.87	PASS
High	2462	-0.23	1.03	3.46	7.87	PASS
G Mode						
Low	2412	-10.01	-10.63	-7.30	7.87	PASS
Mid	2437	-7.77	-8.74	-5.22	7.87	PASS
High	2462	-8.32	-7.76	-5.02	7.87	PASS
N20 Mode						
Low	2412	-9.53	-11.27	-7.30	7.87	PASS
Mid	2437	-8.56	-8.66	-5.60	7.87	PASS
High	2462	-7.32	-8.42	-4.82	7.87	PASS
N40 Mode						
Low	2422	-15.80	-16.60	-13.17	7.87	PASS
Mid	2437	-12.78	-12.38	-9.57	7.87	PASS
High	2452	-9.90	-11.96	-7.80	7.87	PASS

The device is a master device. the 2 antenna maximum antenna gain are 3.12dBi, and 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:

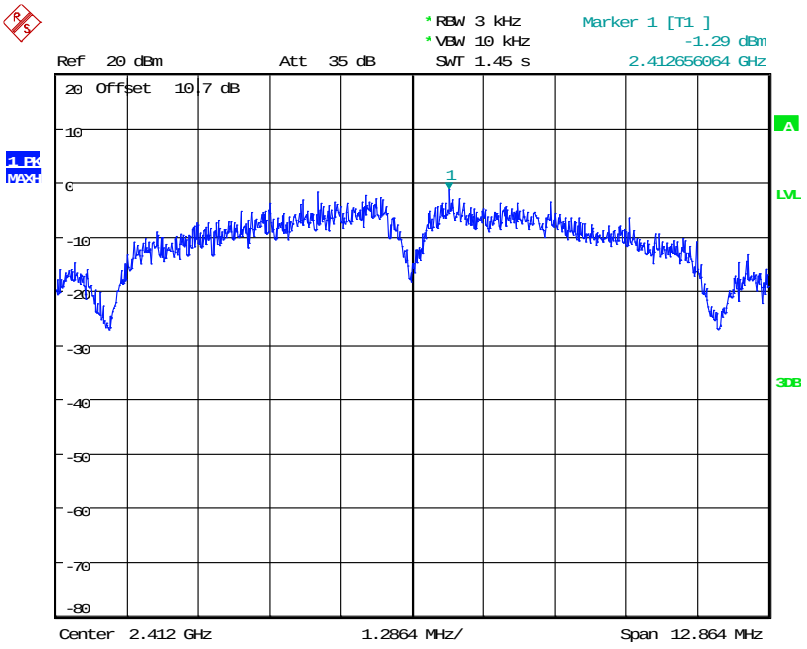
Array Gain = 10 log(NANT/NSS) dB.

So:

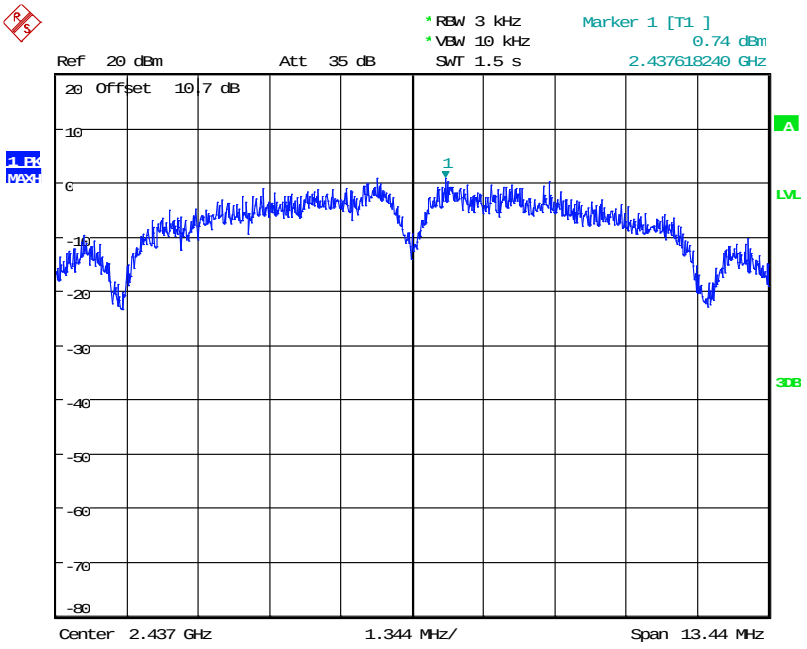
Directional gain = GANT + Array Gain =3.12+10*log(2) =6.13 dBi

The Power density Limits was reduce 0.13 dB

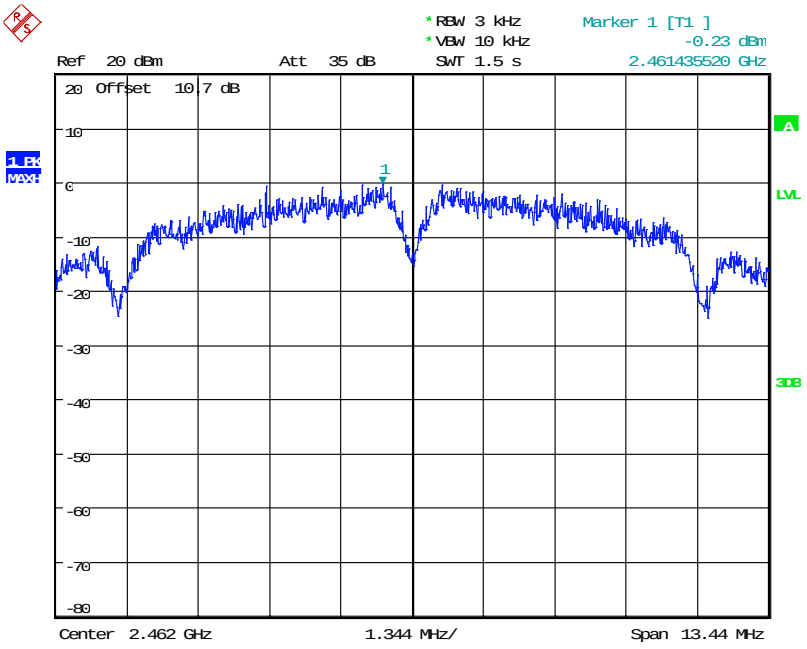
B Mode PSD, Low Channel (Chain 0)



B Mode PSD, Middle Channel (Chain 0)



B Mode PSD, High Channel (Chain 0)



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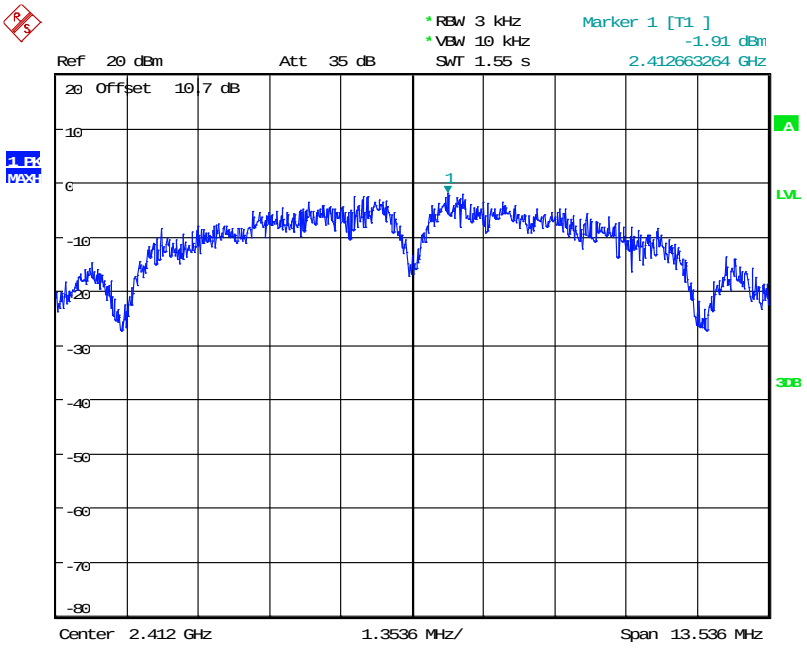
B Mode PSD, Low Channel (Chain 1)



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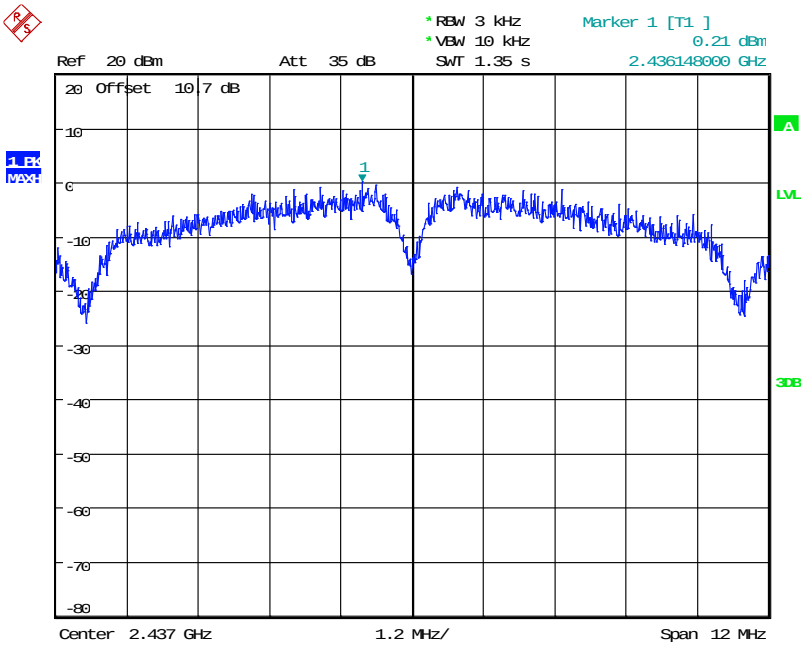
B Mode PSD, Middle Channel (Chain 1)



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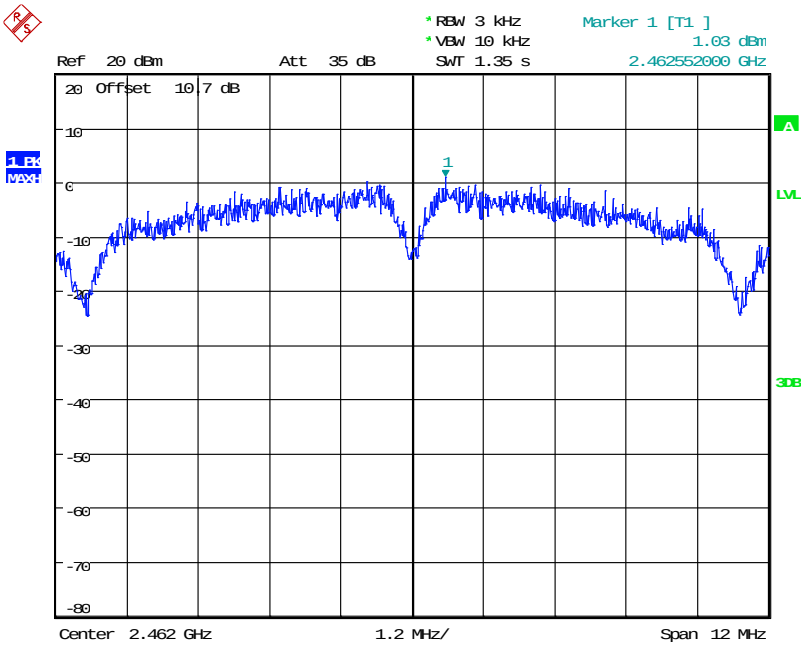
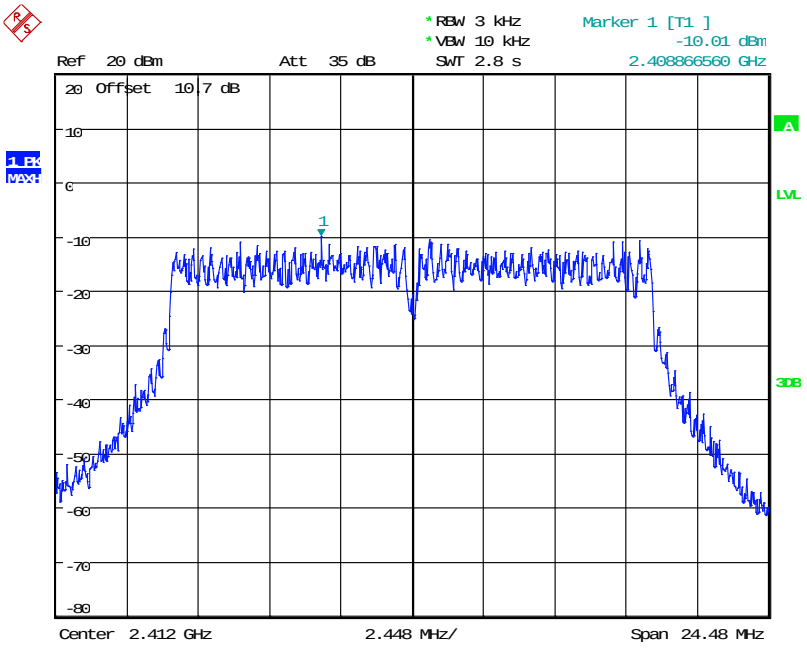
B Mode PSD, High Channel (Chain 1)



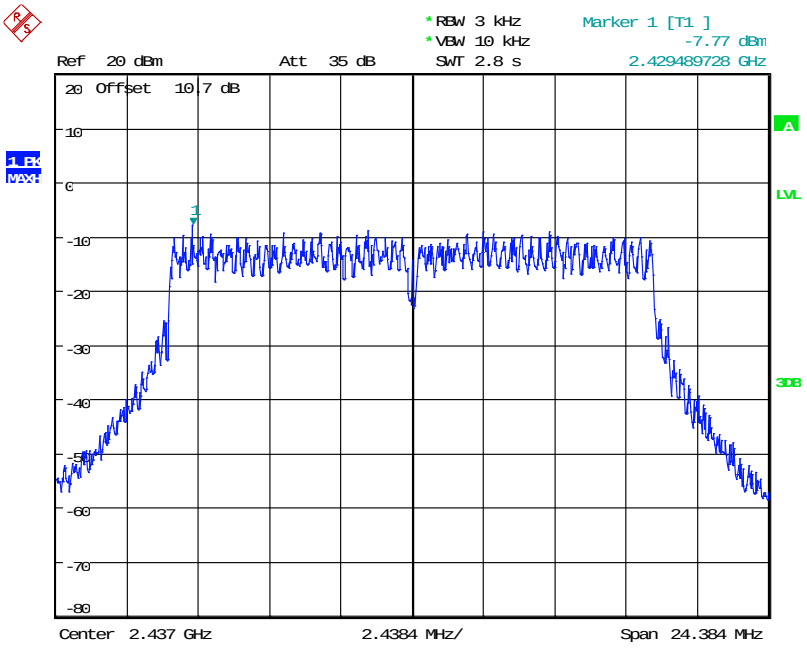
Date: 17.JAN.2018 18:14:38

G Mode PSD, Low Channel (Chain 0)



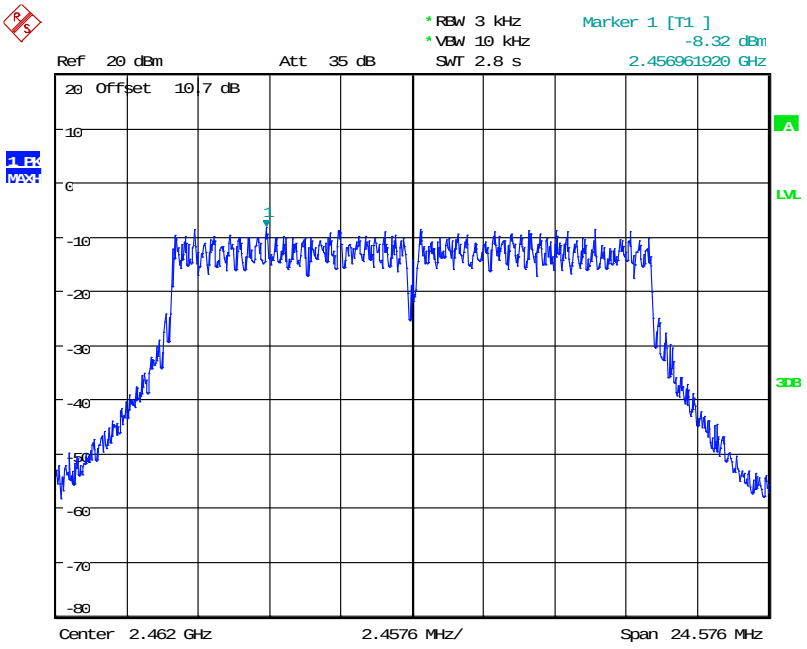
Date: 17.JAN.2018 16:19:09

G Mode PSD, Middle Channel (Chain 0)



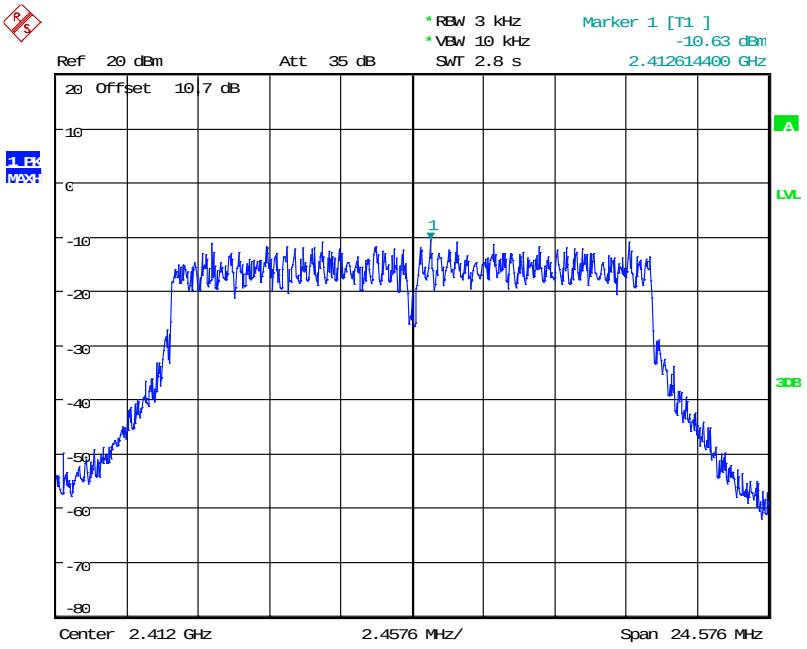
Date: 17.JAN.2018 16:20:32

G Mode PSD, High Channel (Chain 0)



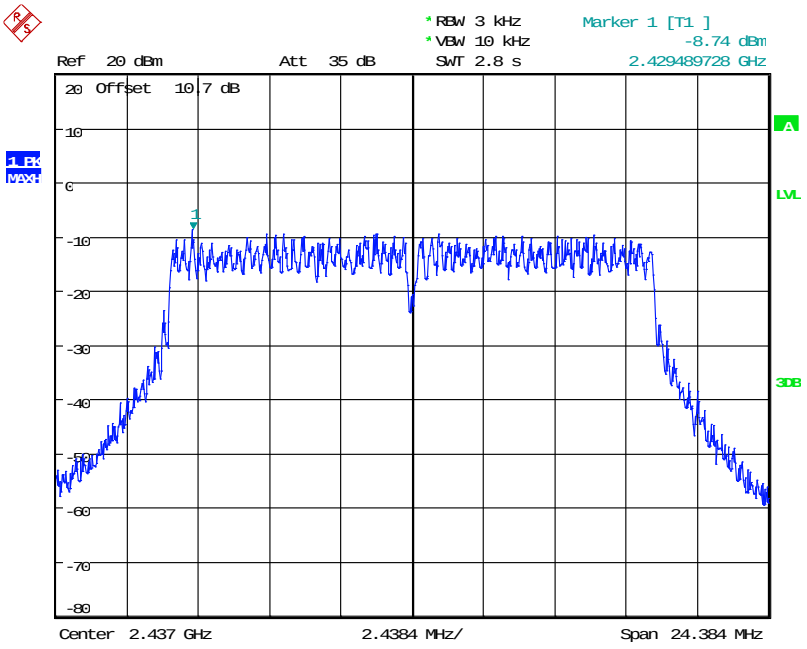
Date: 17.JAN.2018 16:23:09

G Mode PSD, Low Channel (Chain 1)

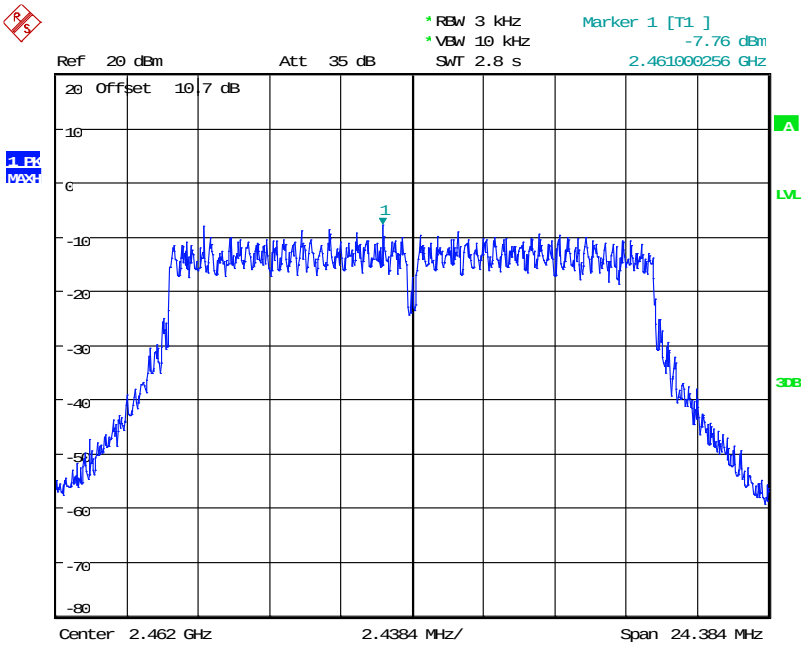


Date: 17.JAN.2018 18:24:06

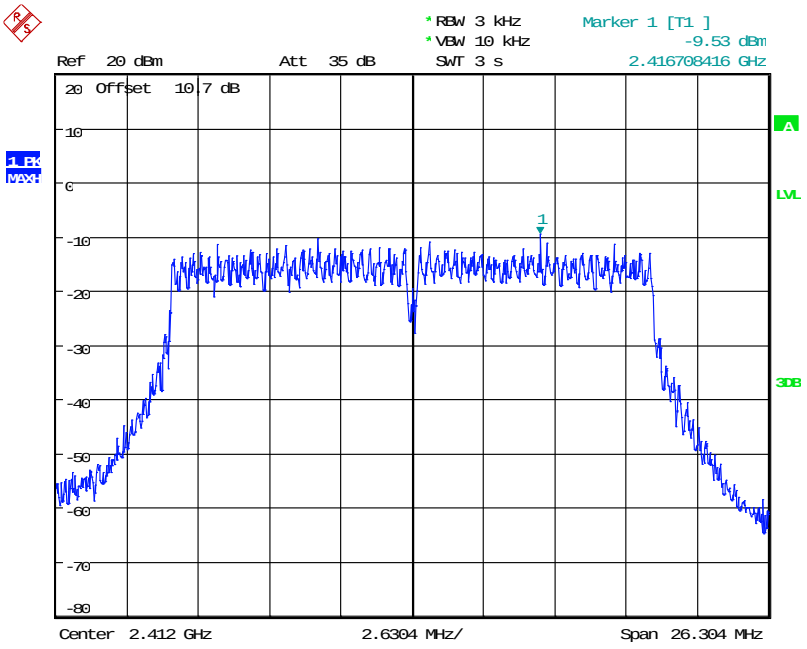
G Mode PSD, Middle Channel (Chain 1)



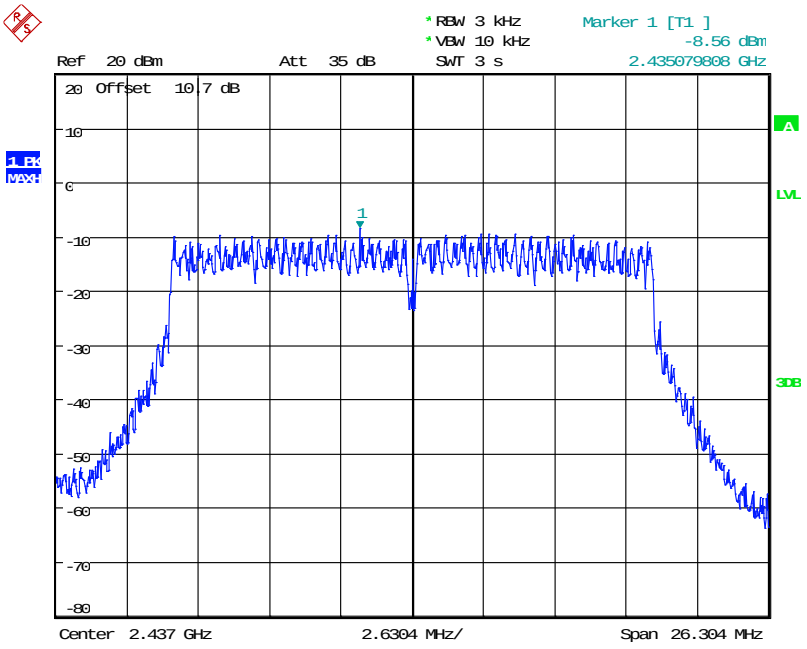
G Mode PSD, High Channel (Chain 1)



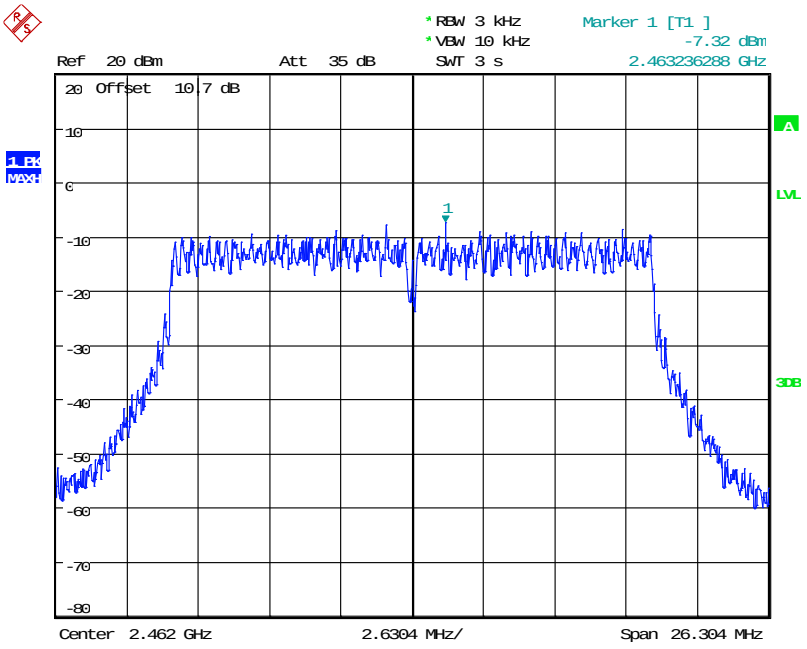
N20 Mode PSD, Low Channel (Chain 0)



N20 Mode PSD, Middle Channel (Chain 0)



N20 Mode PSD, High Channel (Chain 0)



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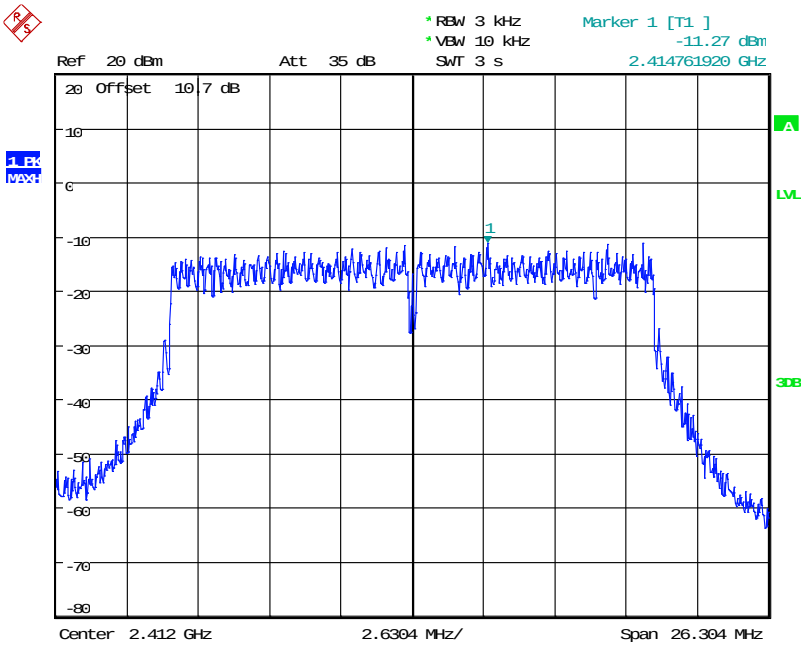
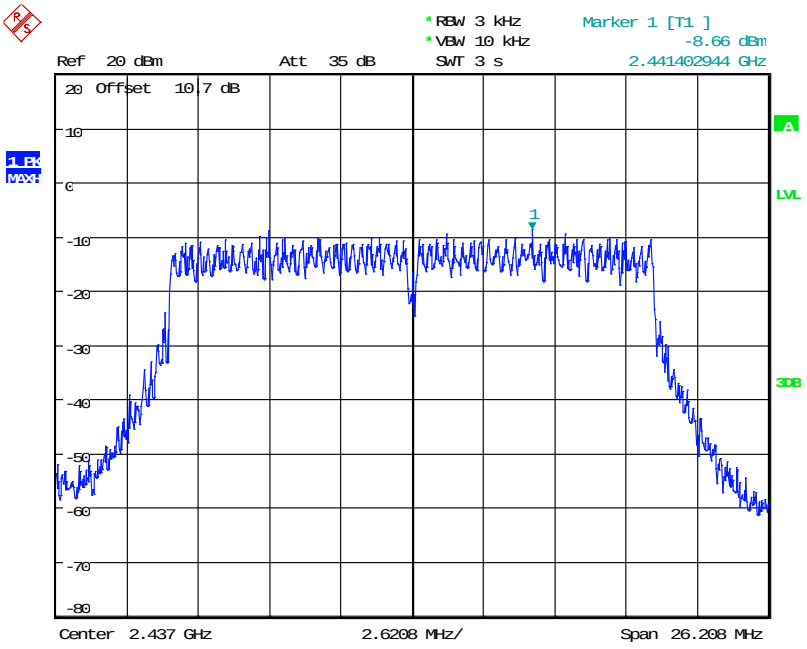
N20 Mode PSD, Low Channel (Chain 1)



Date: 17.JAN.2018 18:38:27

N20 Mode PSD, Middle Channel (Chain 1)



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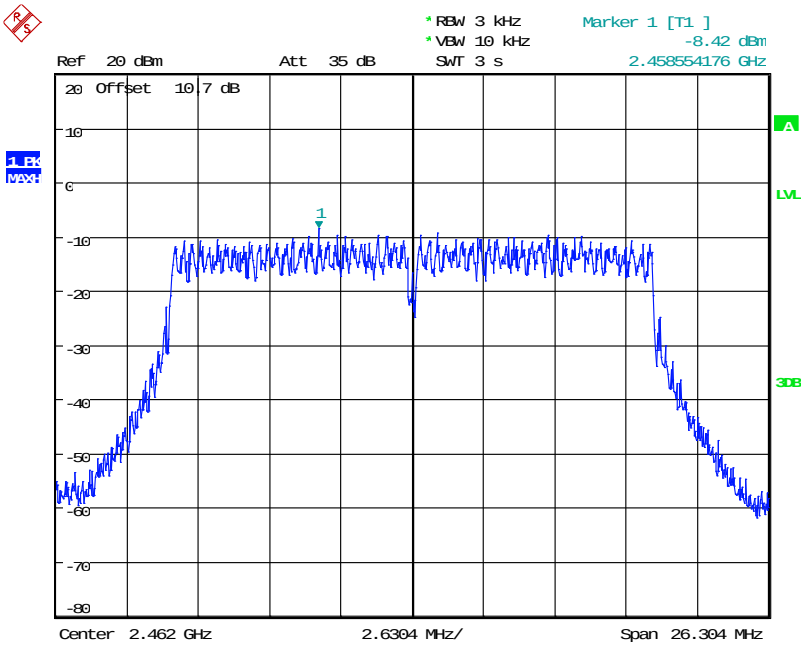
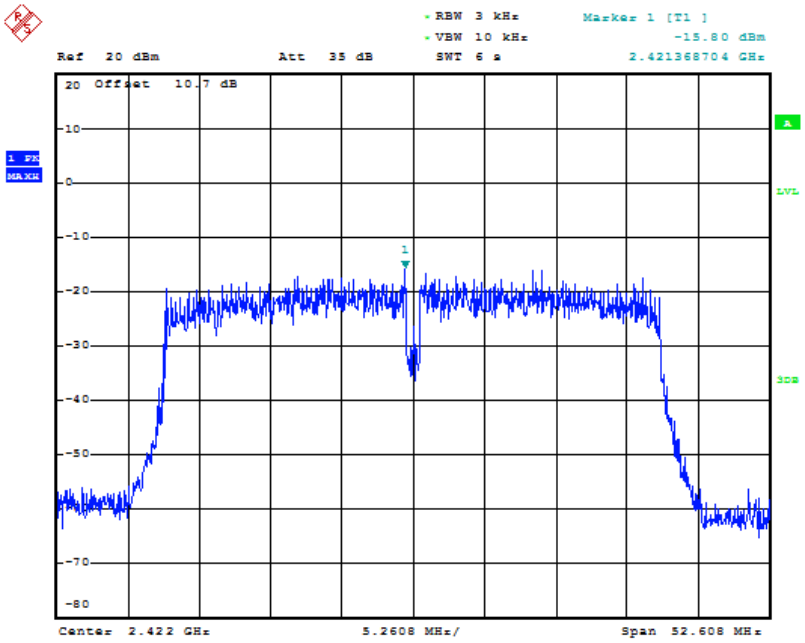
N20 Mode PSD, High Channel (Chain 1)



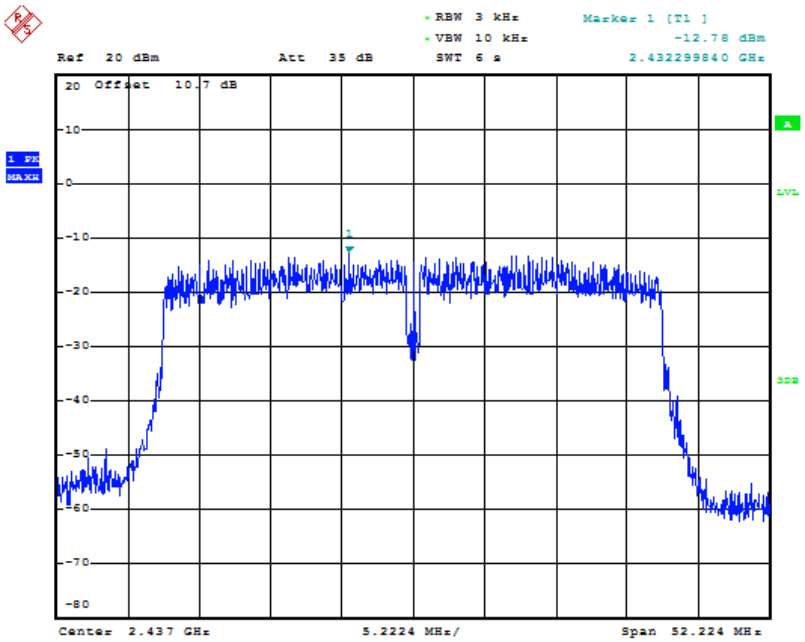
Date: 17.JAN.2018 18:43:14

N40 Mode PSD, Low Channel (Chain 0)



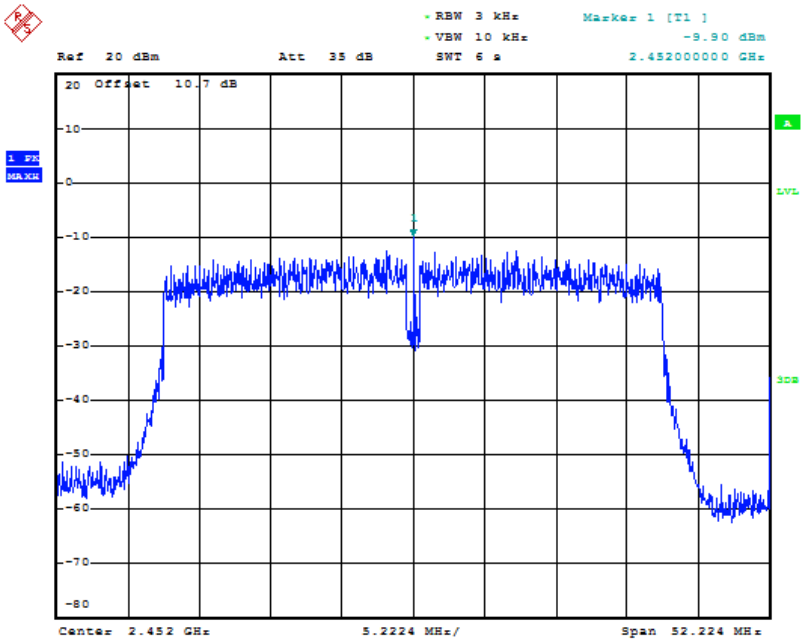
Date: 17.JAN.2018 16:45:54

N40 Mode PSD, Middle Channel (Chain 0)



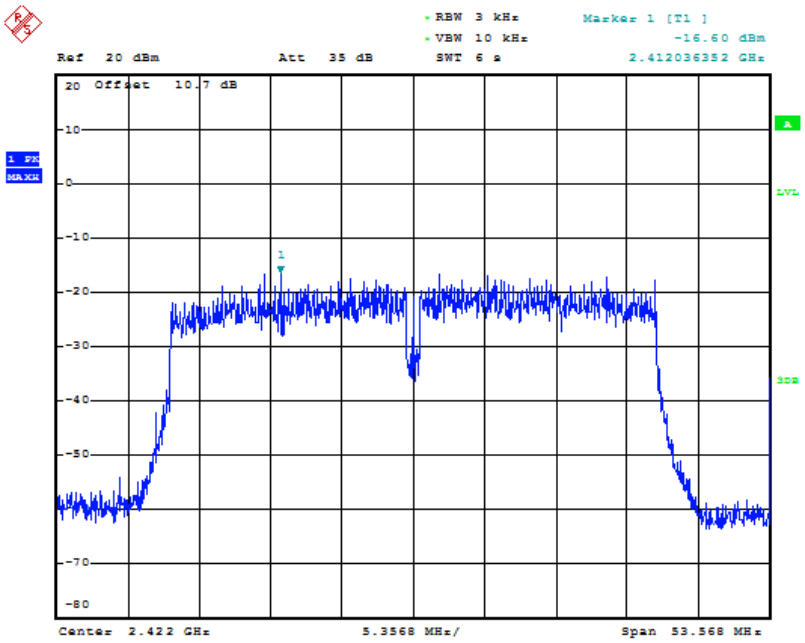
Date: 17.JAN.2018 16:47:16

N40 Mode PSD, High Channel (Chain 0)



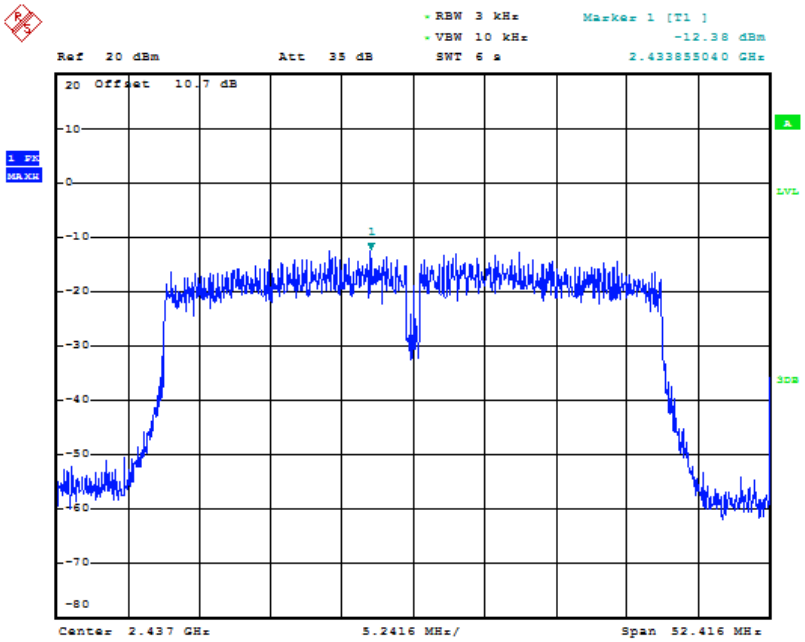
Date: 17.JAN.2018 16:58:20

N40 Mode PSD, Low Channel (Chain 1)



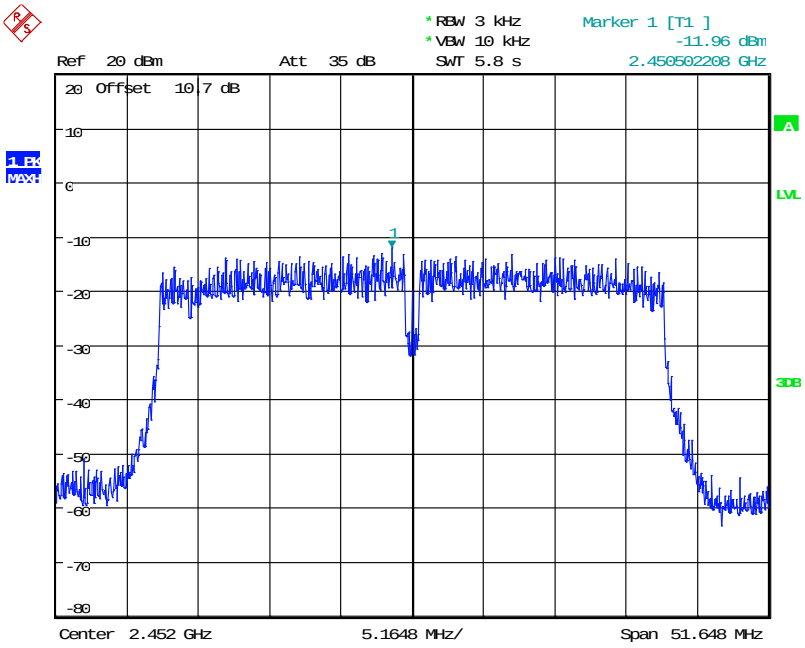
Date: 17.JAN.2018 17:56:41

N40 Mode PSD, Middle Channel (Chain 1)



Date: 17.JAN.2018 17:58:30

N40 Mode PSD, High Channel (Chain 1)



Date: 17.JAN.2018 18:03:49

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