

TEST REPORT

Report number : JPD-TR-17243-0

Issue date : December 29, 2017

The device, as described herewith, was tested pursuant to applicable test procedure and complies with the requirements of;

FCC Part 24 Subpart E

The test results are traceable to the international or national standards.

Applicant	: KYOCERA Corporation
Equipment under test (EUT)	: Mobile Phone
Model number	: YKFA21
FCC ID	: JOYYKFA21

Date of test : November 29, 30, 2017
December 6, 7, 8, 14, 15, 16, 18, 22, 2017

Test place : TÜV SÜD Zacta Ltd. Yonezawa Testing Center
5-4149-7, Hachimanpara, Yonezawa-shi,
Yamagata, 992-1128 Japan
Phone: +81-238-28-2881 Fax: +81-238-28-2888

Test results : Complied

The results in this report are applicable only to the equipment tested.

This report shall not be re-produced except in full without the written approval of TÜV SÜD Zacta Ltd.

This test report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, ILAC-MRA, or any agency of the federal government.

Tested by : Tadahiro Seino Chiaki Kanno
Tadahiro Seino Chiaki Kanno

Approved by : Hiroaki Suzuki
Hiroaki Suzuki
Lab Manager of RF Lab



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1. Summary of Test

1.1 Purpose of test

It is the original test in order to verify conformance to FCC Part 24 Subpart E.

1.2 Standards

CFR47 FCC Part 24 Subpart E

1.2.1 Test Methods

KDB 971168 D01 Power Meas License Digital Systems v02r02
ANSI/TIA/EIA-603-D-2010

1.2.2 Deviation from standards

None

1.3 List of applied test to the EUT

Test items Section	Test items	Condition	Result
2.1046	Conducted Output Power	Conducted	PASS ^{Note 1}
24.232(c)	Effective Radiated Power Equivalent Isotropic Radiated Power	Radiated	PASS
24.232(d)	Peak to Average Ratio	Conducted	PASS
24.238(a) 2.1049	Occupied Bandwidth	Conducted	PASS
24.238(a) 2.1051	Band Edge Spurious and Harmonic at Antenna Terminal	Conducted	PASS
24.238(a) 2.1053	Radiated emissions and Harmonic Emissions	Radiated	PASS
24.235 2.1055	Frequency Stability	Conducted	PASS

Note 1: Refer to RF Exposure Report (Test Report_SAR)

1.3.1 Test set up

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1.4 Modification to the EUT by laboratory

None

2. Equipment Under Test

2.1 General Description of equipment

EUT is the Mobile Phone.

2.2 EUT information

Applicant	: KYOCERA Corporation Yokohama Office 2-1-1 Kagahara, Tsuzuki-ku Yokohama-shi, Kanagawa, Japan Phone: +81-45-943-6253 Fax: +81-45-943-6314
Equipment under test	: Mobile Phone
Trade name	: Kyocera
Model number	: YKFA21
Serial number	: N/A
EUT condition	: Pre-Production
Power ratings	: Battery: DC 3.8V
Size	: (W) 71.5mm × (D) 8.4mm × (H) 145.0mm
Environment	: Indoor and Outdoor use
Terminal limitation	: -20°C to 60°C
RF Specification Frequency of Operation	: Up Link GSM1900: 1850.2-1909.8MHz WCDMA Band II: 1852.4-1907.6MHz LTE Band II: 1850.0-1910.0MHz Down Link GSM1900: 1930.2-1989.8MHz WCDMA Band II: 1932.4-1987.6MHz LTE Band II: 1930.0-1990.0MHz
Modulation type	: GSM1900: GMSK WCDMA Band II: QPSK, 16QAM LTE Band II: QPSK, 16QAM
Emission designator	: GSM1900: 244KGXW WCDMA Band II: 4M13F9W LTE Band II: BW 1.4M QPSK: 1M10G7D, 16QAM: 1M10W7D BW 3M QPSK: 2M71G7D, 16QAM: 2M72W7D BW 5M QPSK: 4M53G7D, 16QAM: 4M50W7D BW 10M QPSK: 8M94G7D, 16QAM: 8M97W7D BW 15M QPSK: 13M5G7D, 16QAM: 13M4W7D BW 20M QPSK: 17M9G7D, 16QAM: 18M0W7D
Equivalent Isotropic Radiated Power (E.I.R.P)	: GSM1900: 1.230W (30.9dBm) WCDMA Band II: 0.135W (21.3dBm) LTE Band II: 0.309W (24.9dBm)

Antenna type : Internal antenna

Antenna gain : GSM1900: -2.5dBi
WCDMA Band II: -2.5dBi
LTE Band II: -2.5dBi

2.3 Variation of the family model(s)

Not applicable

2.4 Description of Test mode

The EUT had been tested under operating condition.
There are three channels have been tested as following:

Band	Modulation	Bandwidth [MHz]	Channel	Frequency [MHz]
GSM1900	GMSK	-	512, 661, 810	1850.2, 1880.0, 1909.8
WCDMA Band II	QPSK	-	9262, 9400, 9538	1852.4, 1880.0, 1907.6
	16QAM	-	9262, 9400, 9538	1852.4, 1880.0, 1907.6
LTE Band II	QPSK	1.4	18607, 18900, 19193	1850.7, 1880.0, 1909.3
		3	18615, 18900, 19185	1851.5, 1880.0, 1908.5
		5	18625, 18900, 19175	1852.5, 1880.0, 1907.5
		10	18650, 18900, 19150	1855.0, 1880.0, 1905.0
		15	18675, 18900, 19125	1857.5, 1880.0, 1902.5
		20	18700, 18900, 19100	1860.0, 1880.0, 1900.0
	16QAM	1.4	18607, 18900, 19193	1850.7, 1880.0, 1909.3
		3	18615, 18900, 19185	1851.5, 1880.0, 1908.5
		5	18625, 18900, 19175	1852.5, 1880.0, 1907.5
		10	18650, 18900, 19150	1855.0, 1880.0, 1905.0
		15	18675, 18900, 19125	1857.5, 1880.0, 1902.5
		20	18700, 18900, 19100	1860.0, 1880.0, 1900.0

The field strength of spurious emissions was measured at each position of all three axis X, Y and Z to compare the level, and the maximum noise.

The worst emission was found in X axis (All Bands) and the worst case recorded.



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3. Configuration of equipment

3.1 Equipment(s) used

No.	Equipment	Company	Model No.	Serial No.	FCC ID / DoC	Comment
1	Mobile Phone	KYOCERA	YKFA21	N/A	JOYYKFA21	EUT

3.2 System configuration

1. Mobile Phone
(EUT)

Note1: Numbers assigned to equipment or cables on this diagram correspond to the list in "3.1 Equipment(s) used".

4. Equivalent Isotropic Radiated Power

4.1 Measurement procedure [FCC 24.232(c)]

<Step 1>

The EUT and support equipment are placed on a 1 meter x 1 meter surface, 0.8 meter height styrene foam table. Radiated emission measurements are performed at 3 meter distance with the broadband antenna (double ridged guide antenna). The antenna is positioned both the horizontal and vertical planes of polarization and height is varied 1 to 4 meters and stopped at height producing the maximum emission. The bandwidth of the spectrum analyzer is set to 1MHz. The turntable is rotated by 360 degrees and stopped at azimuth of producing the maximum emission.

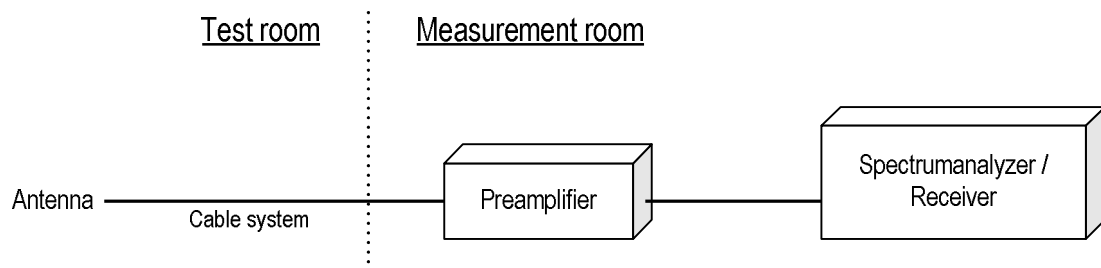
<Step 2>

The substitution antenna is replaced by the transmitter antenna (EUT). The frequency of the signal generator is adjusted to the measurement frequency. Level of the signal generator is adjusted to the level that is obtained from step 1, and record the emission level of signal generator.

The spectrum analyzer is set to;

- a) Span = 1.5 times the OBW
- b) RBW = 1-5% of the expected OBW, not to exceed 1MHz
- c) VBW $\geq 3 \times$ RBW
- d) Number of sweep points $\geq 2 \times$ span / RBW
- e) Sweep time = auto-couple
- f) Detector = RMS (power averaging)
- g) If the EUT can be configured to transmit continuously (i.e., burst duty cycle $\geq 98\%$), then set the trigger to free run.
- h) If the EUT cannot be configured to transmit continuously (i.e., burst duty cycle $< 98\%$), then use a sweep trigger with the level set to enable triggering only on full power bursts and configure the EUT to transmit at full power for the entire duration of each sweep. Ensure that the sweep time is less than or equal to the transmission burst duration.
- i) Trace average at least 100 traces in power averaging (i.e., RMS) mode.
- j) Compute the power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function, with the band limits set equal to the OBW band edges. If the instrument does not have a band power function, then sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.

- Test configuration



4.2 Calculation method

Result(EIRP) = Ant. Input - Cable loss + Antenna Gain

Margin = Limit – Result (EIRP)

Example:

Limit @ 1880MHz : 33.0dBm

Ant. Input = 19.3dBm Cable loss = 1.1dB Ant. Gain = 8.3dBi

Result = 19.3 - 1.1 + 8.3 = 26.5dBm

Margin = 33.0 - 26.5 = 6.5dB

4.3 Limit

2 W (33dBm)

4.4 Test data

Date : December 6, 2017

Temperature : 23.5 [°C]

Humidity : 20.8 [%]

Test place : 3m Semi-anechoic chamber

Test engineer :

Tadahiro Seino

Date : December 7, 2017

Temperature : 23.3 [°C]

Humidity : 40.5 [%]

Test place : 3m Semi-anechoic chamber

Test engineer :

Tadahiro Seino

Date : December 16, 2017

Temperature : 20.6 [°C]

Humidity : 24.0 [%]

Test place : 3m Semi-anechoic chamber

Test engineer :

Tadahiro Seino

Date : December 22, 2017

Temperature : 20.4 [°C]

Humidity : 22.5 [%]

Test place : 3m Semi-anechoic chamber

Test engineer :

Tadahiro Seino

[GSM1900]

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBi]	Result [dBm]	Limit [dBm]	Margin [dB]
H	1850.2	-31.6	20.5	1.1	8.1	27.4	33.0	5.6
H	1880.0	-31.1	21.7	1.1	8.0	28.6	33.0	4.4
H	1909.8	-30.1	24.1	1.2	8.0	30.9	33.0	2.1

[WCDMA Band II]

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBi]	Result [dBm]	Limit [dBm]	Margin [dB]
H	1852.4	-30.9	12.4	1.1	8.1	19.3	33.0	13.7
H	1880.0	-29.8	13.9	1.1	8.0	20.7	33.0	12.3
H	1907.6	-30.1	14.5	1.2	7.9	21.3	33.0	11.7

[LTE Band II]
QPSK, BW 1.4MHz

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBi]	Result [dBm]	Limit [dBm]	Margin [dB]
H	1850.7	-29.0	14.0	1.1	8.1	20.9	33.0	12.1
H	1880.0	-27.5	16.1	1.1	8.0	22.9	33.0	10.1
H	1909.3	-26.5	18.1	1.2	8.0	24.9	33.0	8.1

16QAM, BW 1.4MHz

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBi]	Result [dBm]	Limit [dBm]	Margin [dB]
H	1850.2	-30.2	12.7	1.1	8.1	19.7	33.0	13.3
H	1880.0	-28.1	15.5	1.1	8.0	22.3	33.0	10.7
H	1909.3	-26.9	17.4	1.2	8.0	24.2	33.0	8.8

QPSK, BW 3MHz

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBi]	Result [dBm]	Limit [dBm]	Margin [dB]
H	1851.5	-29.3	14.0	1.1	8.1	20.9	33.0	12.1
H	1880.0	-28.5	15.4	1.1	8.0	22.2	33.0	10.8
H	1908.5	-27.1	17.7	1.2	7.9	24.5	33.0	8.5

16QAM, BW 3MHz

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBi]	Result [dBm]	Limit [dBm]	Margin [dB]
H	1851.5	-30.3	13.0	1.1	8.1	19.9	33.0	13.1
H	1880.0	-29.0	14.9	1.1	8.0	21.7	33.0	11.3
H	1908.5	-28.0	16.9	1.2	7.9	23.7	33.0	9.3

QPSK, BW 5MHz

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBi]	Result [dBm]	Limit [dBm]	Margin [dB]
H	1852.5	-29.1	14.4	1.1	8.1	21.3	33.0	11.7
H	1880.0	-28.0	15.9	1.1	8.0	22.7	33.0	10.3
H	1907.5	-26.9	17.9	1.2	7.9	24.7	33.0	8.3

16QAM, BW 5MHz

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBi]	Result [dBm]	Limit [dBm]	Margin [dB]
H	1852.5	-30.0	13.5	1.1	8.1	20.4	33.0	12.6
H	1880.0	-28.8	15.1	1.1	8.0	21.9	33.0	11.1
H	1907.5	-27.7	17.0	1.2	7.9	23.8	33.0	9.2

QPSK, BW 10MHz

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBi]	Result [dBm]	Limit [dBm]	Margin [dB]
H	1855.0	-28.6	15.4	1.1	8.0	22.3	33.0	10.7
H	1880.0	-27.2	16.7	1.1	8.0	23.5	33.0	9.5
H	1905.0	-27.0	17.3	1.2	7.9	24.1	33.0	8.9

16QAM, BW 10MHz

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBi]	Result [dBm]	Limit [dBm]	Margin [dB]
H	1855.0	-29.0	14.9	1.1	8.0	21.8	33.0	11.2
H	1880.0	-28.1	15.8	1.1	8.0	22.6	33.0	10.4
H	1905.0	-27.8	16.6	1.2	7.9	23.4	33.0	9.6

QPSK, BW 15MHz

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBi]	Result [dBm]	Limit [dBm]	Margin [dB]
H	1857.5	-28.9	15.4	1.1	8.0	22.3	33.0	10.7
H	1880.0	-27.4	16.5	1.1	8.0	23.3	33.0	9.7
H	1902.5	-26.8	16.9	1.2	7.9	23.7	33.0	9.3

16QAM, BW 15MHz

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBi]	Result [dBm]	Limit [dBm]	Margin [dB]
H	1857.5	-29.8	14.5	1.1	8.0	21.4	33.0	11.6
H	1880.0	-28.3	15.6	1.1	8.0	22.4	33.0	10.6
H	1902.5	-27.9	16.0	1.2	7.9	22.8	33.0	10.2

QPSK, BW 20MHz

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBi]	Result [dBm]	Limit [dBm]	Margin [dB]
H	1860.0	-28.9	15.7	1.1	8.0	22.6	33.0	10.4
H	1880.0	-27.7	16.2	1.1	8.0	23.0	33.0	10.0
H	1900.0	-26.9	16.7	1.2	7.9	23.4	33.0	9.6

16QAM, BW 20MHz

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBi]	Result [dBm]	Limit [dBm]	Margin [dB]
H	1860.0	-29.8	14.8	1.1	8.0	21.7	33.0	11.3
H	1880.0	-28.9	15.1	1.1	8.0	21.9	33.0	11.1
H	1900.0	-27.9	15.7	1.2	7.9	22.4	33.0	10.6

5. Peak to Average Ratio

5.1 Measurement procedure [FCC 24.232(d)]

The peak to average ratio was measured with a spectrum analyzer connected to the antenna terminal.

The spectrum analyzer is set to;

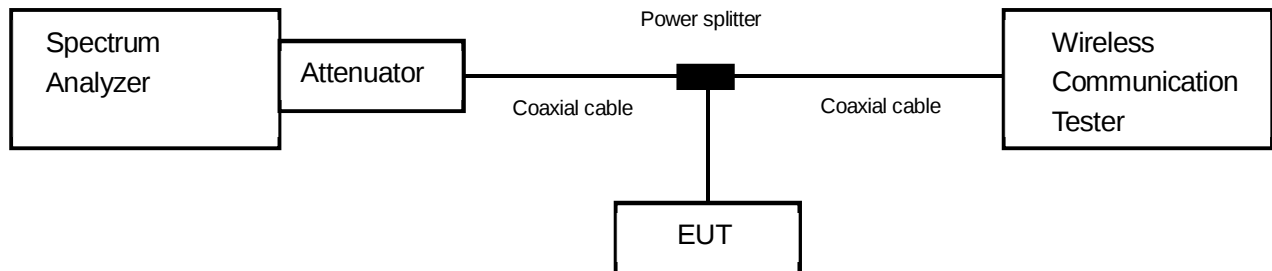
[GSM1900]

- a) Span = 5MHz
- b) RBW = 1MHz
- c) VBW $\geq 3 \times$ RBW
- d) Detector = Peak / Average
- e) Sweep time = auto-couple
- f) Trace mode=Max hold

[WCDMA Band II, LTE Band II]

- a) Power Stat CCDF mode
- b) Set resolution / measurement bandwidth $\geq$ signal's occupied bandwidth.
- c) Set the number of counts to a value that stabilizes the measured CCDF curve.
- d) Set the measurement interval as follows:
 - 1) For continuous transmissions, set to 1ms.
 - 2) For burst transmissions, employ an external trigger that is synchronized with the EUT burst timing sequence, or use the internal burst trigger with a trigger level that allows the burst duration.
- e) Record the maximum PAPR level associated with a probability of 0.1%.

- Test configuration



5.2 Limit

13dB or less

5.3 Measurement result

Date : November 29, 2017
 Temperature : 24.0 [°C]
 Humidity : 34.1 [%]
 Test place : Shielded room No.4

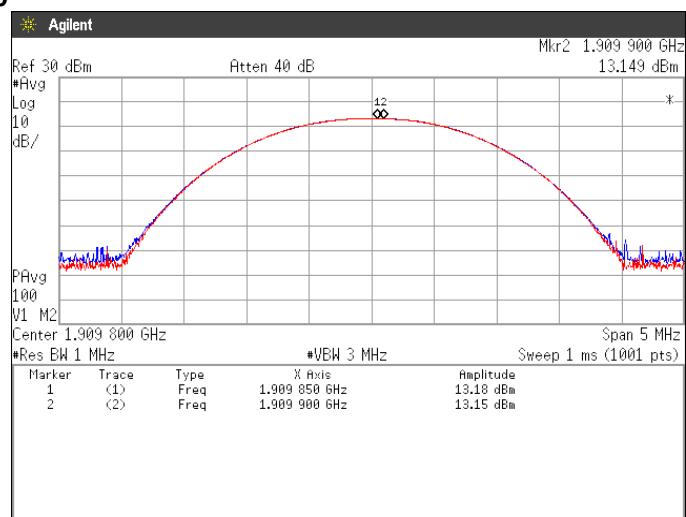
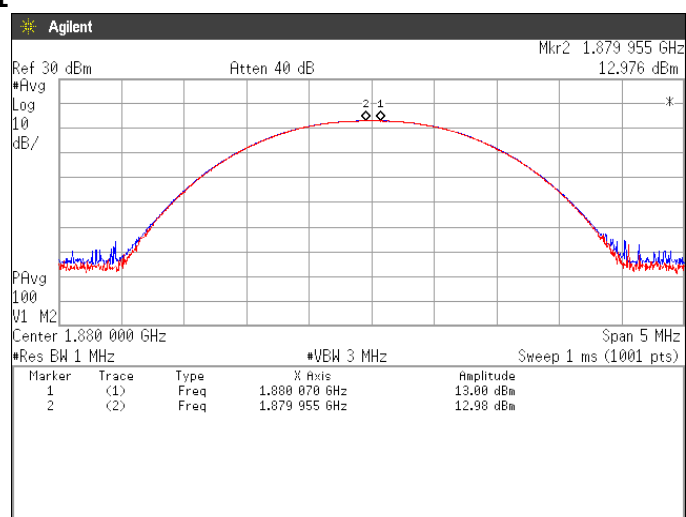
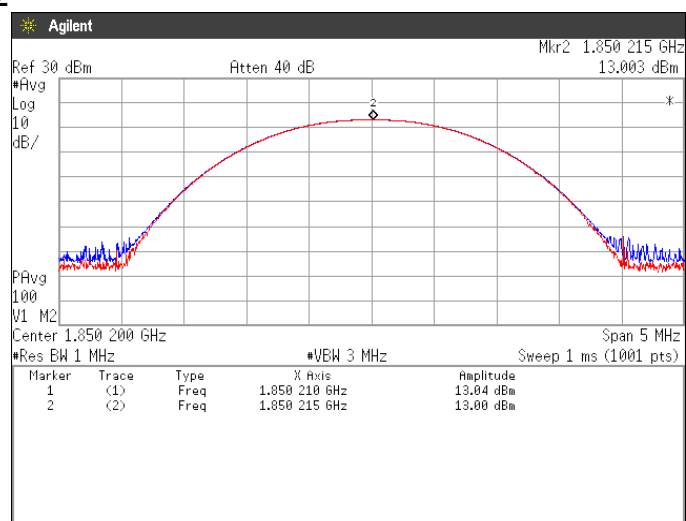
Test engineer : Chiaki Kanno

Date : November 30, 2017
 Temperature : 22.1 [°C]
 Humidity : 36.3 [%]
 Test place : Shielded room No.4

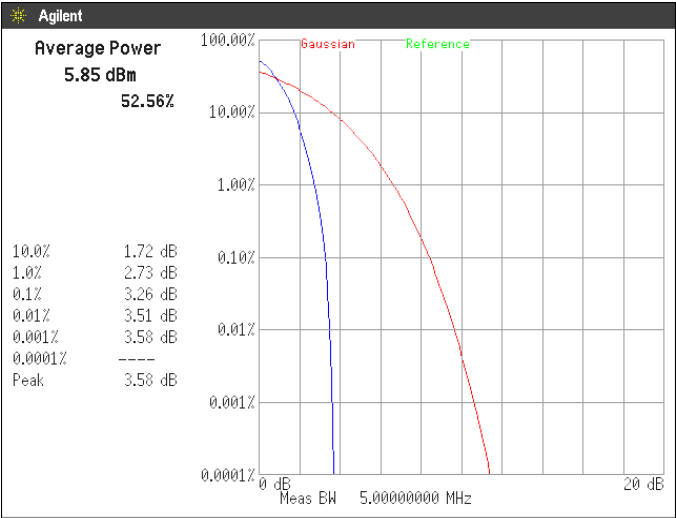
Test engineer : Chiaki Kanno

Band	Channel	Frequency [MHz]	Peak to Average Power Ratio [dB]	Limit [dB]
GSM1900	512	1850.2	0.04	13.0
	661	1880.0	0.02	
	810	1909.8	0.03	
WCDMA Band II	9262	1852.4	3.26	13.0
	9400	1880.0	3.28	
	9538	1907.6	3.30	

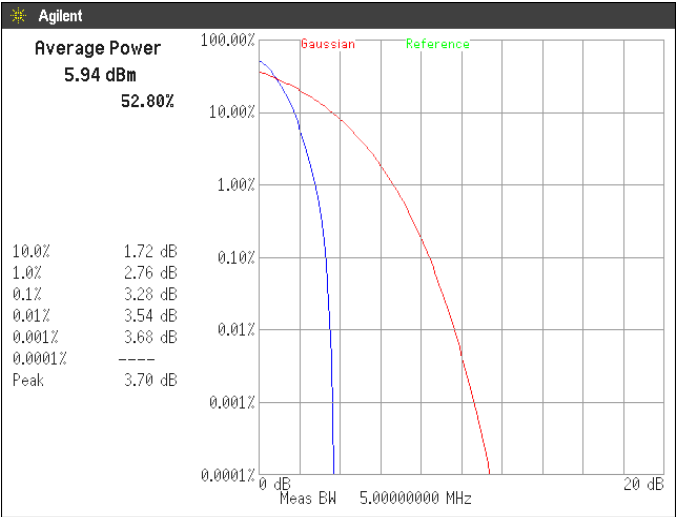
Band	Channel	Frequency [MHz]	Modulation	Bandwidth [MHz]	RB	Peak to Average Power Ratio [dB]	Limit [dB]
LTE Band II	18900	1880.0	QPSK	1.4	6-0	5.31	13.0
				3	15-0	5.38	
				5	25-0	5.29	
				10	50-0	4.69	
				15	75-0	5.84	
				20	100-0	6.57	
			16QAM	1.4	6-0	6.19	
				3	15-0	6.37	
				5	25-0	6.18	
				10	50-0	6.23	
				15	75-0	6.92	
				20	100-0	7.37	



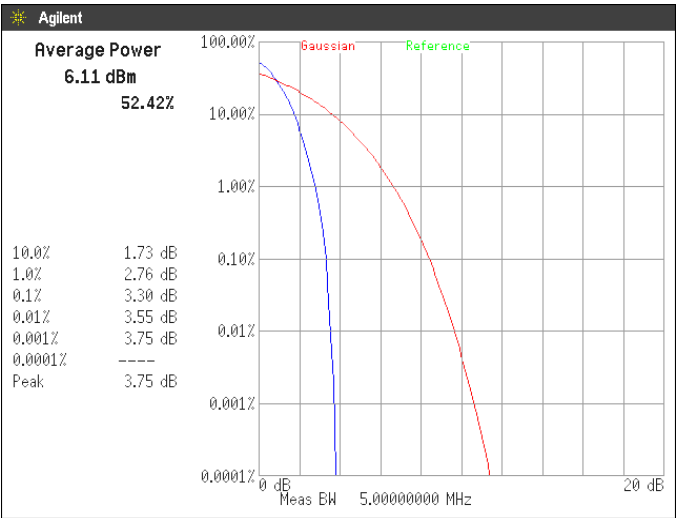
[WCDMA Band II]
Channel: 9262



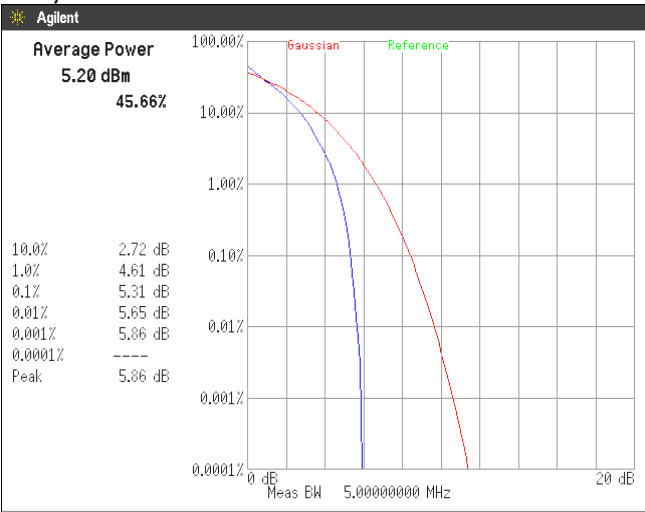
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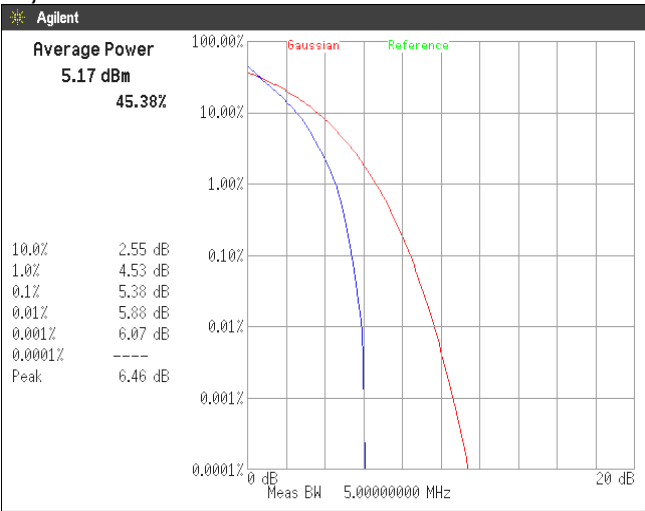
Channel: 9538



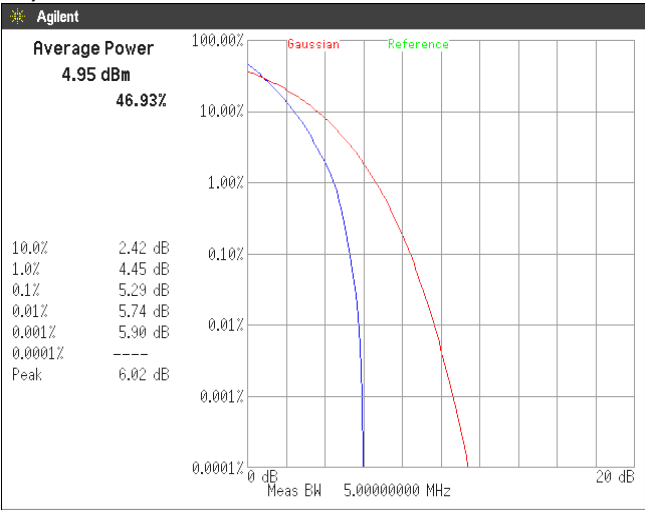
[LTE Band II]
Channel: 18900
QPSK, BW 1.4MHz, RB6-0



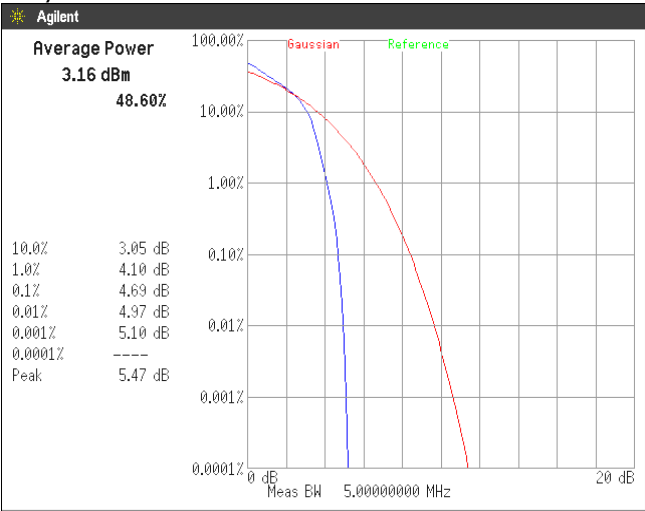
QPSK, BW 3MHz, RB15-0



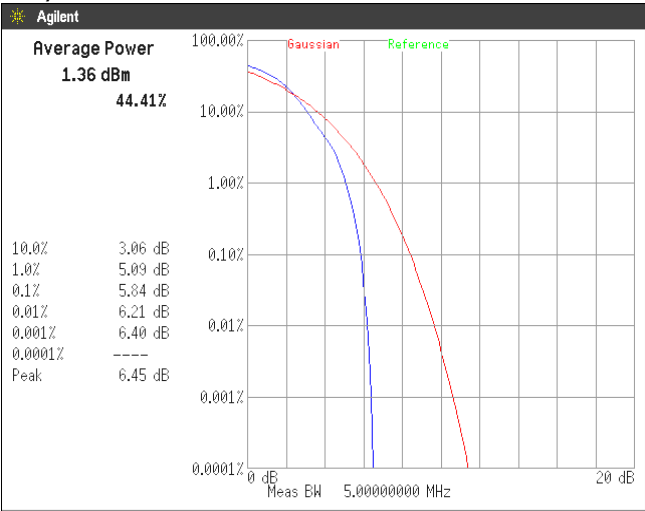
QPSK, BW 5MHz, RB25-0



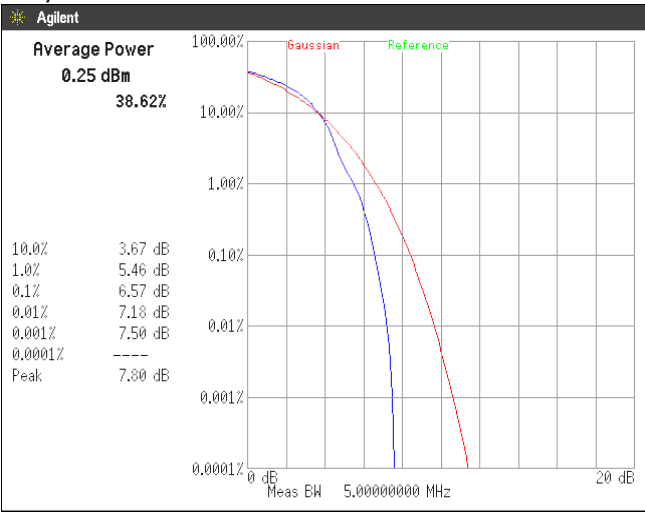
Channel: 18900
QPSK, BW 10MHz, RB50-0



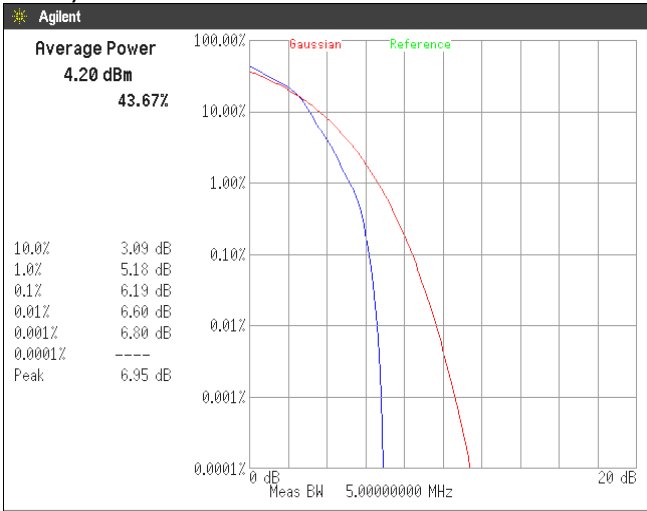
QPSK, BW 15MHz, RB75-0



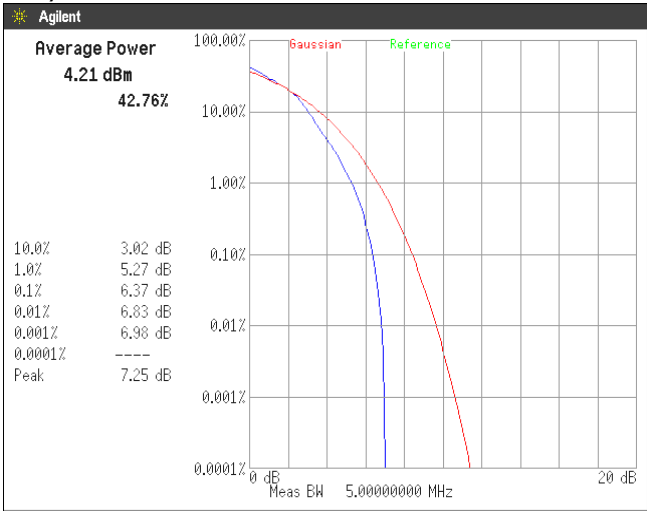
QPSK, BW 20MHz, RB100-0



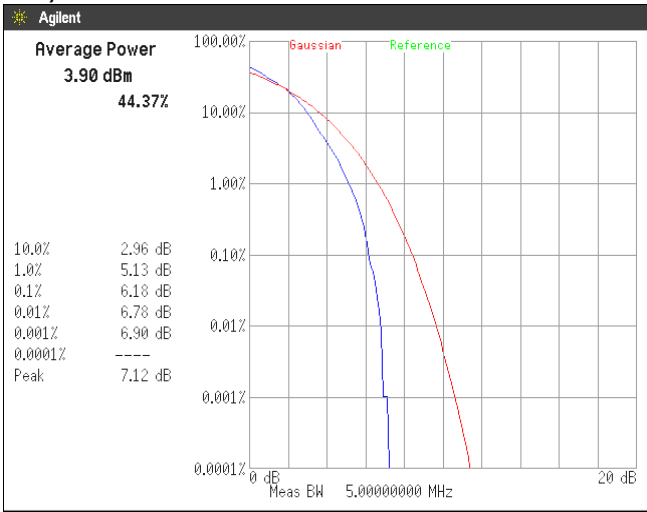
Channel: 18900
16QAM, BW 1.4MHz, RB6-0



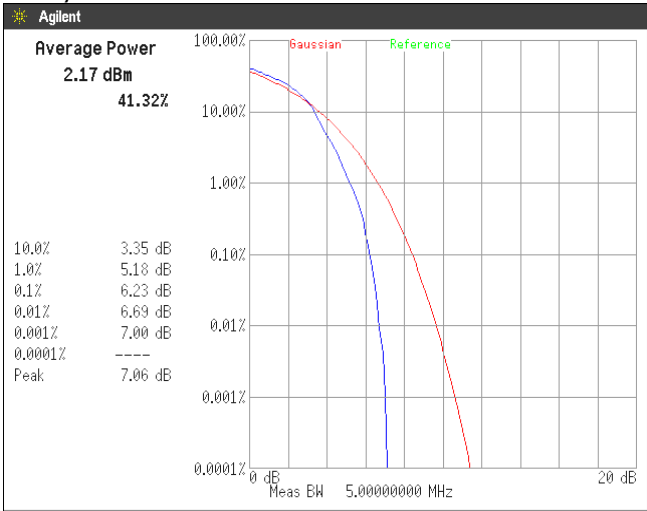
16QAM, BW 3MHz, RB15-0



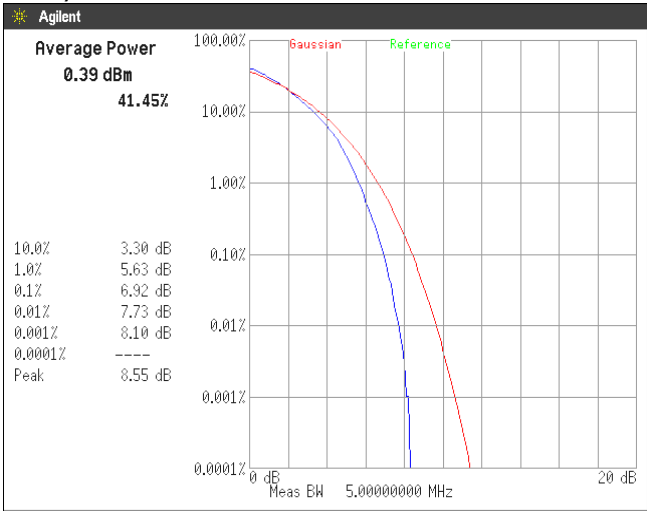
16QAM, BW 5MHz, RB25-0



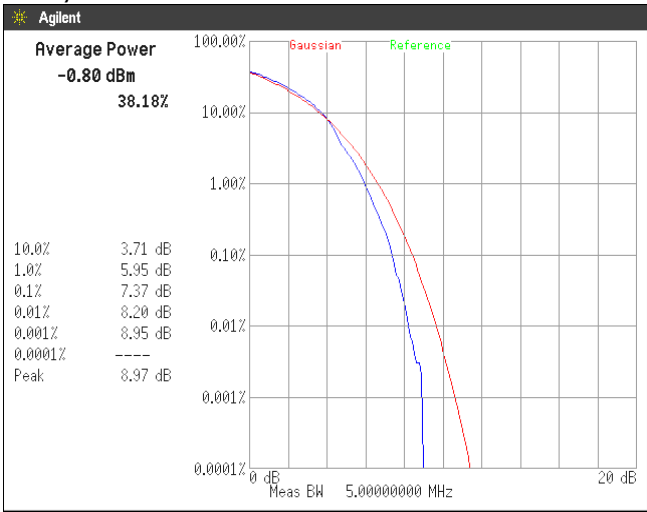
Channel: 18900
16QAM, BW 10MHz, RB50-0



16QAM, BW 15MHz, RB75-0



16QAM, BW 20MHz, RB100-0



6. Occupied Bandwidth

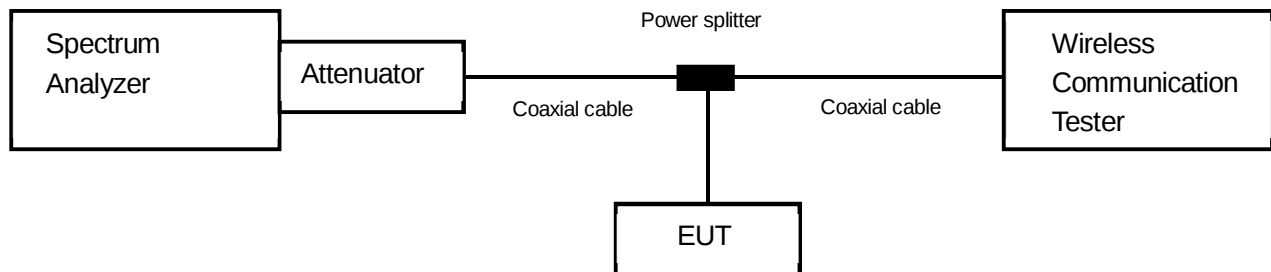
6.1 Measurement procedure [FCC 24.238(a), 2.1049]

The Occupied bandwidth was measured with a spectrum analyzer connected to the antenna terminal.

The spectrum analyzer is set to;

- a) RBW = 1-5% of the expected OBW & VBW $\geq 3 \times$ RBW
- b) Detector = Peak
- c) Trace mode = Max hold
- d) Sweep time = auto-couple

- Test configuration



6.2 Limit

None

6.3 Measurement result

Date : November 29, 2017
 Temperature : 24.0 [°C]
 Humidity : 34.1 [%]
 Test place : Shielded room No.4

Test engineer : Chiaki Kanno

Date : November 30, 2017
 Temperature : 22.1 [°C]
 Humidity : 36.3 [%]
 Test place : Shielded room No.4

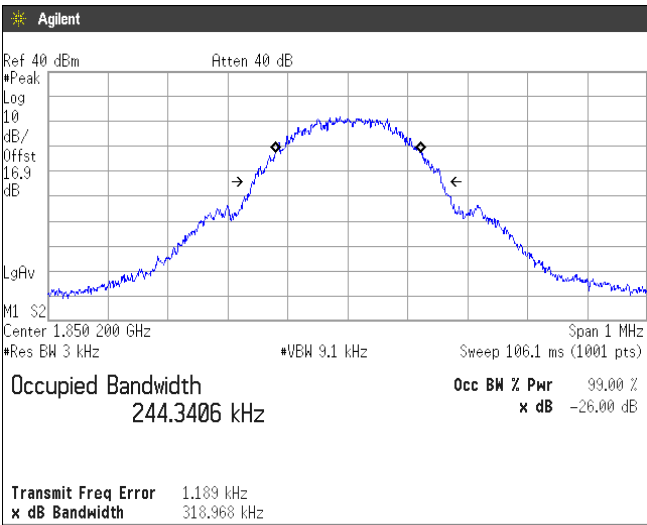
Test engineer : Chiaki Kanno

Band	Channel	Frequency [MHz]	Test Result [kHz]
GSM1900	512	1850.2	244.3406
	661	1880.0	244.2760
	810	1909.8	242.6947

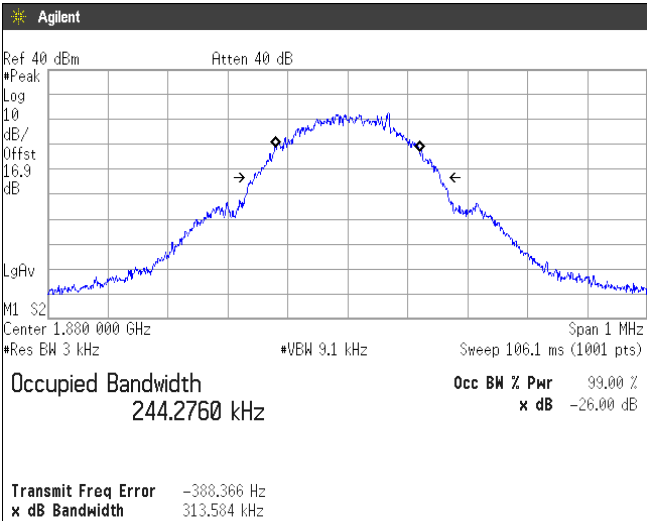
Band	Channel	Frequency [MHz]	Test Result [MHz]
WCDMA Band II	9262	1852.4	4.1198
	9400	1880.0	4.1237
	9538	1907.6	4.1261

Band	Channel	Frequency [MHz]	Bandwidth [MHz]	Modulation	RB	Test Result [MHz]
LTE Band II	18900	1880.0	1.4	QPSK	3-1	0.6150
					6-0	1.0973
				16QAM	3-1	0.6232
					6-0	1.1011
			3	QPSK	8-4	1.5300
					15-0	2.7071
				16QAM	8-4	1.5404
					15-0	2.7208
			5	QPSK	12-7	2.3759
					25-0	4.5333
				16QAM	12-7	2.3312
					25-0	4.5028
			10	QPSK	25-12	4.6609
					50-0	8.9367
				16QAM	25-12	4.7599
					50-0	8.9667
			15	QPSK	36-20	6.8117
					75-0	13.4581
				16QAM	36-20	6.7790
					75-0	13.4172
			20	QPSK	50-24	9.2611
					100-0	17.8847
				16QAM	50-24	9.2411
					100-0	17.9674

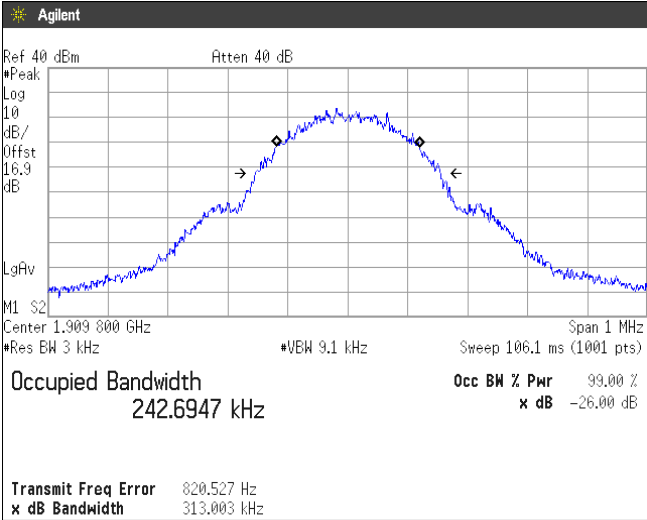
6.4 Trace data
[GSM1900]
Channel: 512



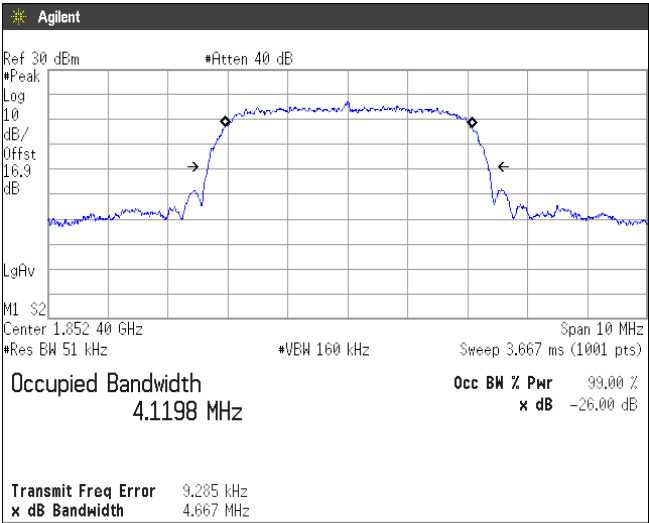
Channel: 661



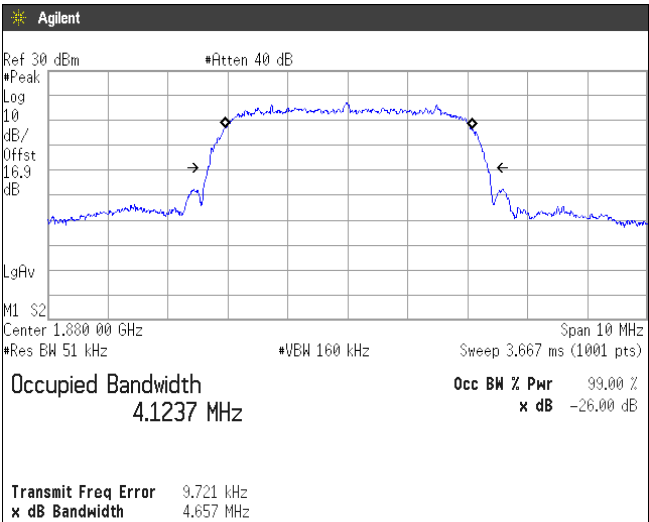
Channel: 810



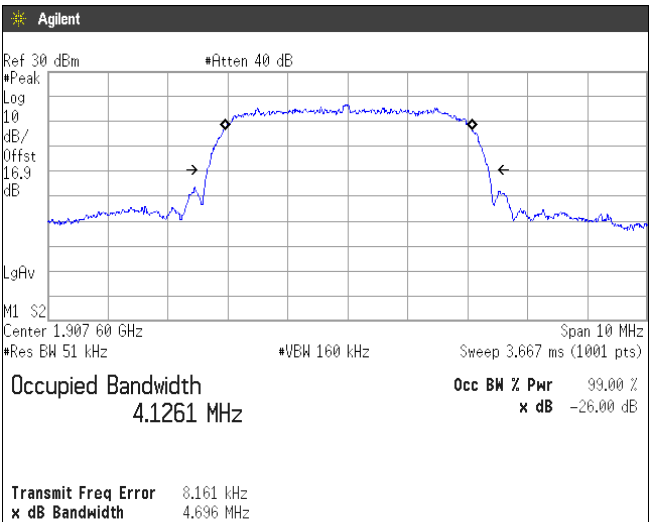
[WCDMA Band II]
Channel: 9262



Channel: 9400

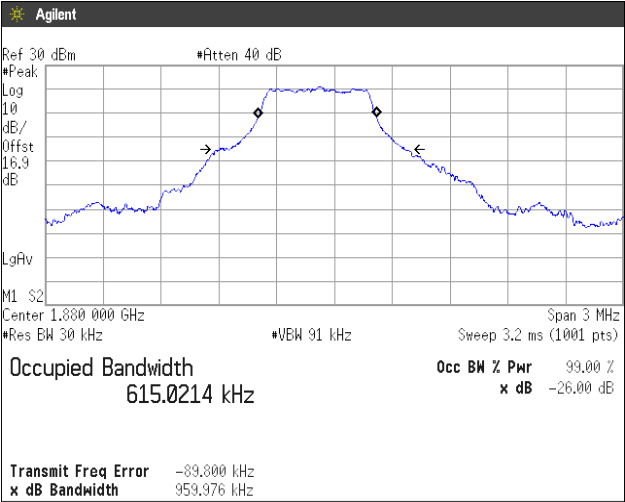


Channel: 9538

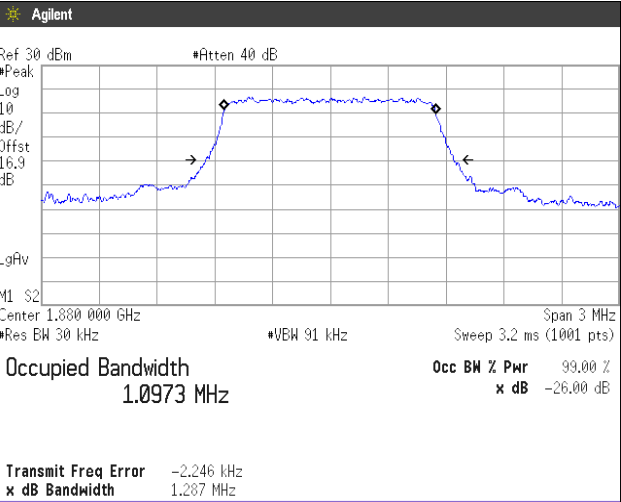


[LTE Band II]
Channel: 18900

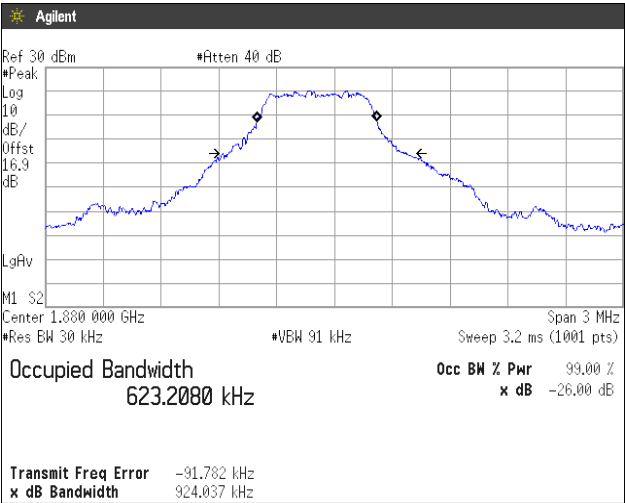
QPSK, BW 1.4MHz
RB3-1



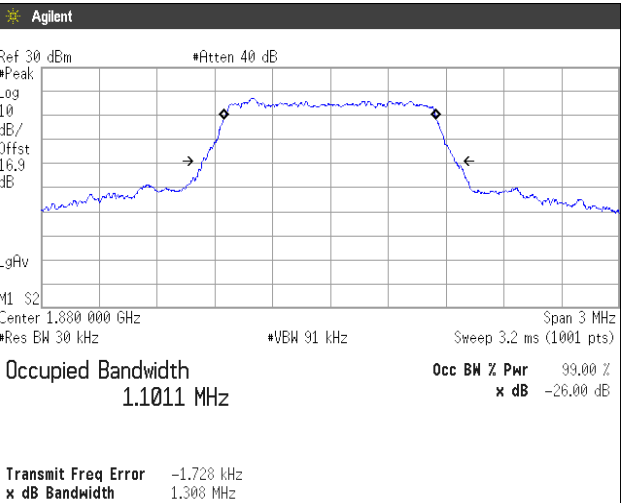
RB6-0



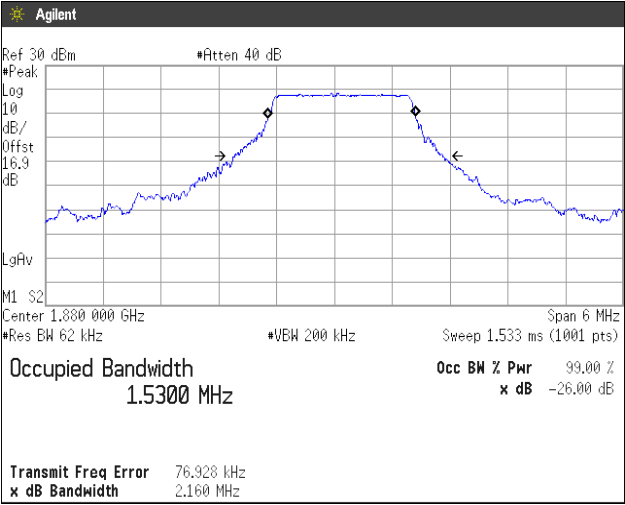
16QAM, BW 1.4MHz
RB3-1



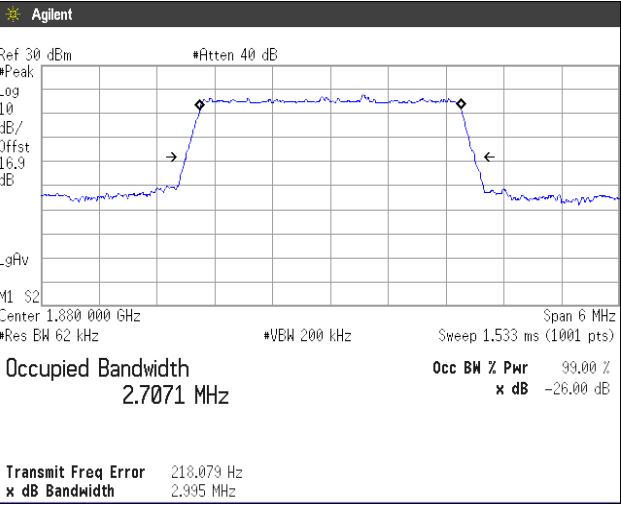
RB6-0



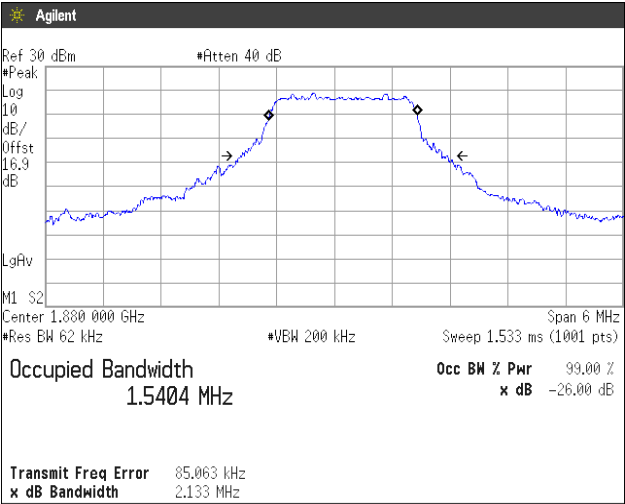
QPSK, BW 3MHz
RB8-4



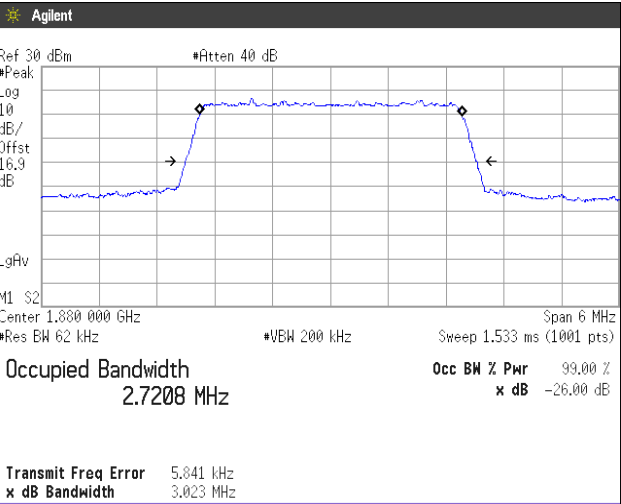
RB15-0



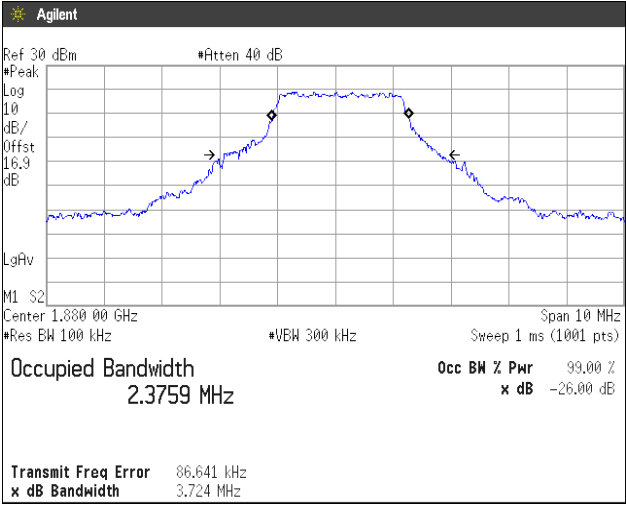
16QAM, BW 3MHz
RB8-4



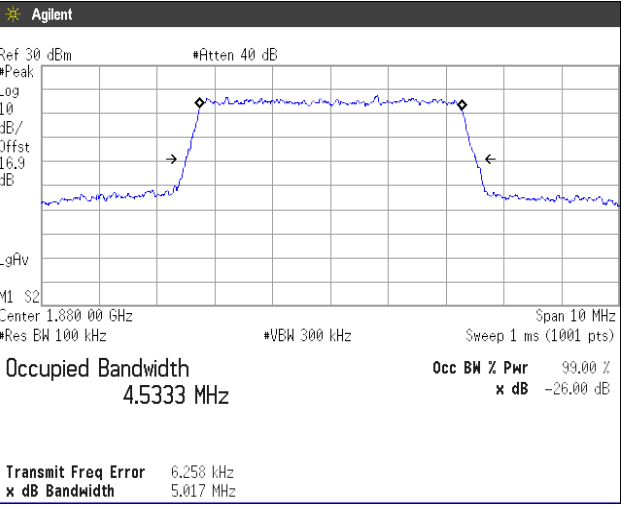
RB15-0



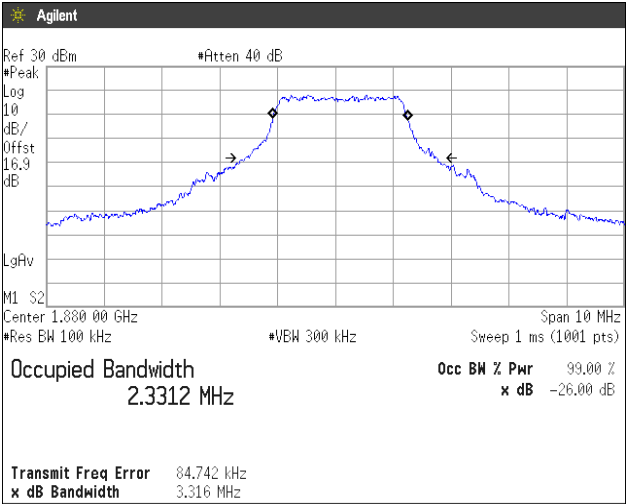
QPSK, BW 5MHz
RB12-7



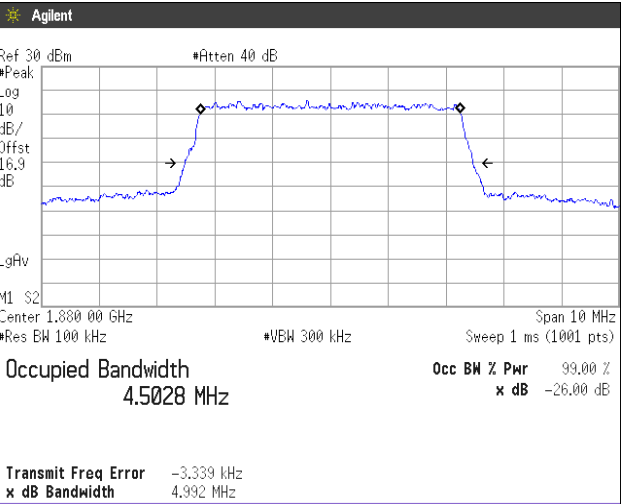
RB25-0



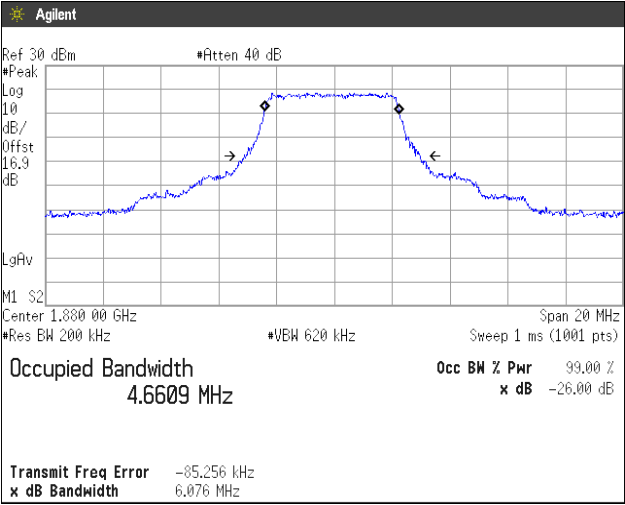
16QAM, BW 5MHz
RB12-7



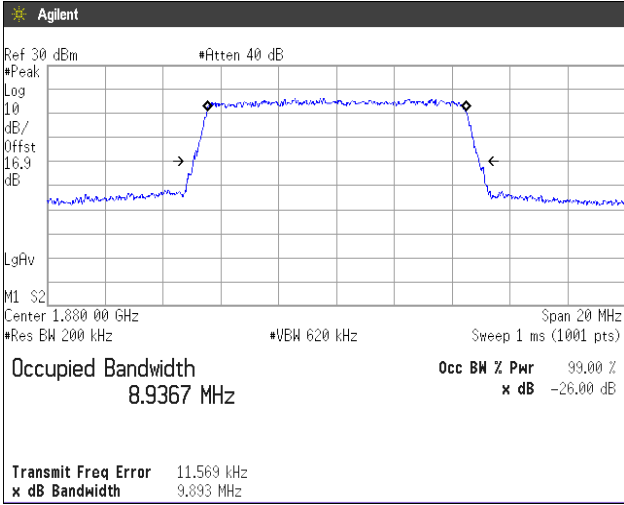
RB25-0



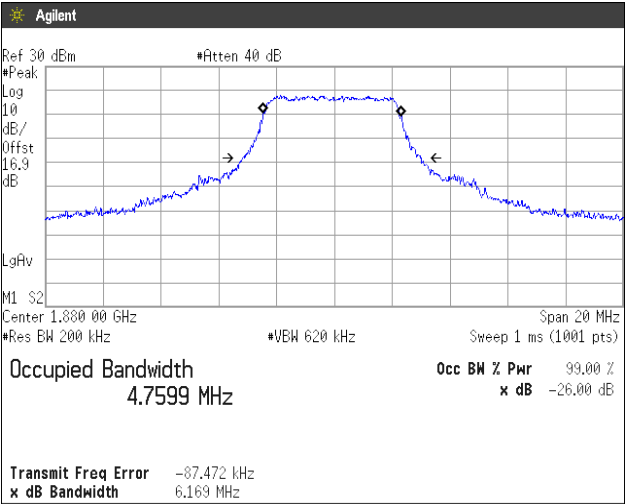
QPSK, BW 10MHz
RB25-12



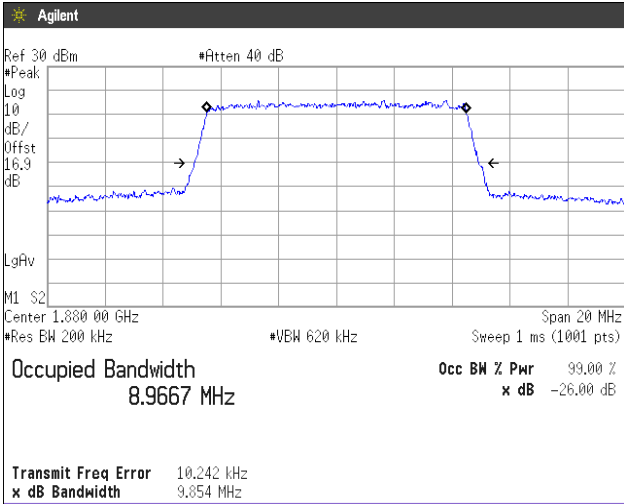
RB50-0



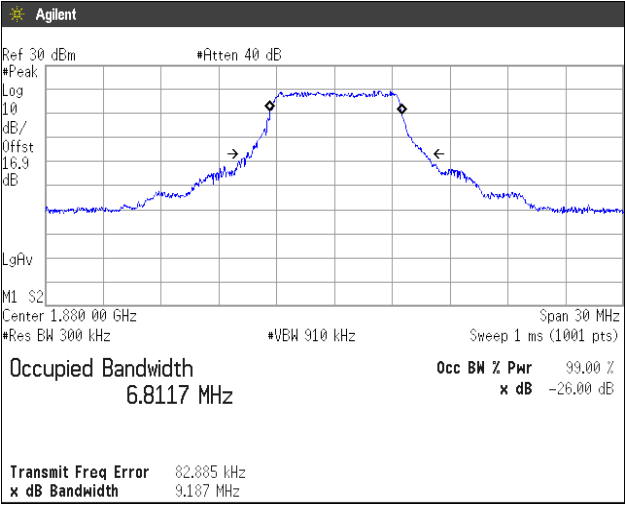
16QAM, BW 10MHz
RB25-12



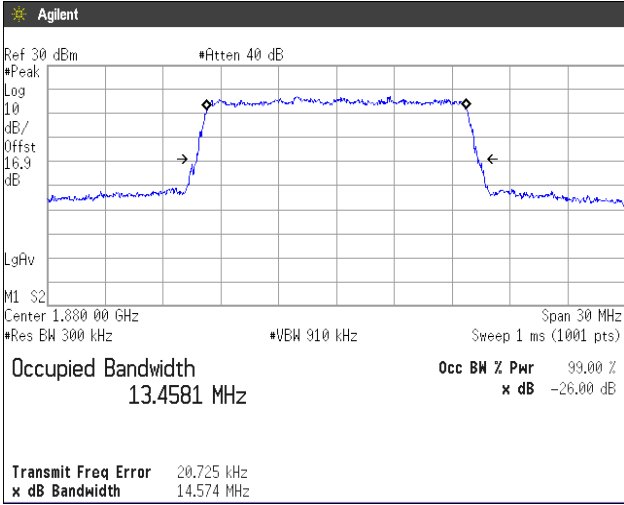
RB50-0



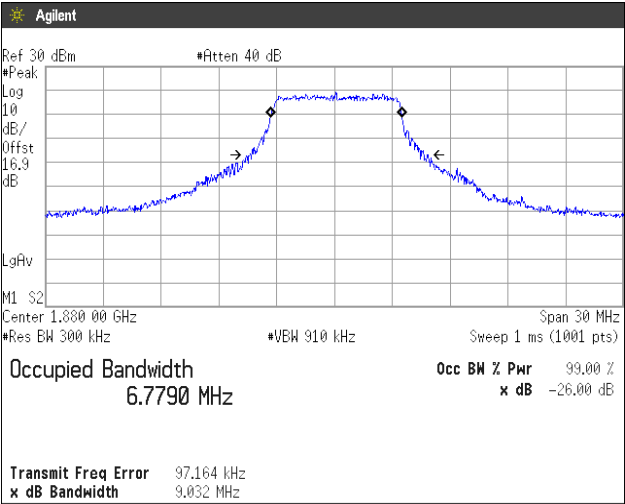
QPSK, BW 15MHz
RB36-20



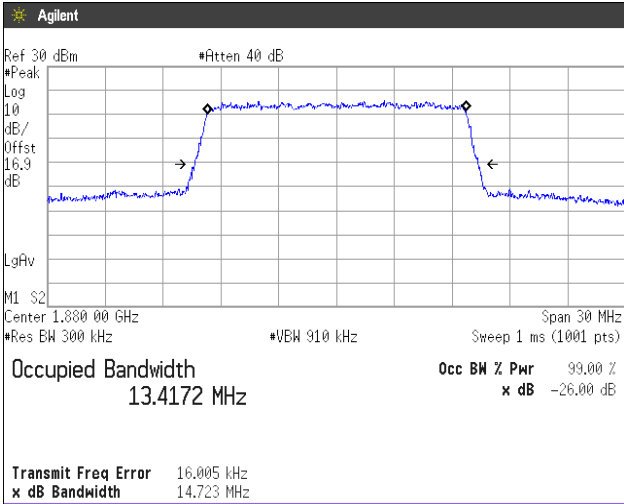
RB75-0



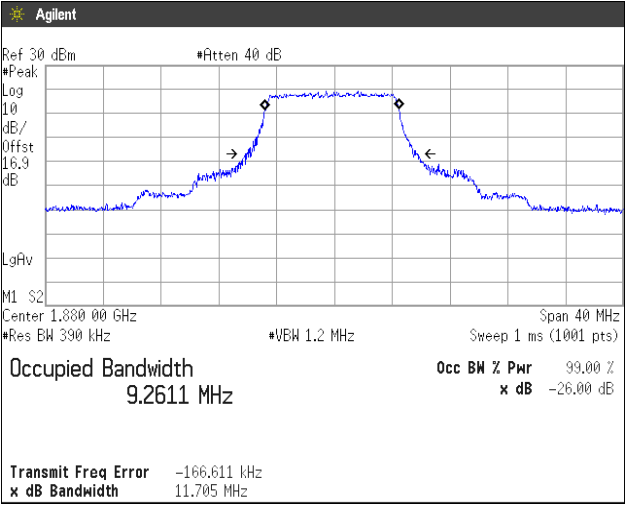
16QAM, BW 15MHz
RB36-20



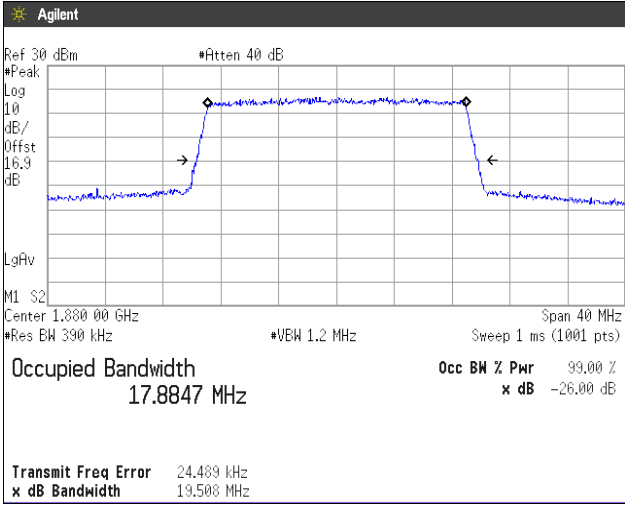
RB75-0



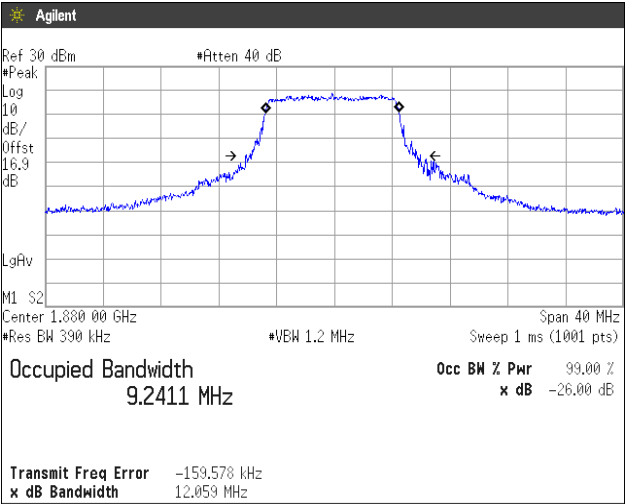
QPSK, BW 20MHz
RB50-24



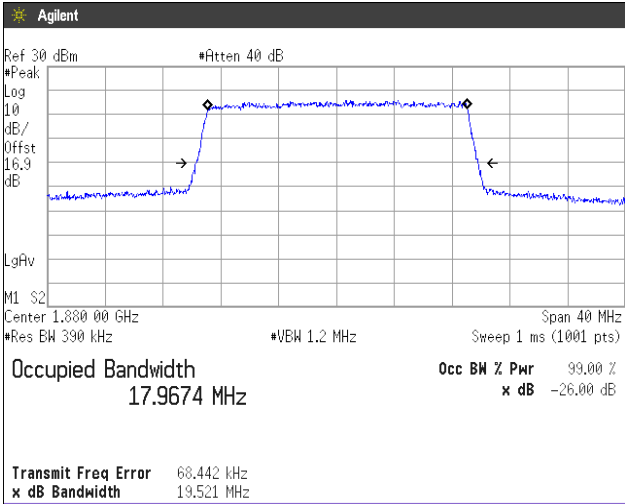
RB100-0



16QAM, BW 20MHz
RB50-24



RB100-0



7. Band Edge Spurious and Harmonic at Antenna Terminals

7.1 Measurement procedure [FCC 24.238(a), 2.1051]

The band edge spurious and harmonic was measured with a spectrum analyzer connected to the antenna terminal.

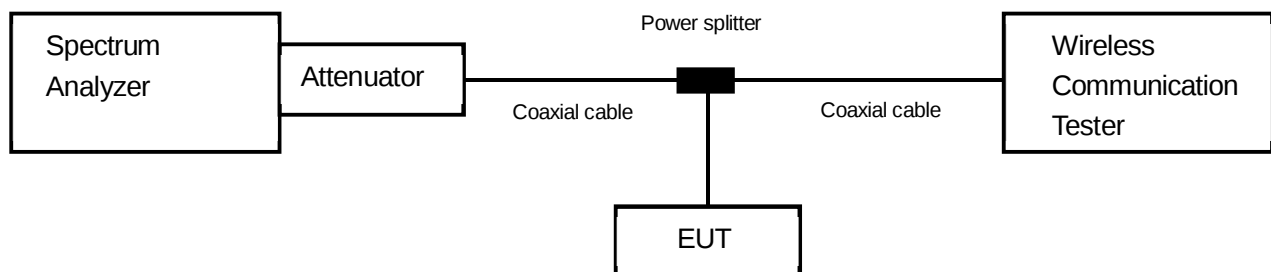
The spectrum analyzer is set to;
<Band Edge>

- a) Span was set large enough so as to capture all out of band emissions near the band edge
- b) RBW $\geq 1\%$ of the emission bandwidth or 2% of the emission bandwidth
- c) VBW $\geq 3 \times$ RBW
- d) Detector = RMS
- e) Trace mode = Max hold
- f) Sweep time = auto-couple
- g) Number of sweep point $\geq 2 \times$ span / RBW

<Spurious Emissions>

- a) RBW = 1MHz & VBW $\geq 3 \times$ RBW
- b) Detector = Peak
- c) Trace mode = Max hold
- d) Sweep time = auto-couple
- e) Number of sweep point $\geq 2 \times$ span / RBW

- Test configuration



7.2 Limit

-13dBm or less

7.3 Measurement result

Date : November 29, 2017
 Temperature : 24.0 [°C]
 Humidity : 34.1 [%]
 Test place : Shielded room No.4

Test engineer : Chiaki Kanno

Date : November 30, 2017
 Temperature : 22.1 [°C]
 Humidity : 36.3 [%]
 Test place : Shielded room No.4

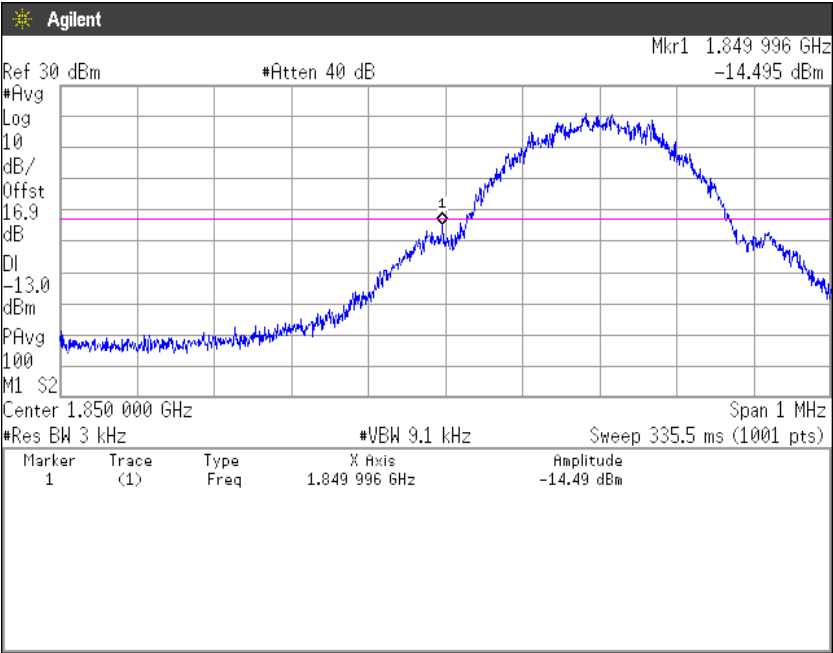
Test engineer : Chiaki Kanno

Band	Channel	Frequency [MHz]	Limit [dB]	Results	
GSM1900	512	1850.2	-13.0	See the trace data	PASS
	810	1909.8	-13.0	See the trace data	PASS
WCDMA Band II	9262	1852.4	-13.0	See the trace data	PASS
	9538	1907.6	-13.0	See the trace data	PASS

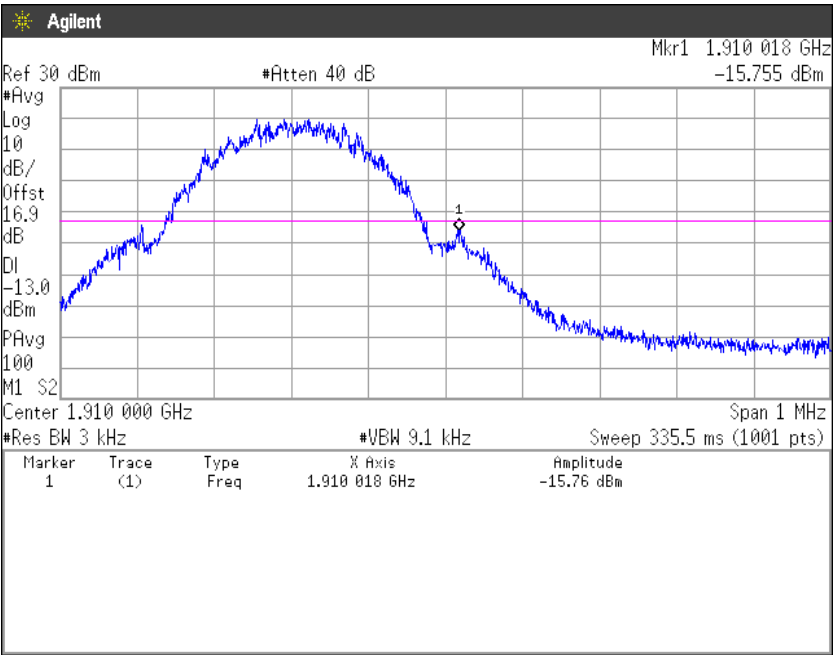
Band	Modulation	Bandwidth [MHz]	Limit [dB]	Results	
LTE Band II	QPSK	1.4	-13.0	See the trace data	PASS
		3	-13.0	See the trace data	PASS
		5	-13.0	See the trace data	PASS
		10	-13.0	See the trace data	PASS
		15	-13.0	See the trace data	PASS
		20	-13.0	See the trace data	PASS
	16QAM	1.4	-13.0	See the trace data	PASS
		3	-13.0	See the trace data	PASS
		5	-13.0	See the trace data	PASS
		10	-13.0	See the trace data	PASS
		15	-13.0	See the trace data	PASS
		20	-13.0	See the trace data	PASS

7.4 Trace data
[GSM1900]
(Band Edge)

Channel: 512



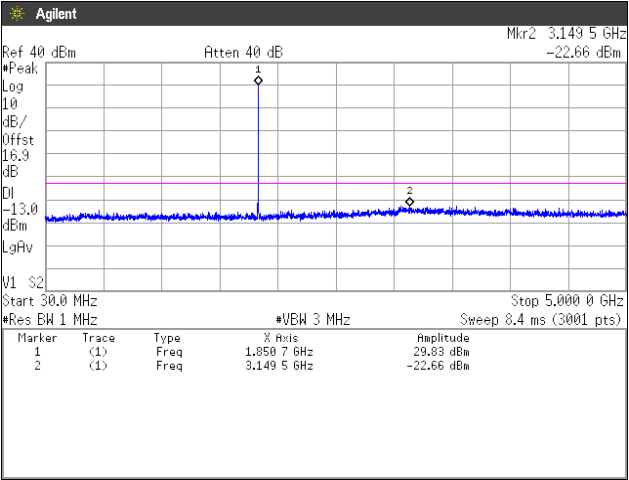
Channel: 810



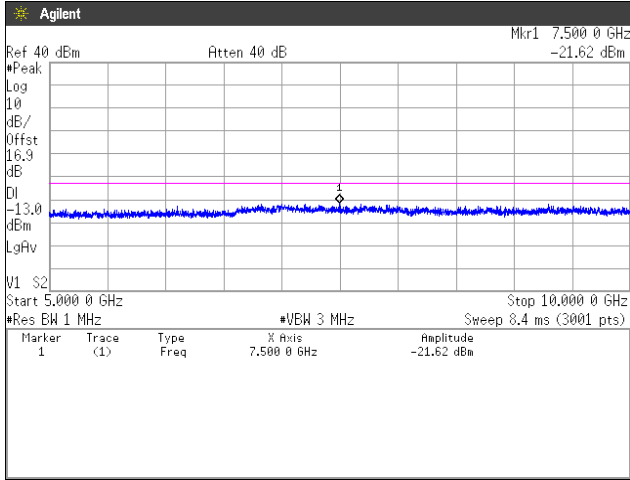
(Spurious Emissions)

Note: Conducted spurious test was measured in the worst case of conducted output power.

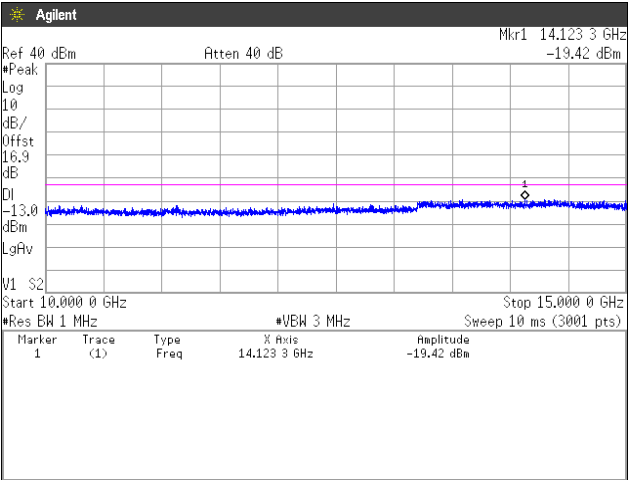
Channel: 512
30MHz-5GHz



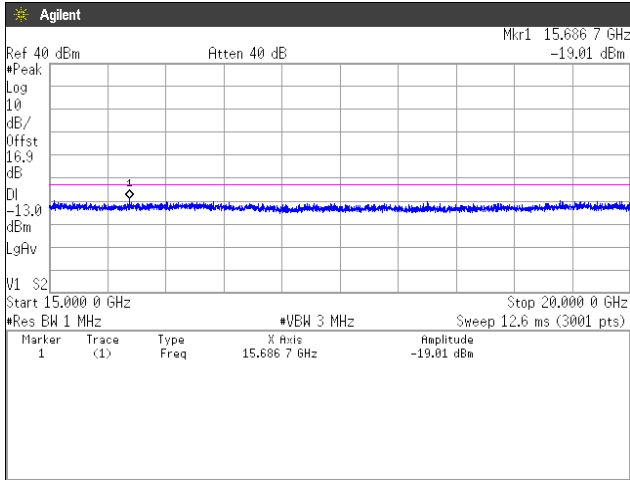
5GHz-10GHz



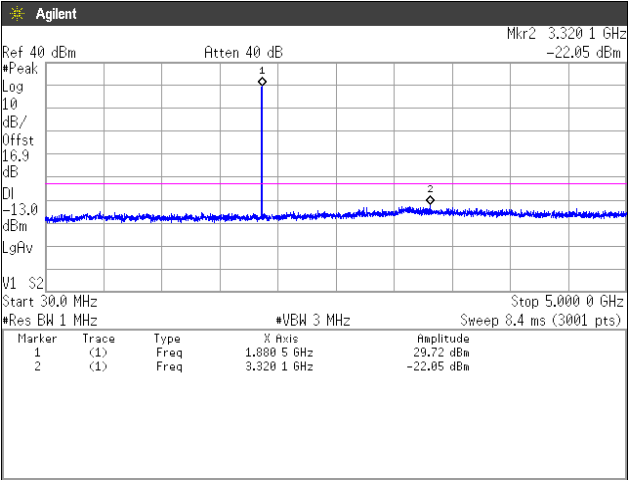
10GHz-15GHz



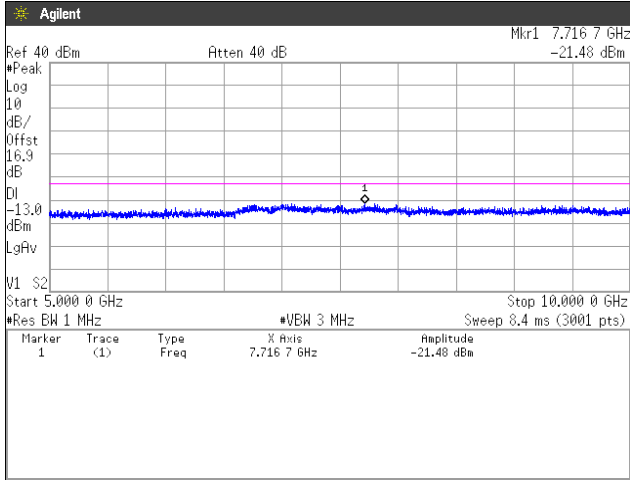
15GHz-20GHz



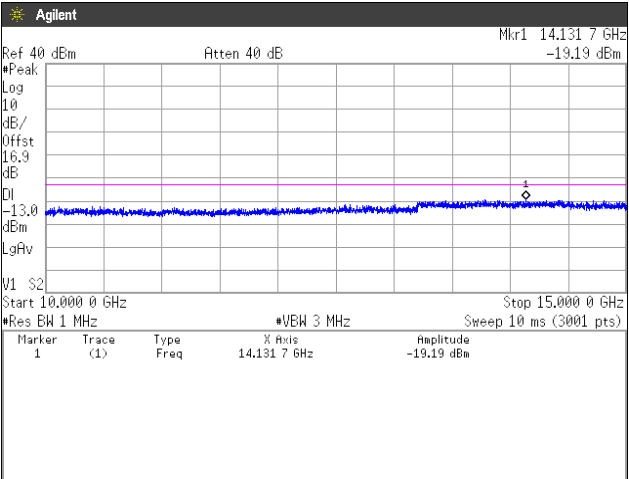
Channel: 661
30MHz-5GHz



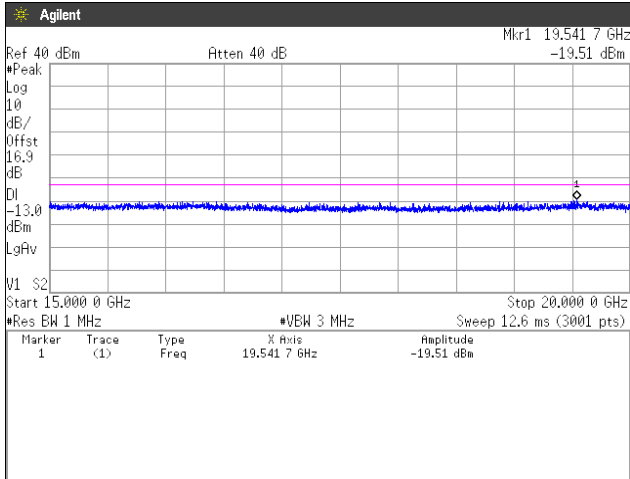
5GHz-10GHz



10GHz-15GHz



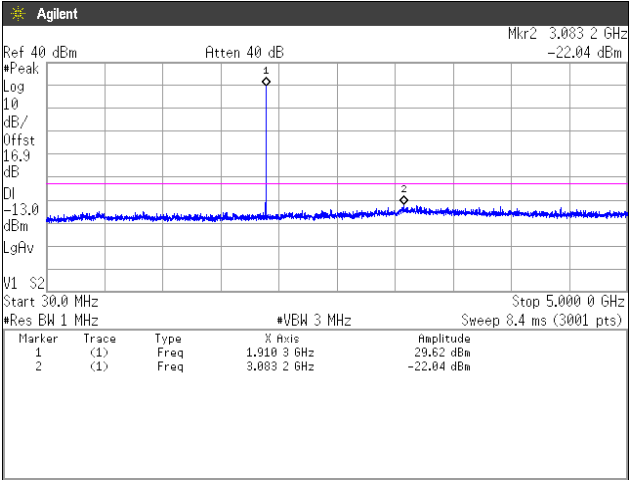
15GHz-20GHz



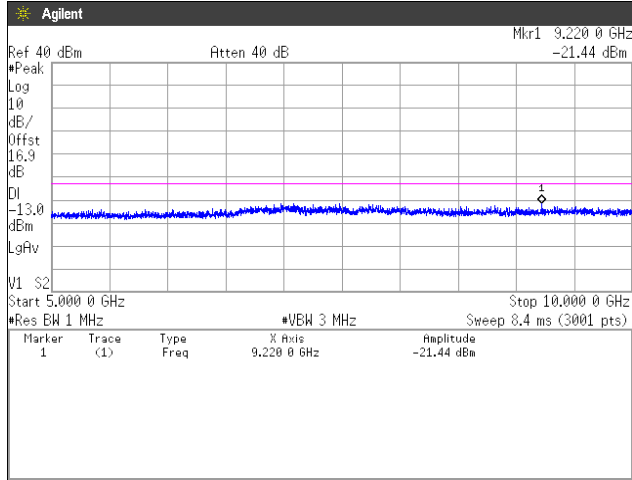


Zacta

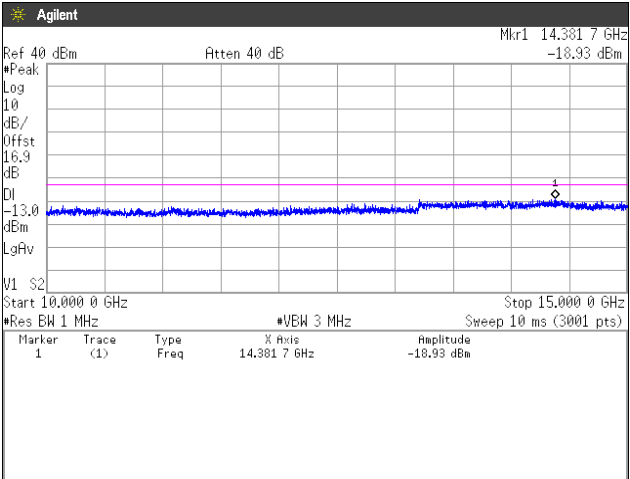
Channel: 810
30MHz-5GHz



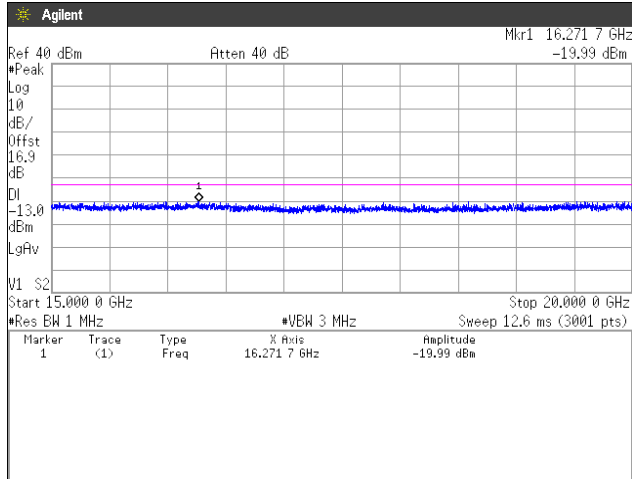
5GHz-10GHz



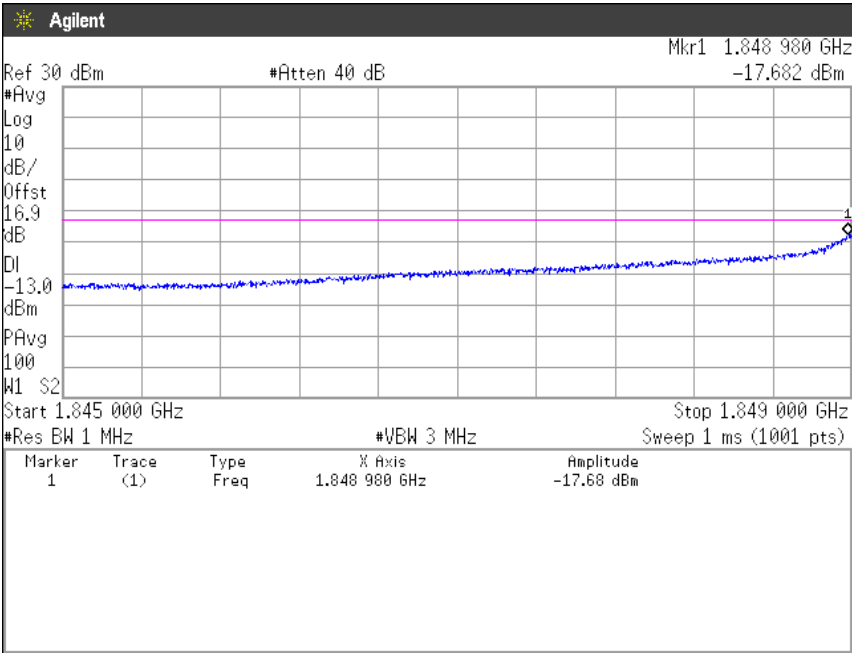
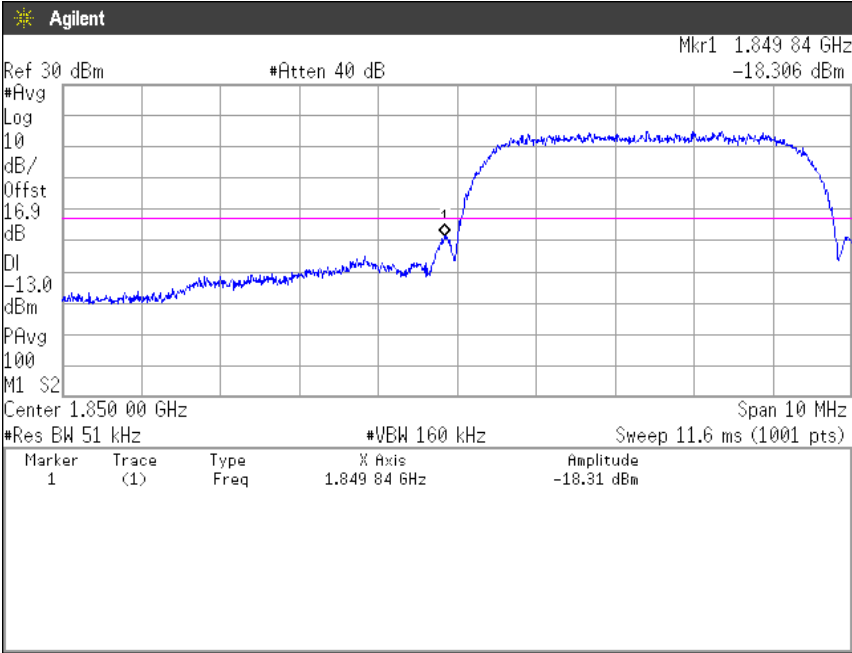
10GHz-15GHz



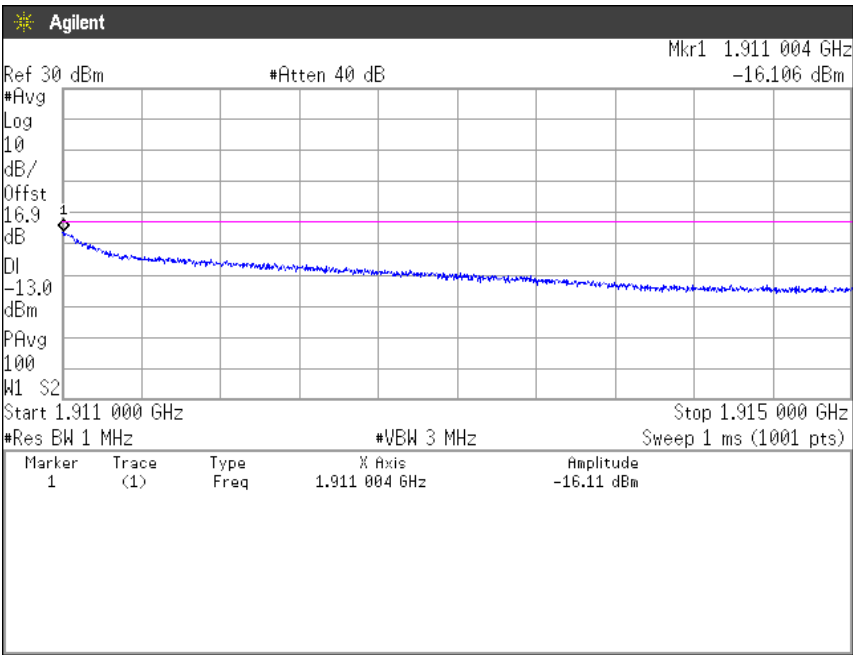
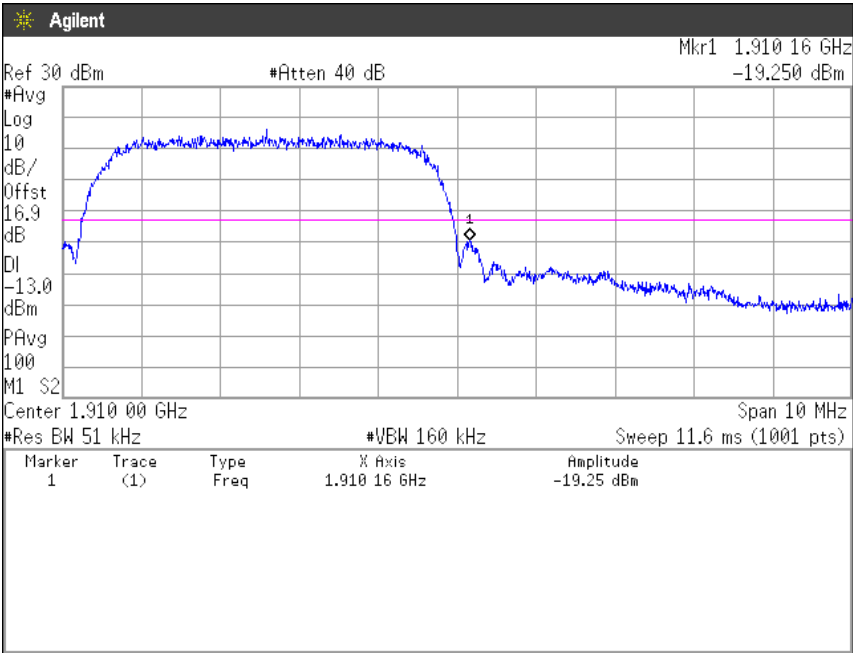
15GHz-20GHz



[WCDMA Band II]
(Band Edge)
Channel: 9262

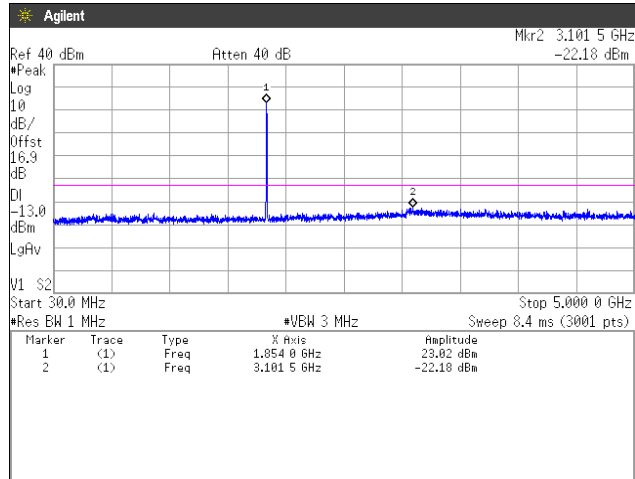
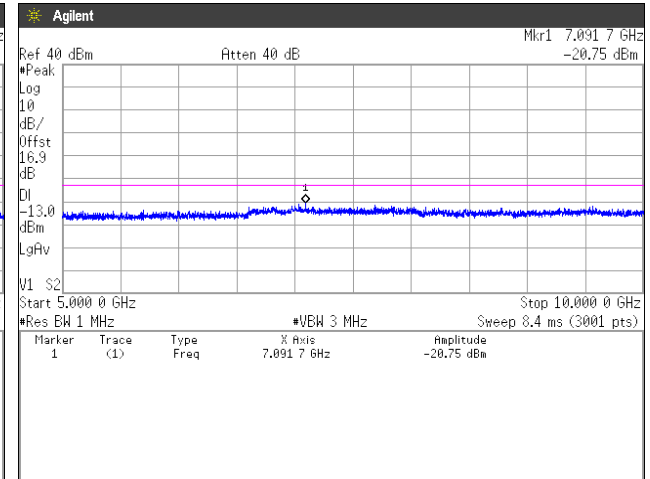
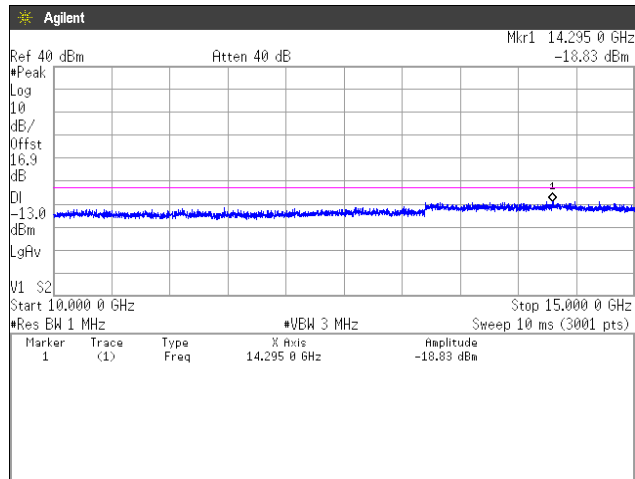
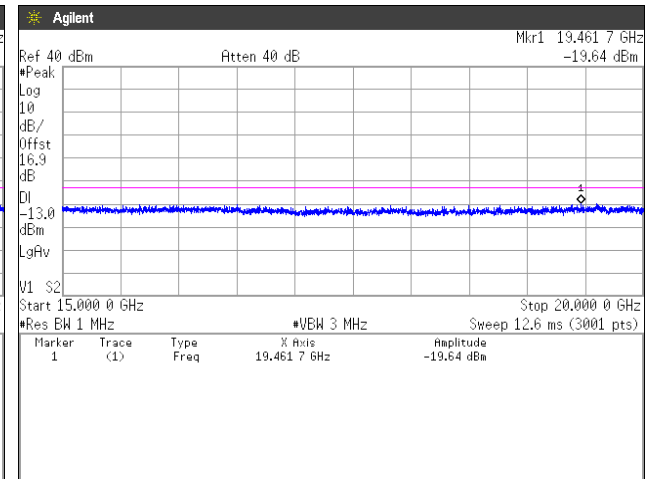


Channel: 9538

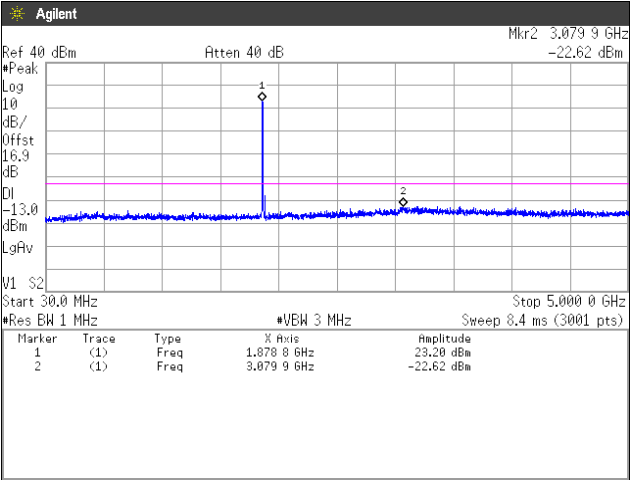


(Spurious Emissions)

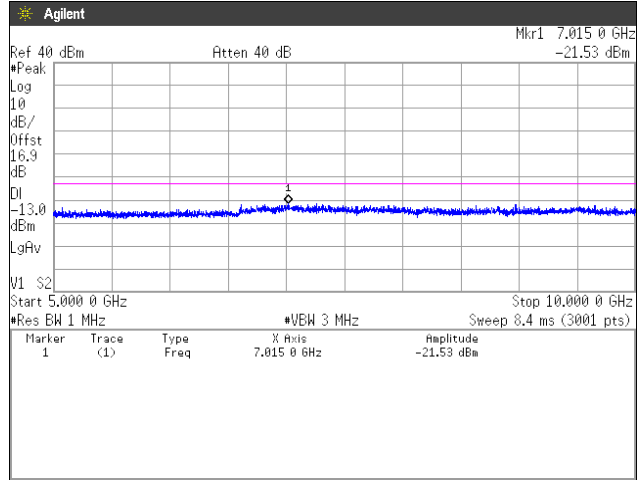
Note: Conducted spurious test was measured in the worst case of conducted output power.

Channel: 9262**30MHz-5GHz****5GHz-10GHz****10GHz-15GHz****15GHz-20GHz**

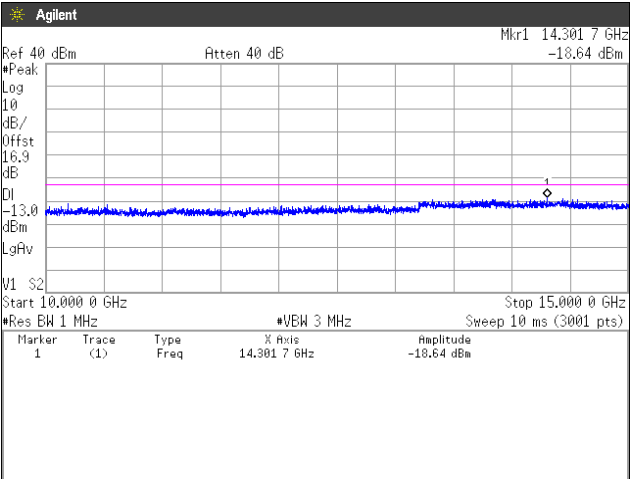
Channel: 9400
30MHz-5GHz



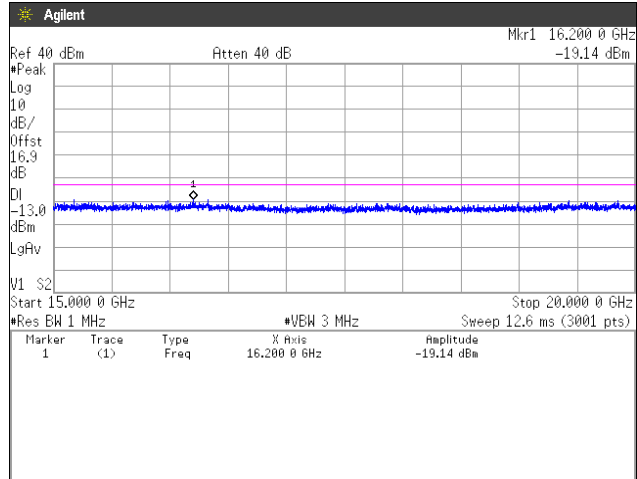
5GHz-10GHz



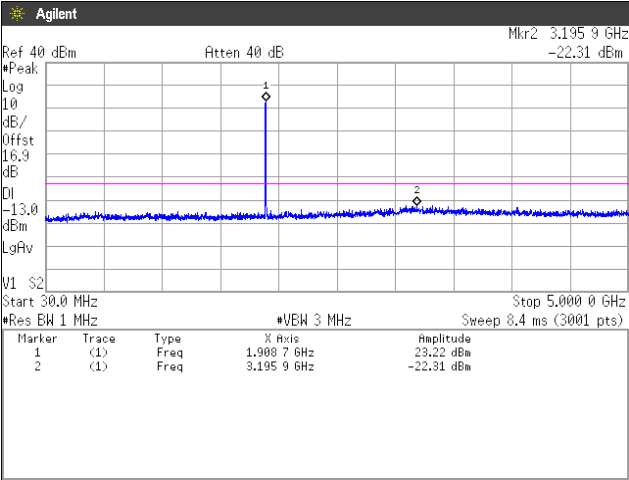
10GHz-15GHz



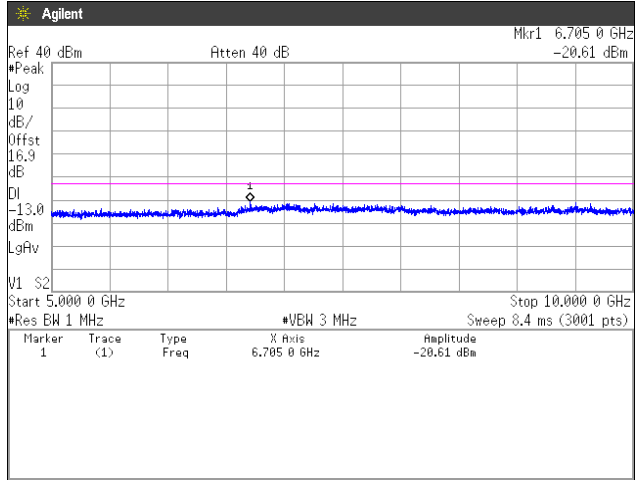
15GHz-20GHz



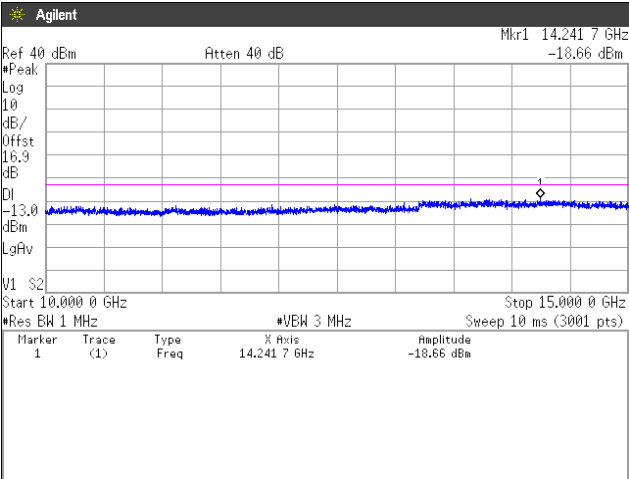
Channel: 9538
30MHz-5GHz



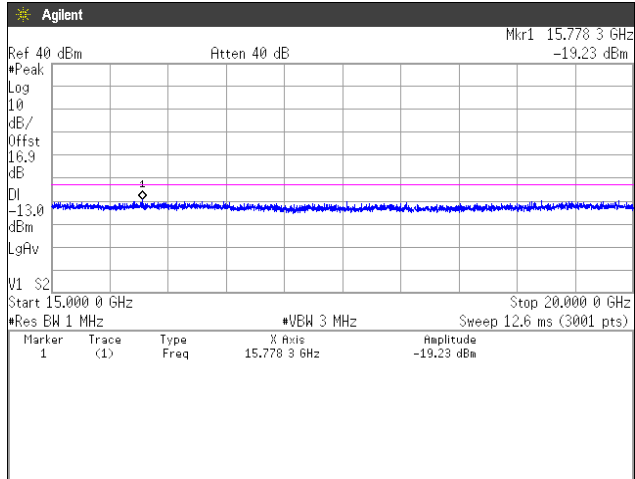
5GHz-10GHz



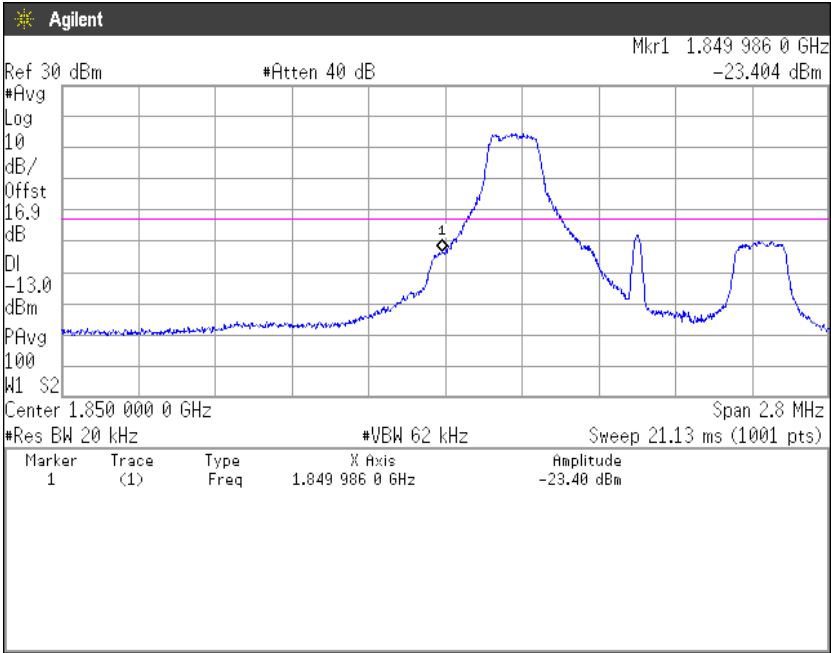
10GHz-15GHz



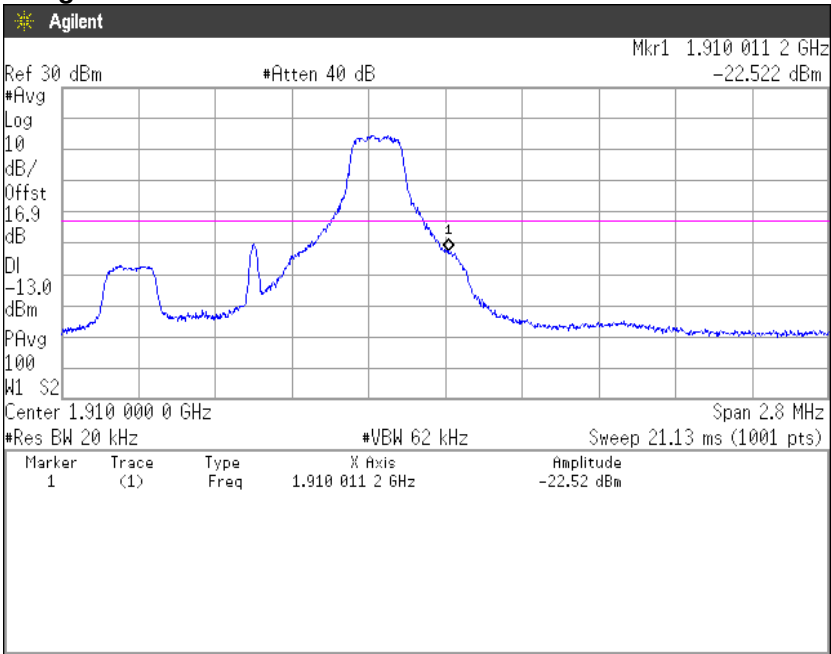
15GHz-20GHz



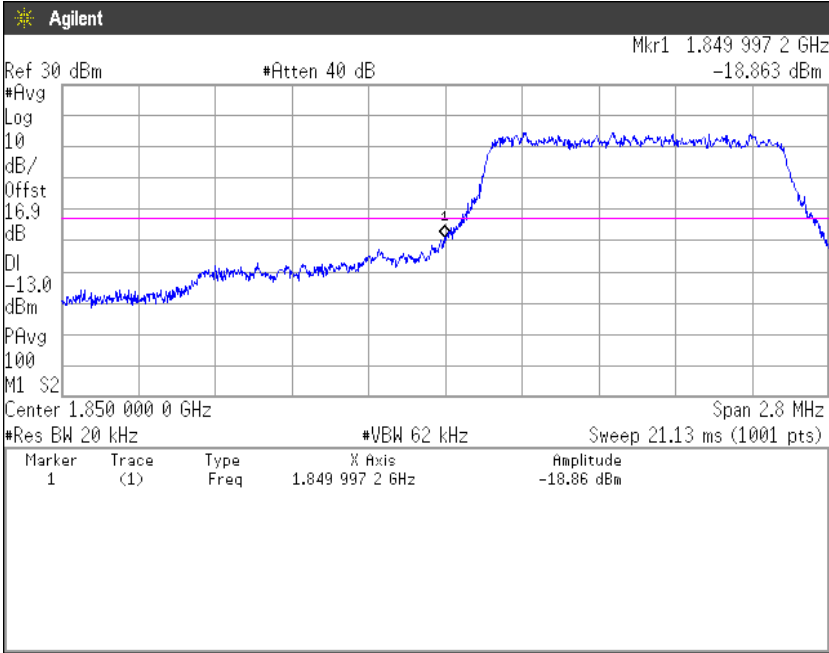
[LTE Band II]
(Band Edge)
QPSK, BW 1.4MHz, RB1-0
Channel: Low



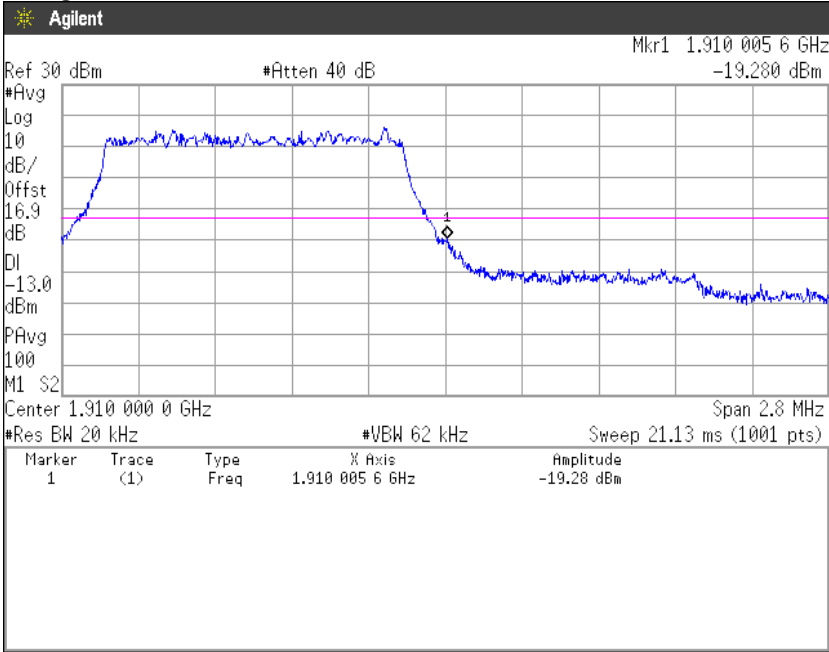
QPSK, BW 1.4MHz, RB1-5
Channel: High



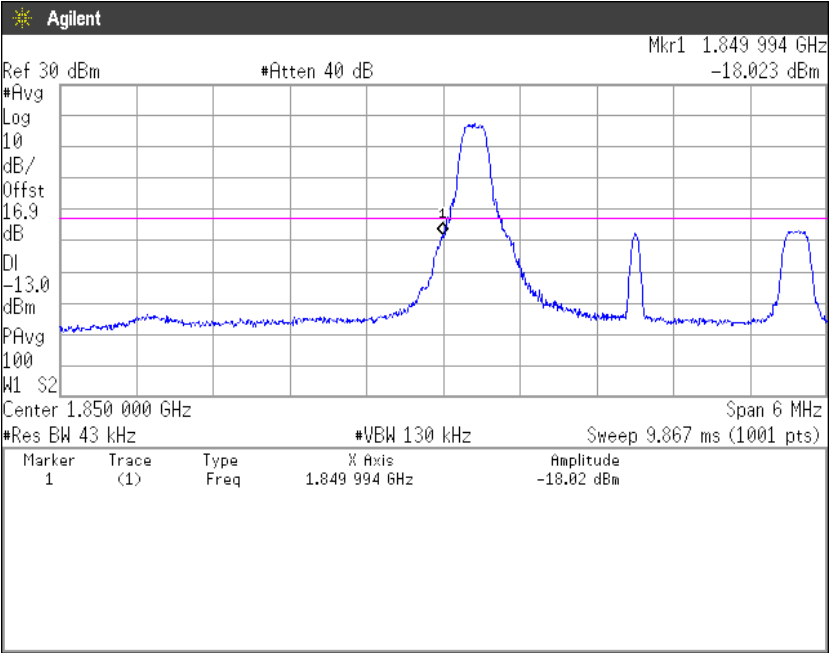
QPSK, BW 1.4MHz, RB6-0
Channel: Low



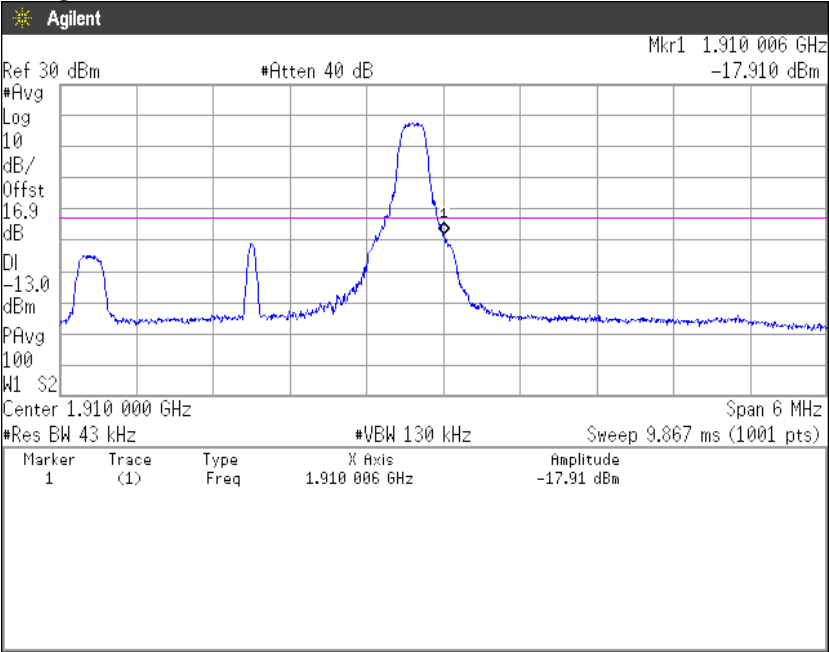
QPSK, BW 1.4MHz, RB6-0
Channel: High



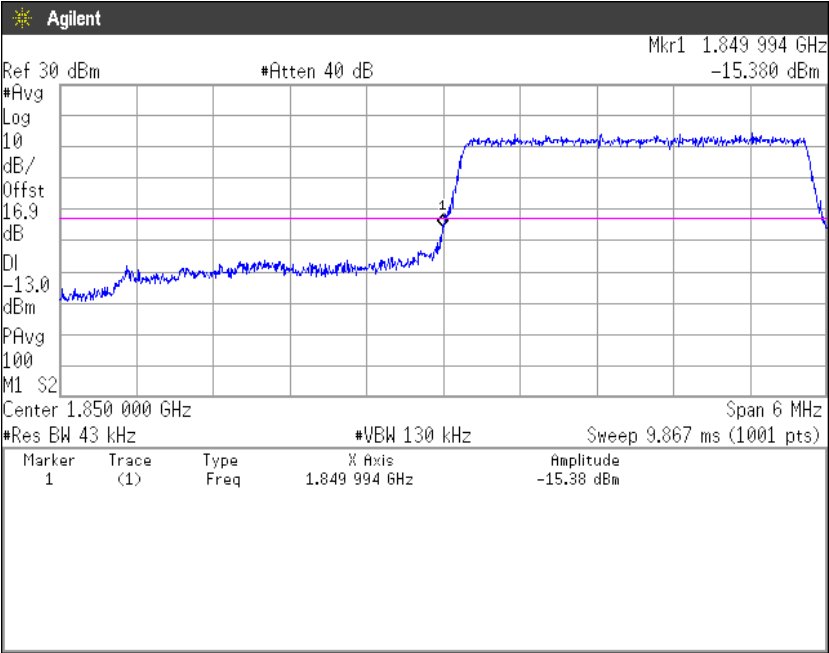
QPSK, BW 3MHz, RB1-0
Channel: Low



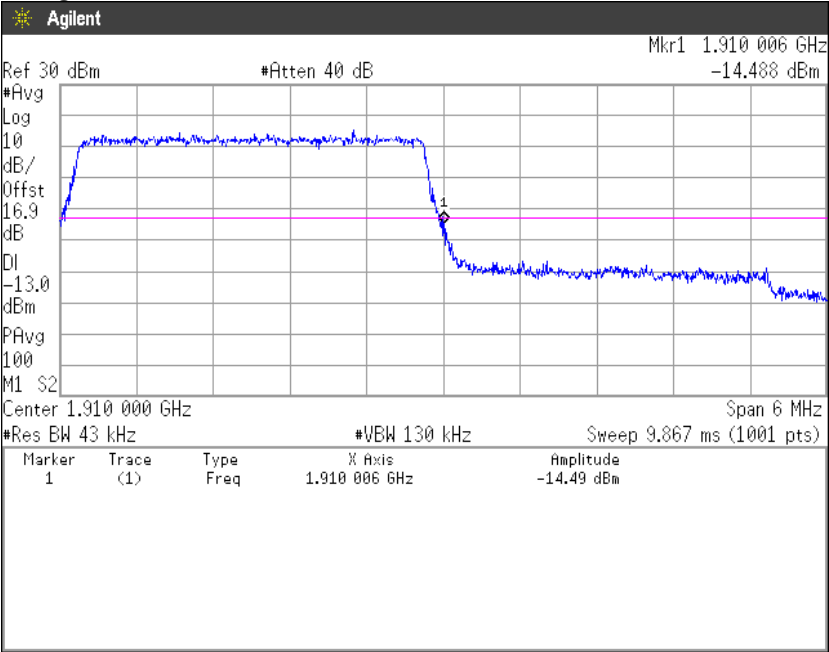
QPSK, BW 3MHz, RB1-14
Channel: High



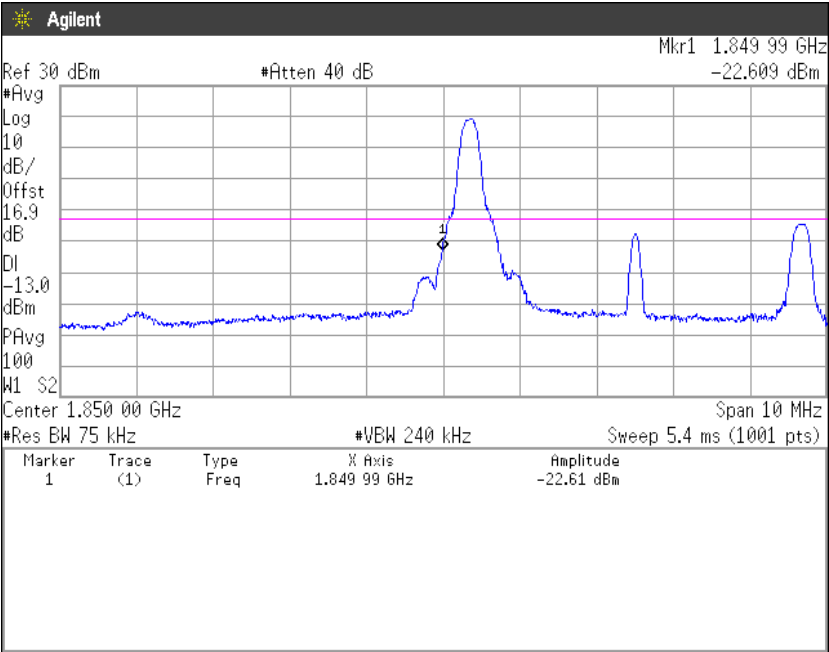
QPSK, BW 3MHz, RB15-0
Channel: Low



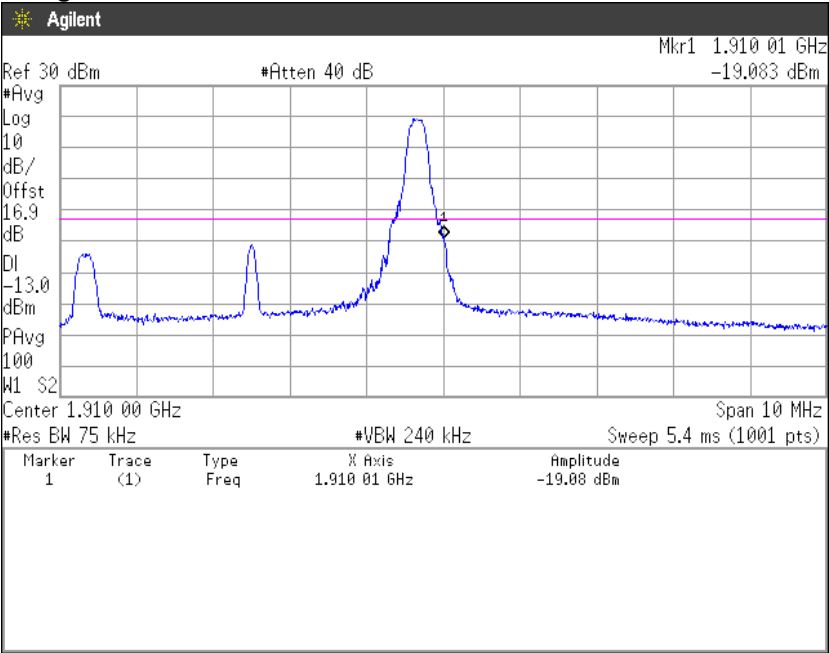
QPSK, BW 3MHz, RB15-0
Channel: High



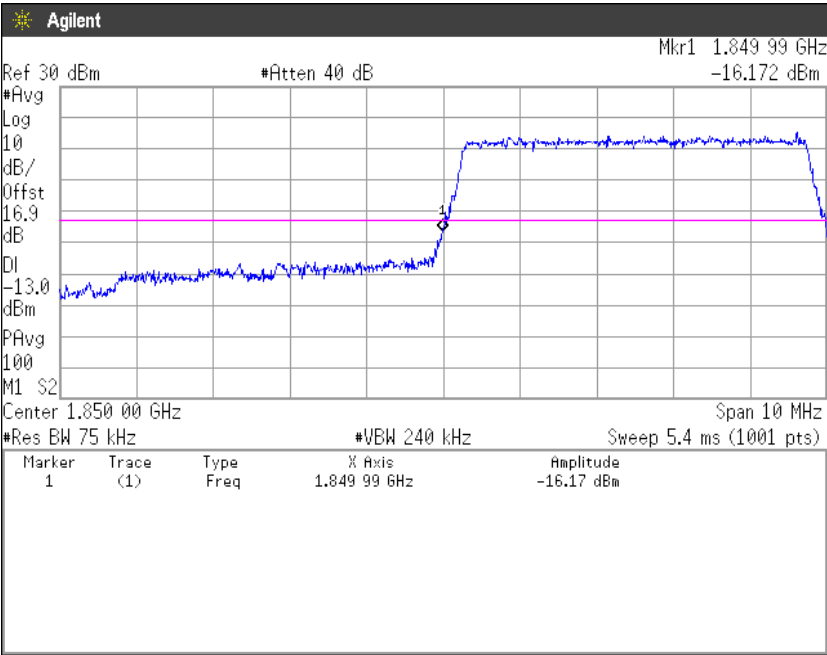
QPSK, BW 5MHz, RB1-0
Channel: Low



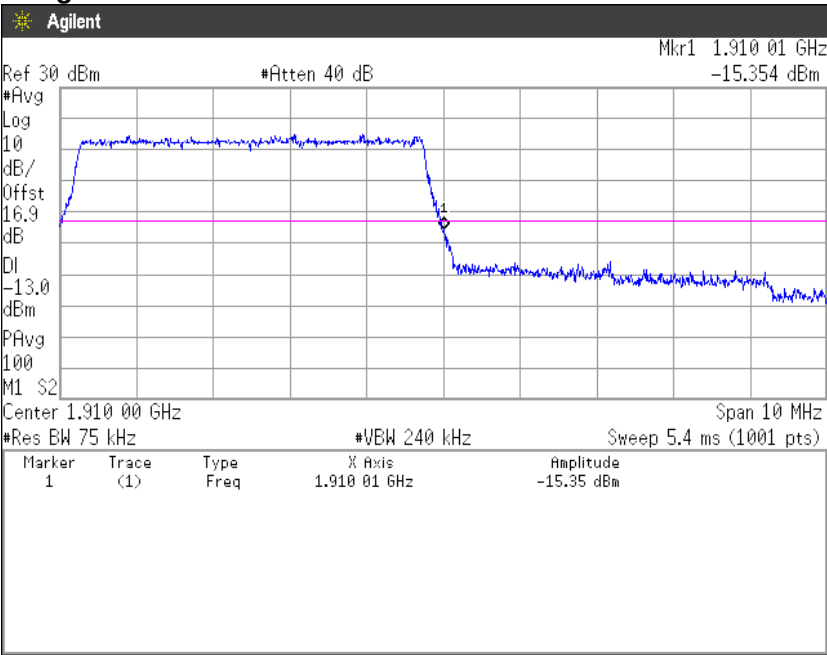
QPSK, BW 5MHz, RB1-24
Channel: High



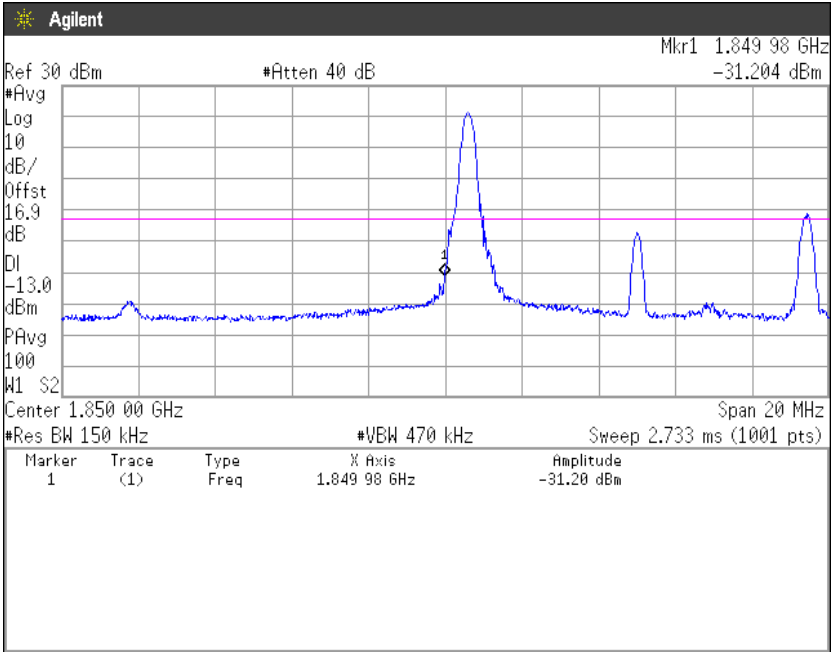
QPSK, BW 5MHz, RB25-0
Channel: Low



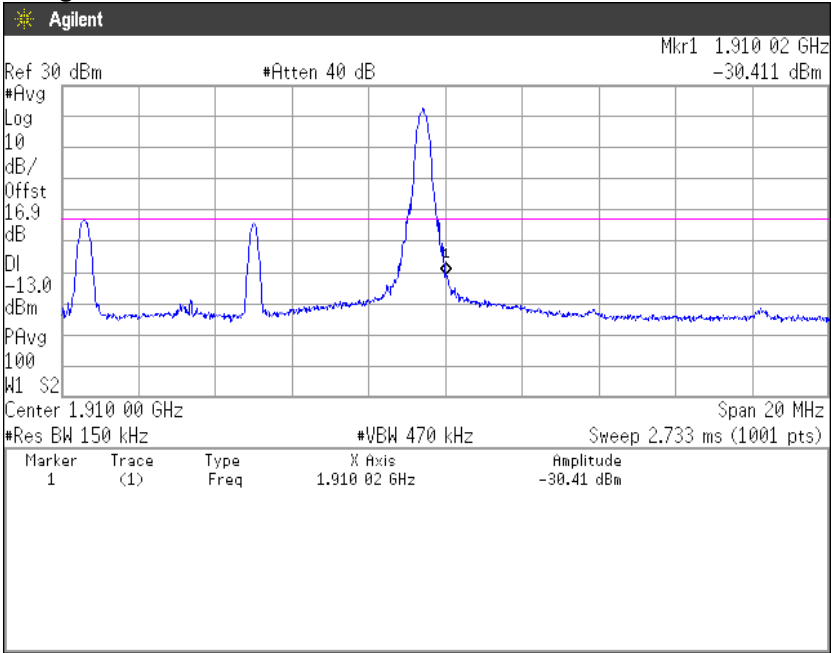
QPSK, BW 5MHz, RB25-0
Channel: High



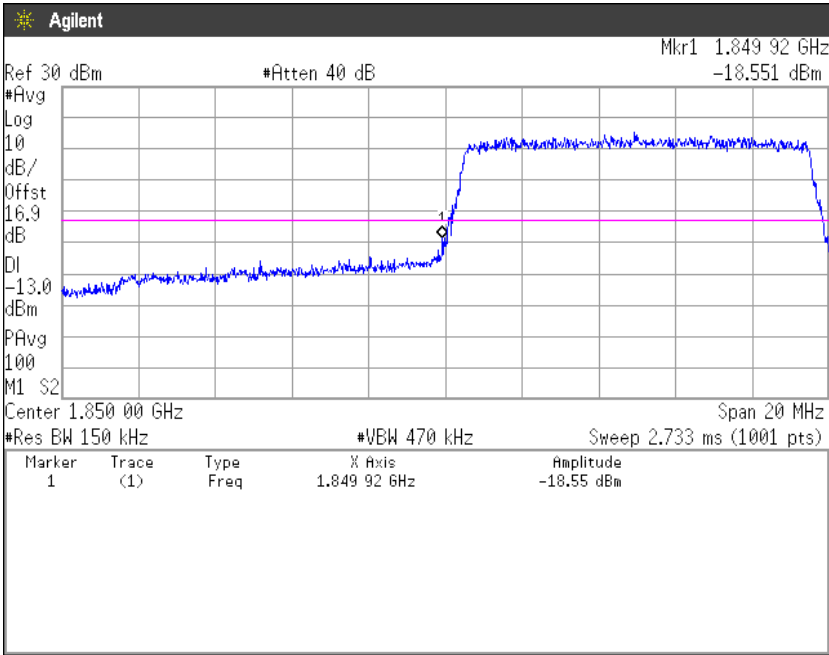
QPSK, BW 10MHz, RB1-0
Channel: Low



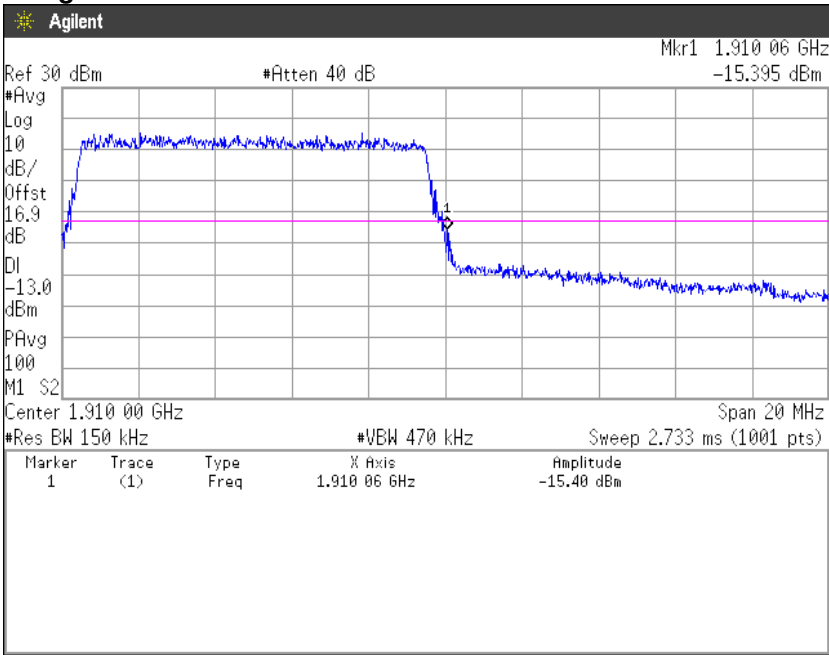
QPSK, BW 10MHz, RB1-49
Channel: High



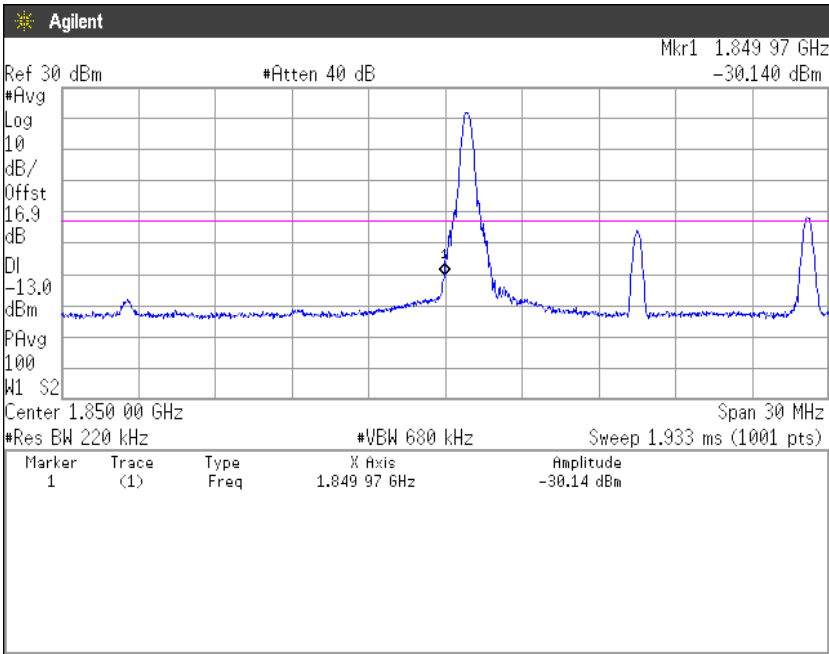
QPSK, BW 10MHz, RB50-0
Channel: Low



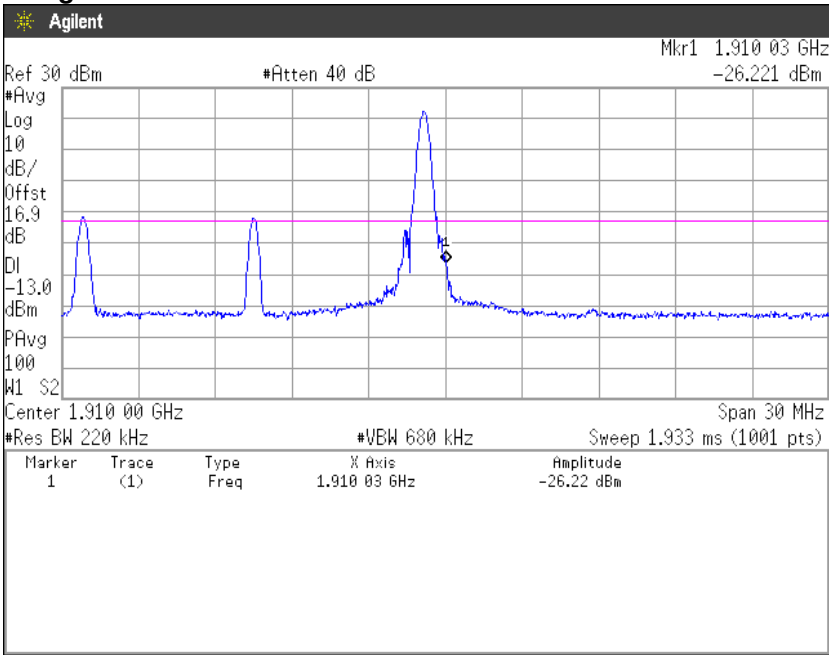
QPSK, BW 10MHz, RB50-0
Channel: High



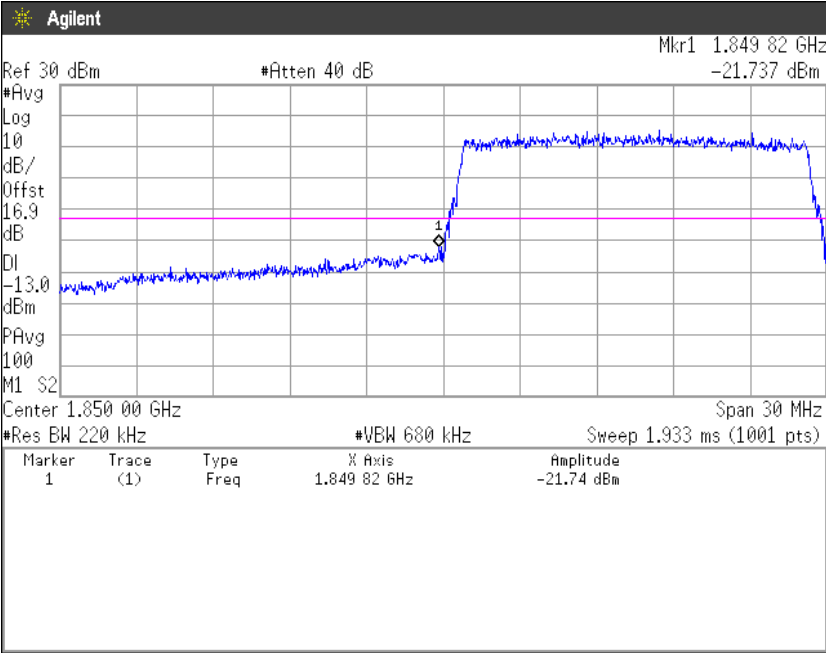
QPSK, BW 15MHz, RB1-0
Channel: Low



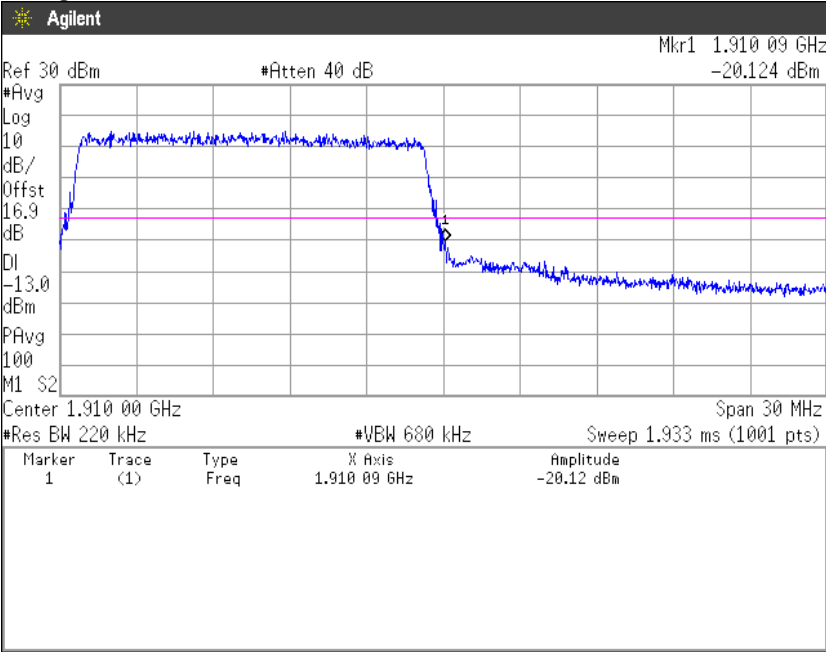
QPSK, BW 15MHz, RB1-74
Channel: High



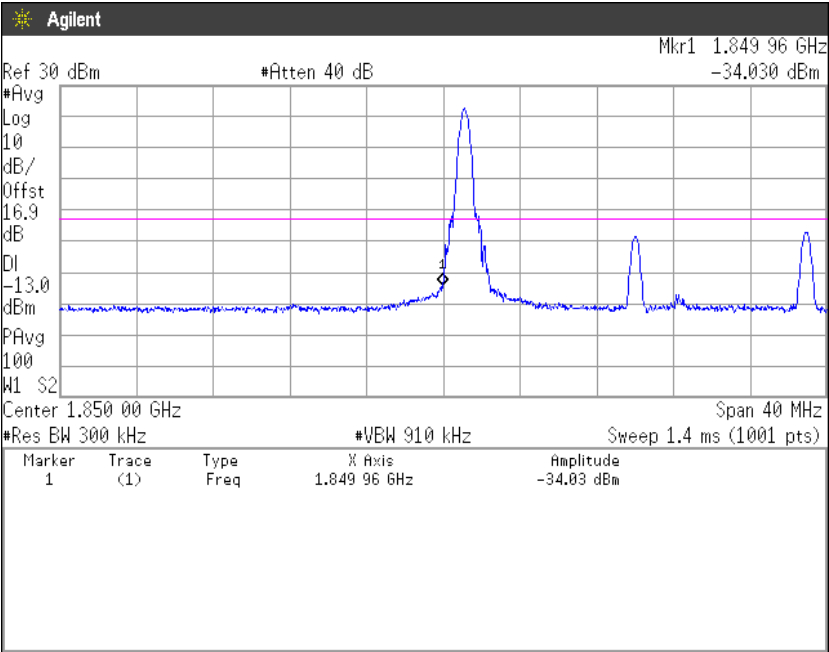
QPSK, BW 15MHz, RB75-0
Channel: Low



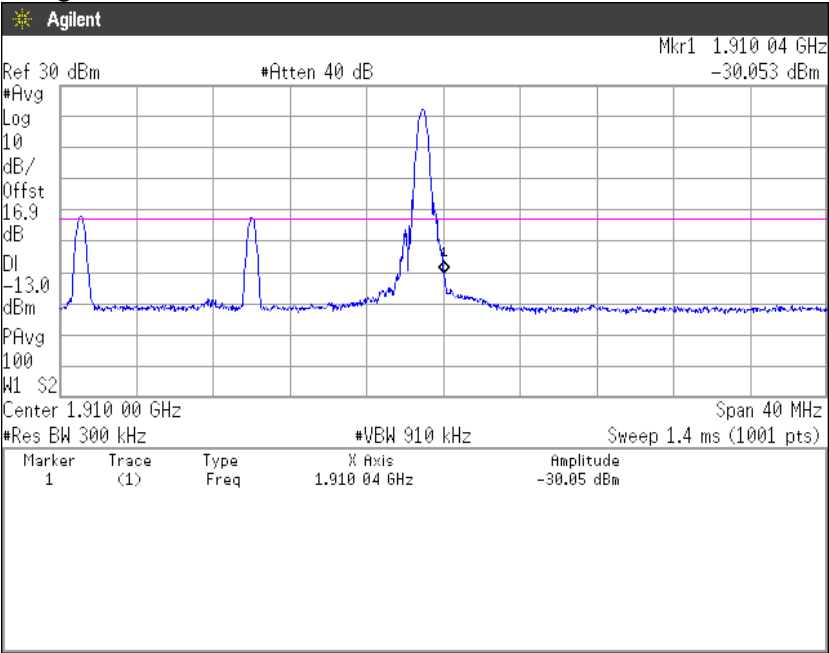
QPSK, BW 15MHz, RB75-0
Channel: High



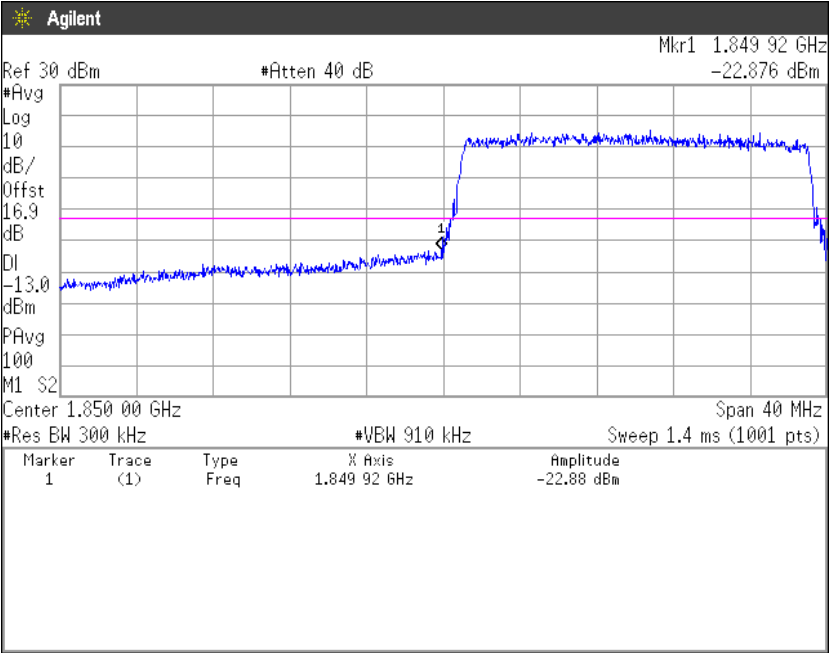
QPSK, BW 20MHz, RB1-0
Channel: Low



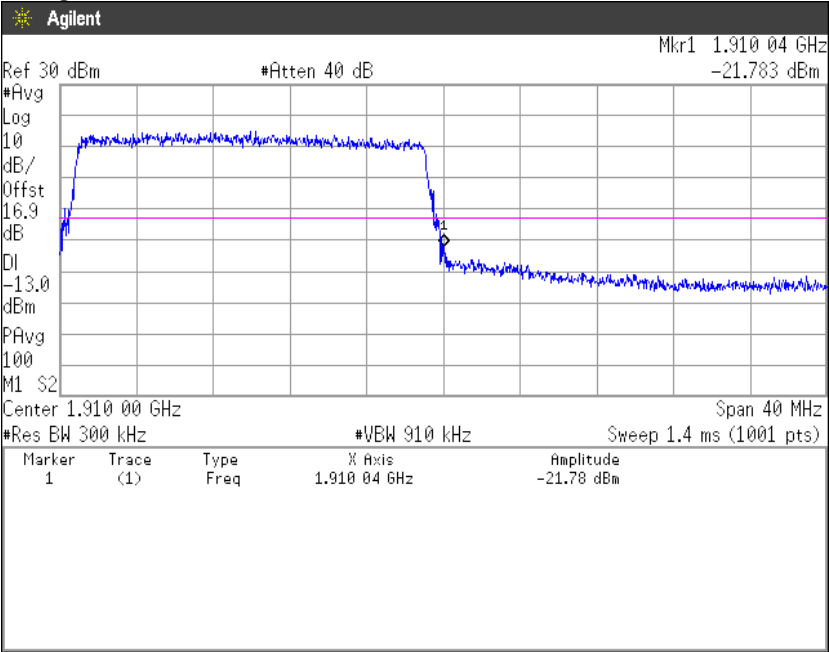
QPSK, BW 20MHz, RB1-99
Channel: High



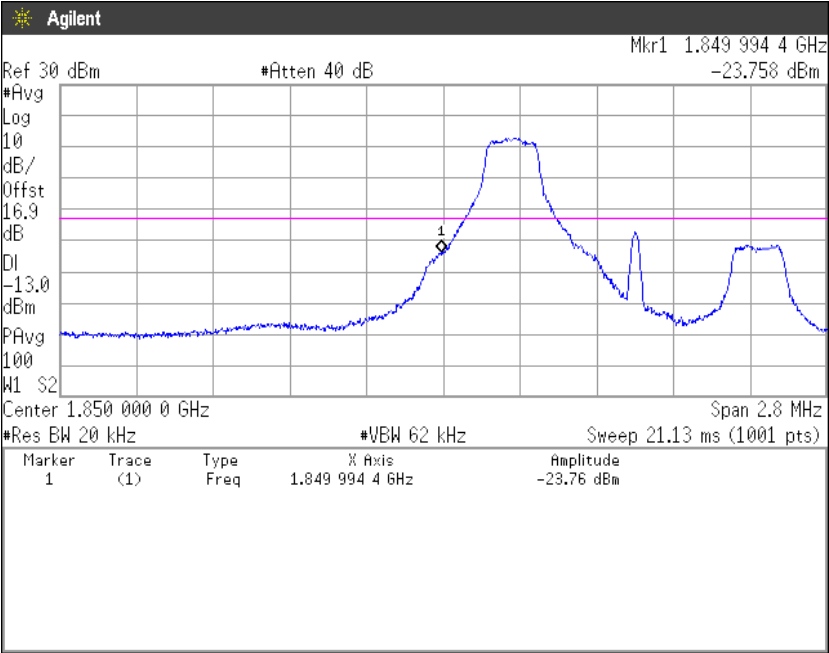
QPSK, BW 20MHz, RB100-0
Channel: Low



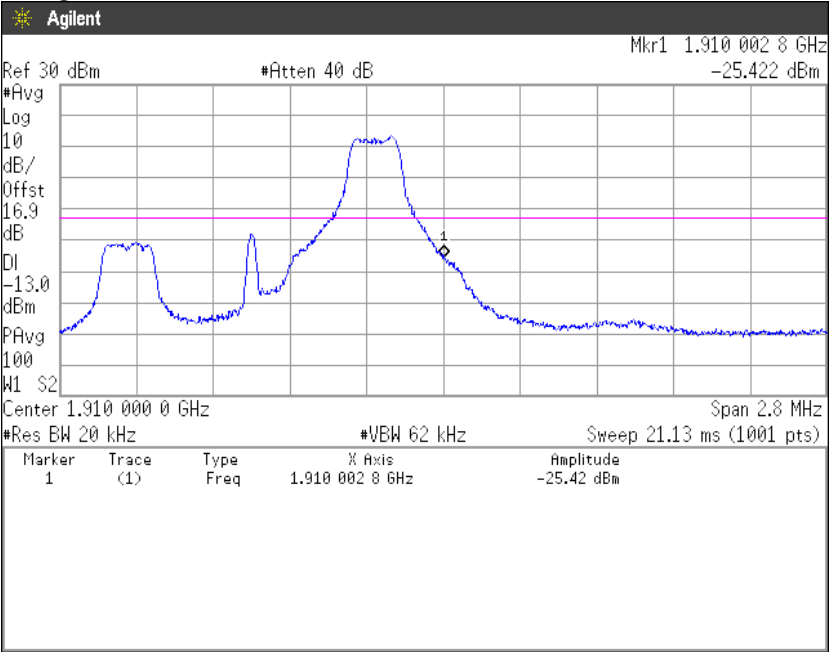
QPSK, BW 20MHz, RB100-0
Channel: High



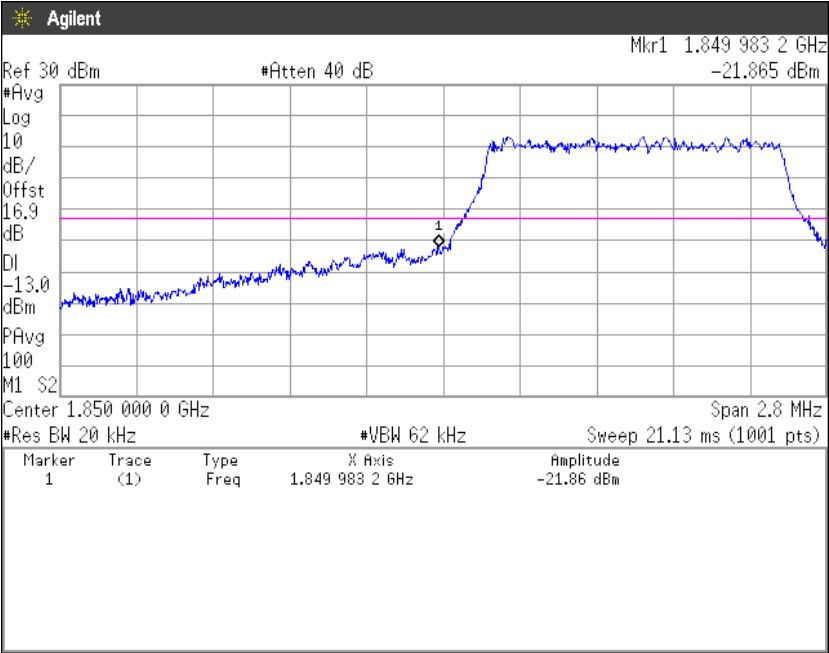
16QAM, BW 1.4MHz, RB1-0
Channel: Low



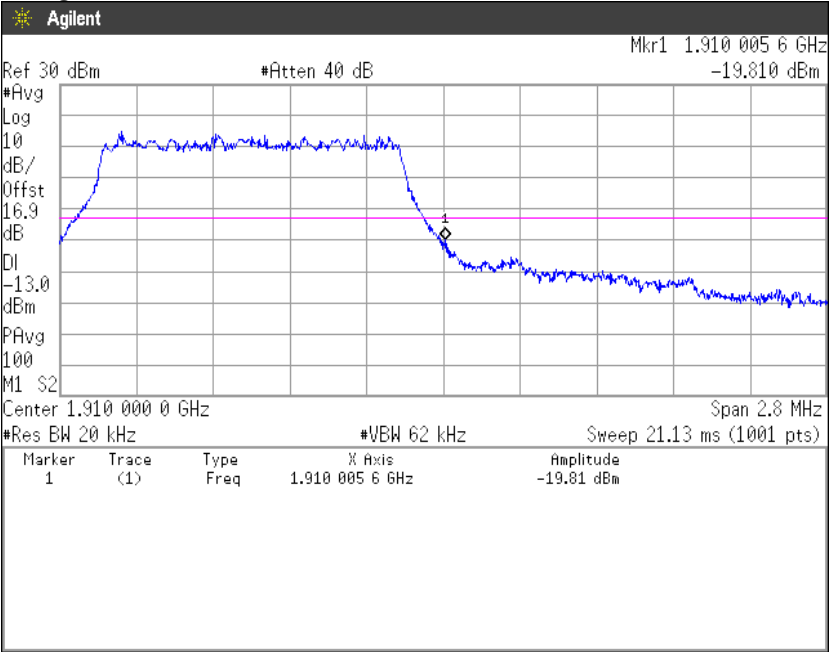
16QAM, BW 1.4MHz, RB1-5
Channel: High



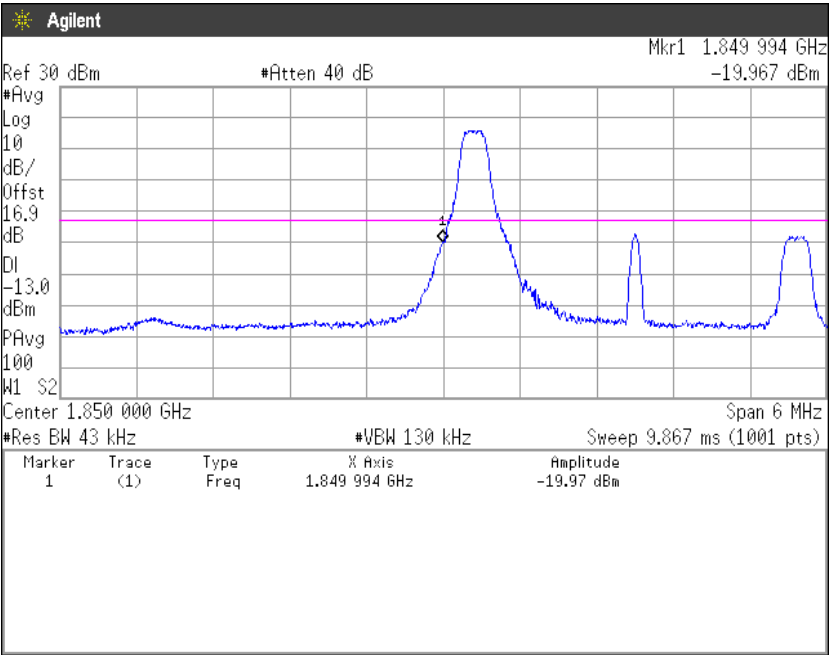
16QAM, BW 1.4MHz, RB6-0
Channel: Low



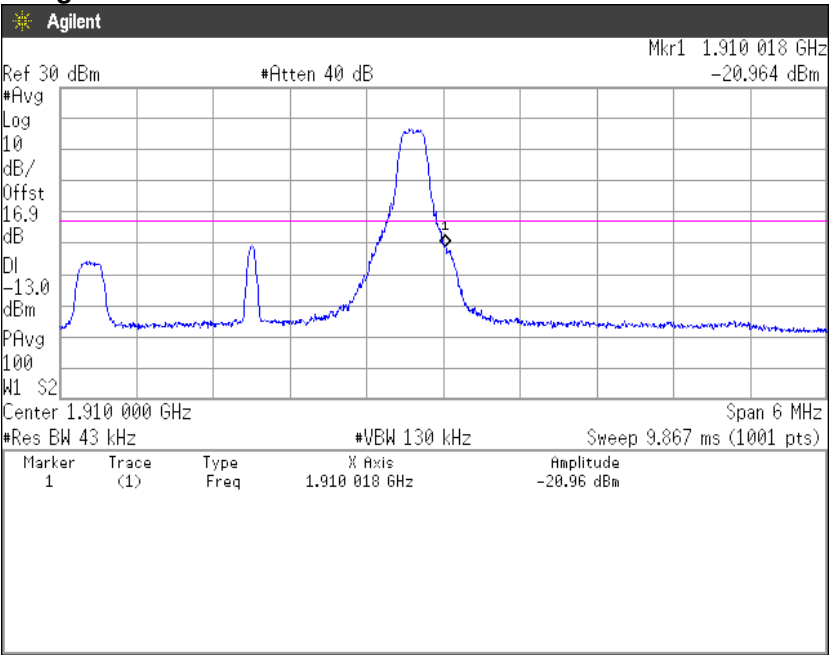
16QAM, BW 1.4MHz, RB6-0
Channel: High



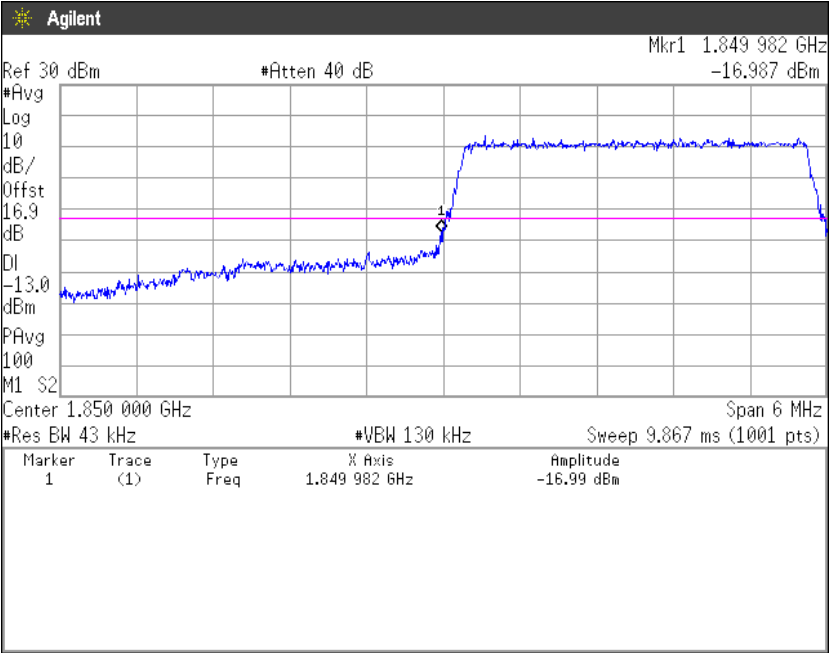
16QAM, BW 3MHz, RB1-0
Channel: Low



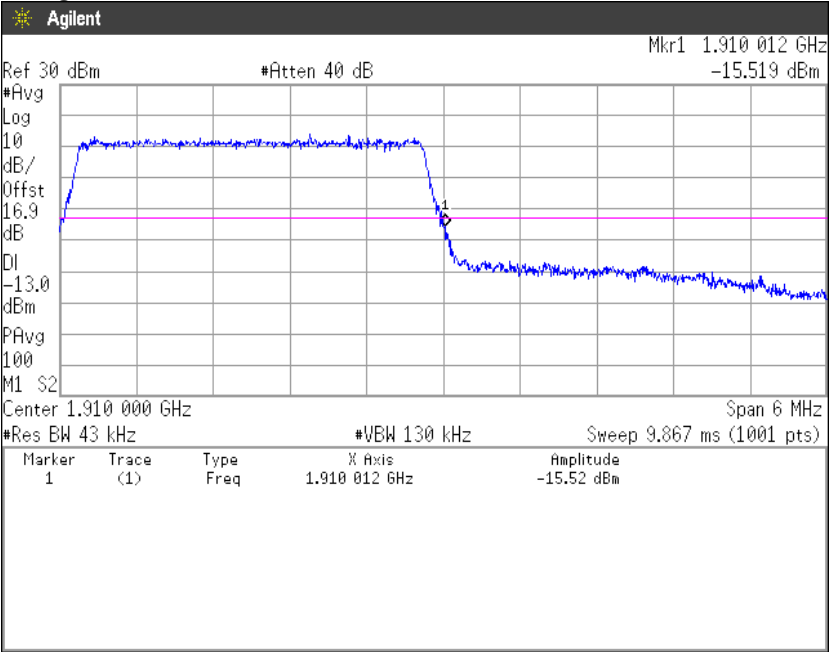
16QAM, BW 3MHz, RB1-14
Channel: High



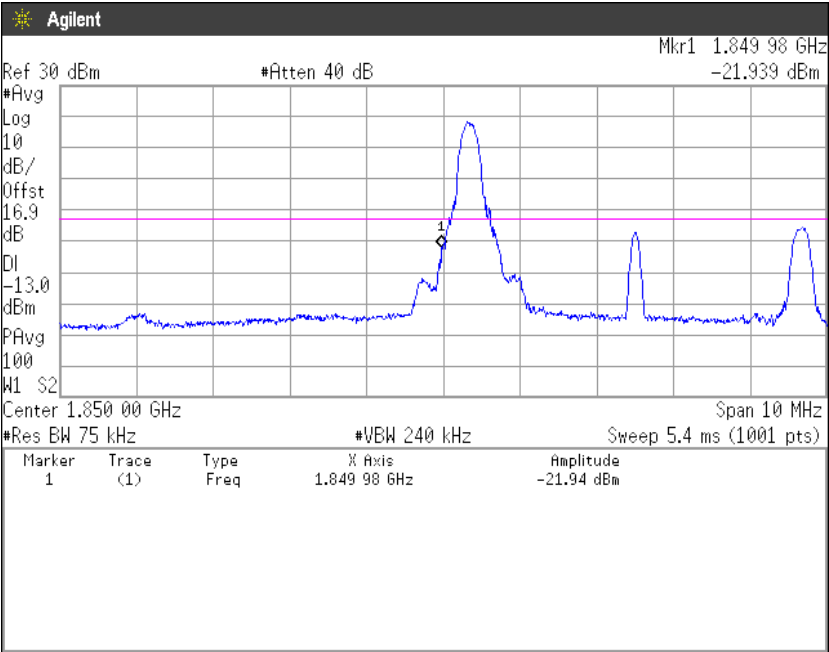
16QAM, BW 3MHz, RB15-0
Channel: Low



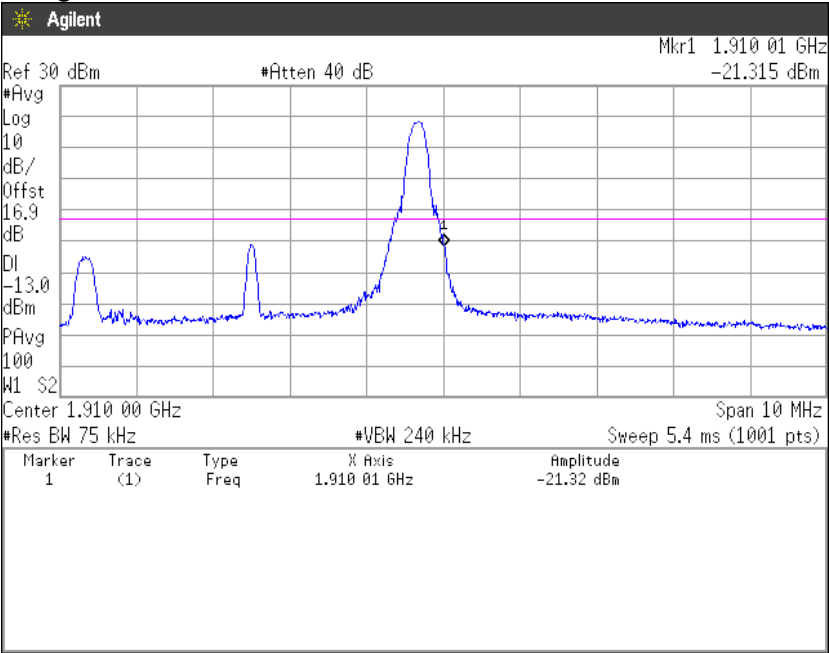
16QAM, BW 3MHz, RB15-0
Channel: High



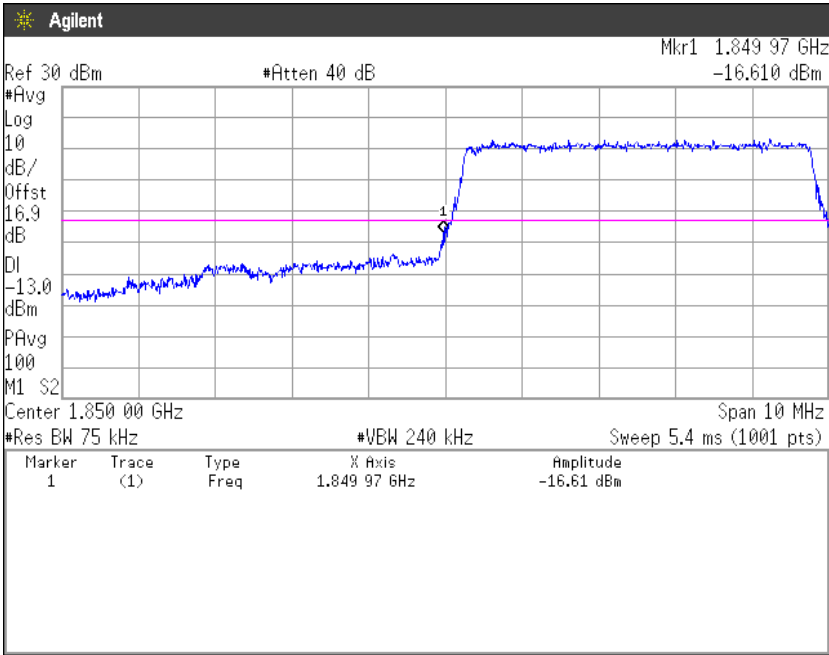
16QAM, BW 5MHz, RB1-0
Channel: Low



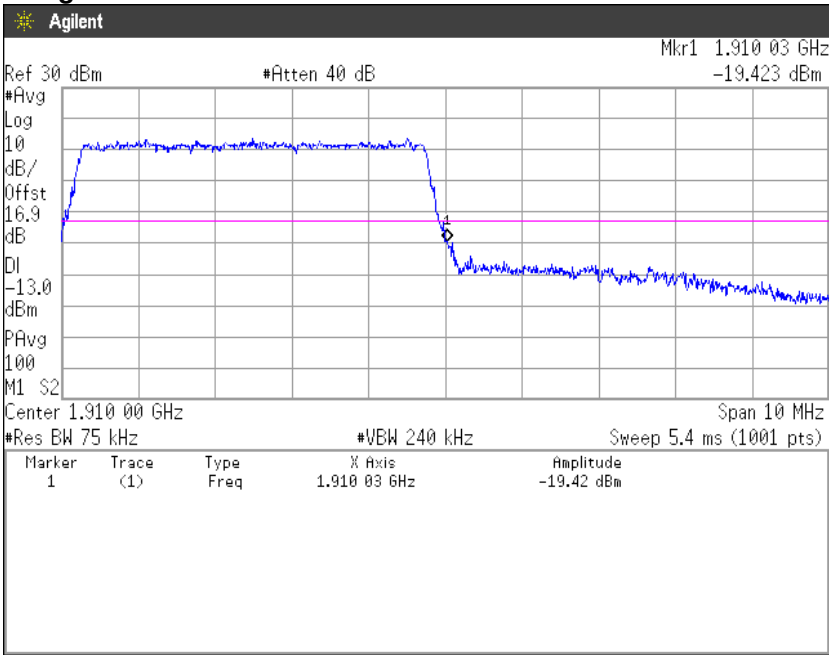
16QAM, BW 5MHz, RB1-24
Channel: High



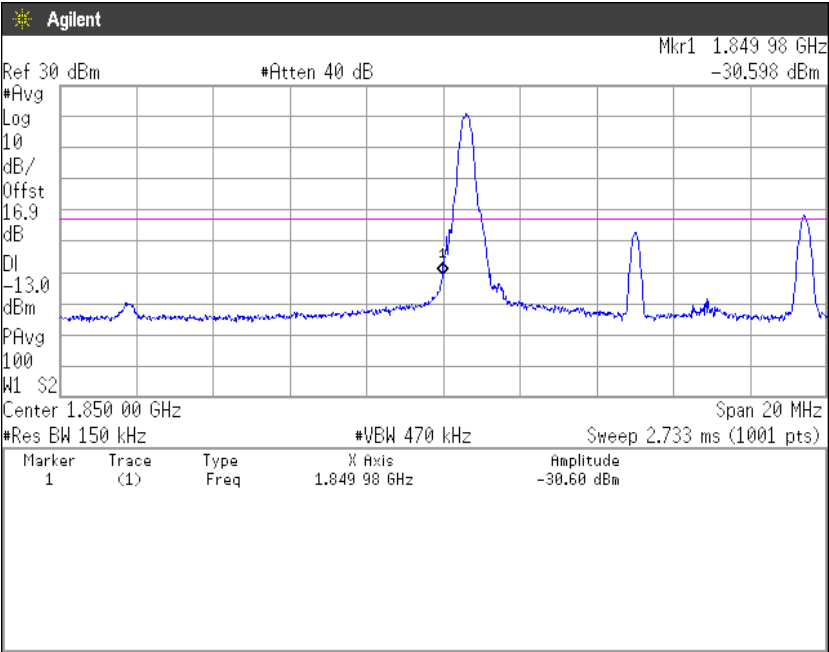
16QAM, BW 5MHz, RB25-0
Channel: Low



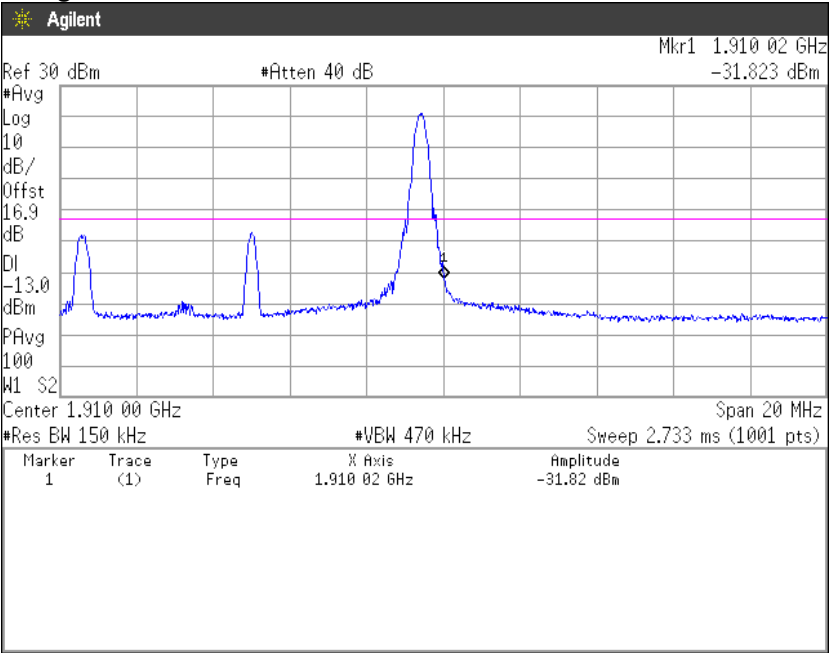
16QAM, BW 5MHz, RB25-0
Channel: High



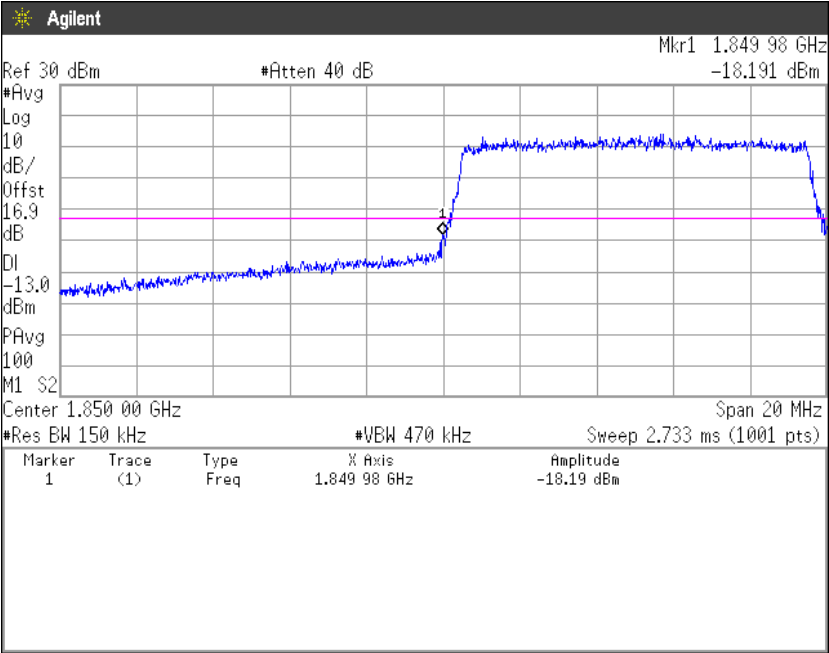
16QAM, BW 10MHz, RB1-0
Channel: Low



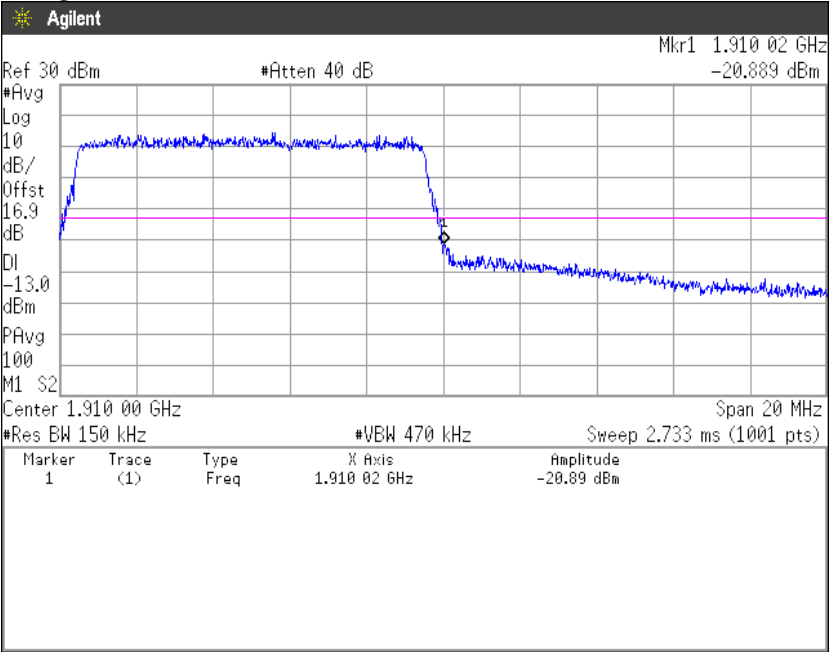
16QAM, BW 10MHz, RB1-49
Channel: High



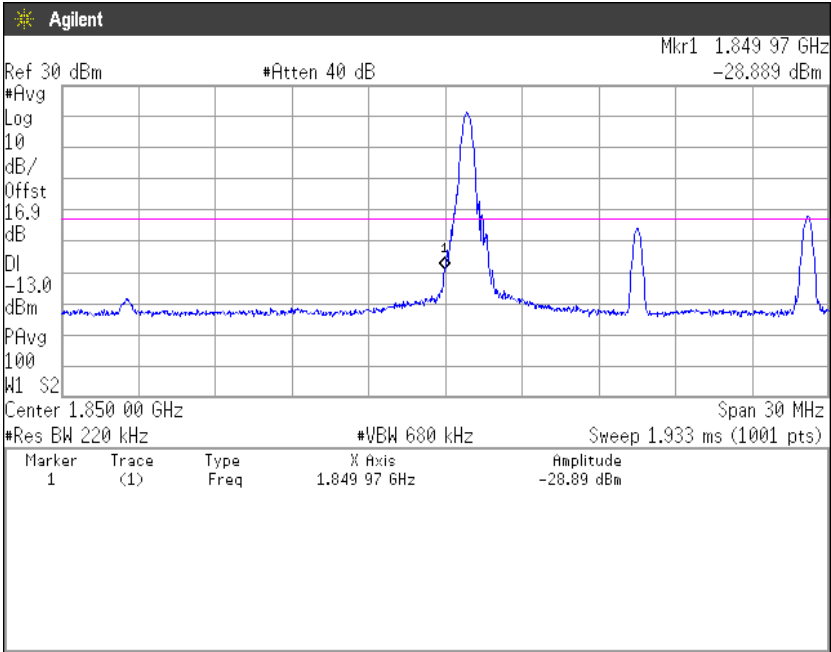
16QAM, BW 10MHz, RB50-0
Channel: Low



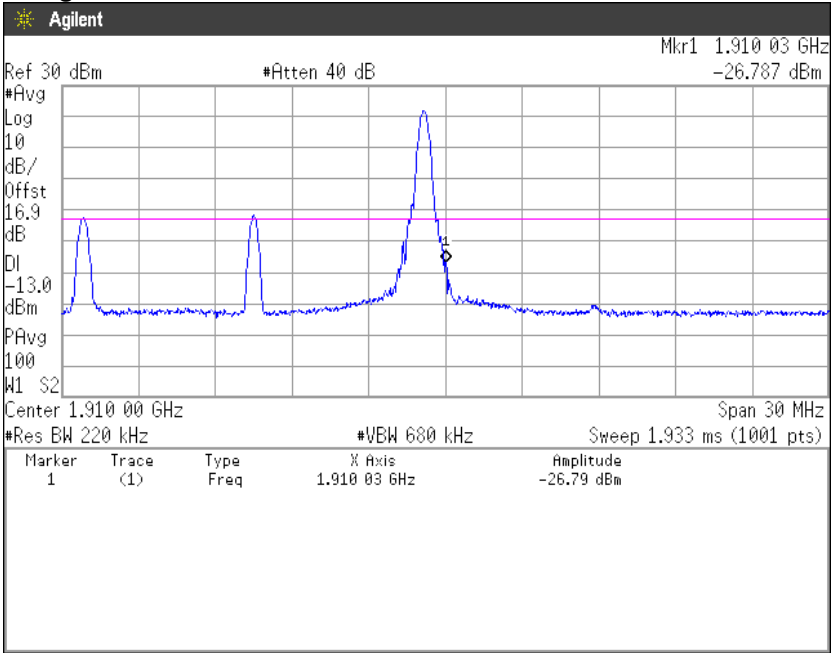
16QAM, BW 10MHz, RB50-0
Channel: High



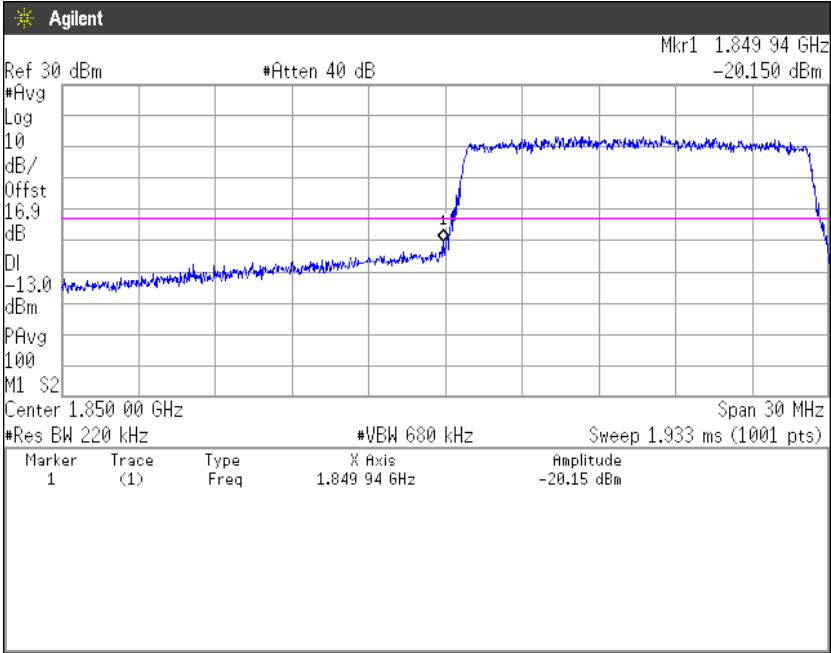
16QAM, BW 15MHz, RB1-0
Channel: Low



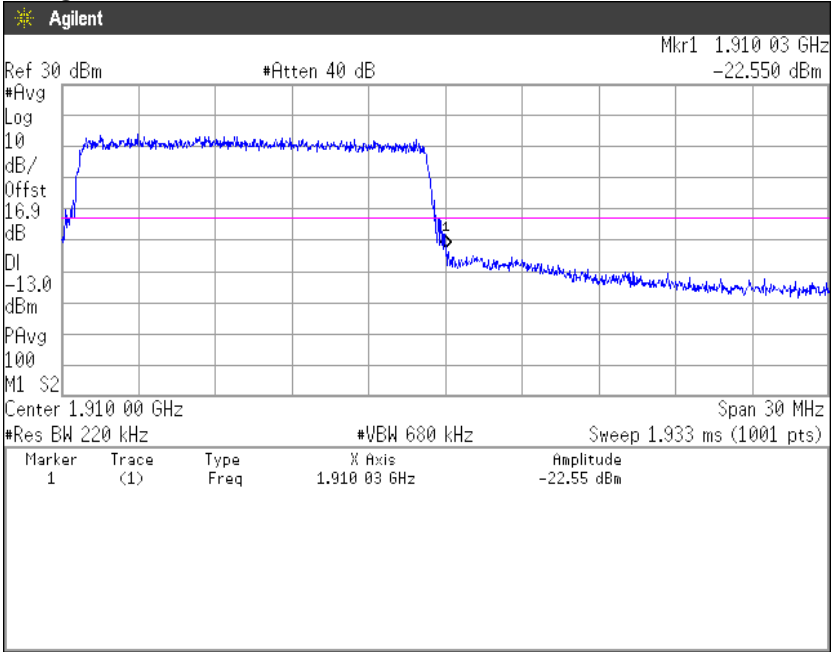
16QAM, BW 15MHz, RB1-74
Channel: High



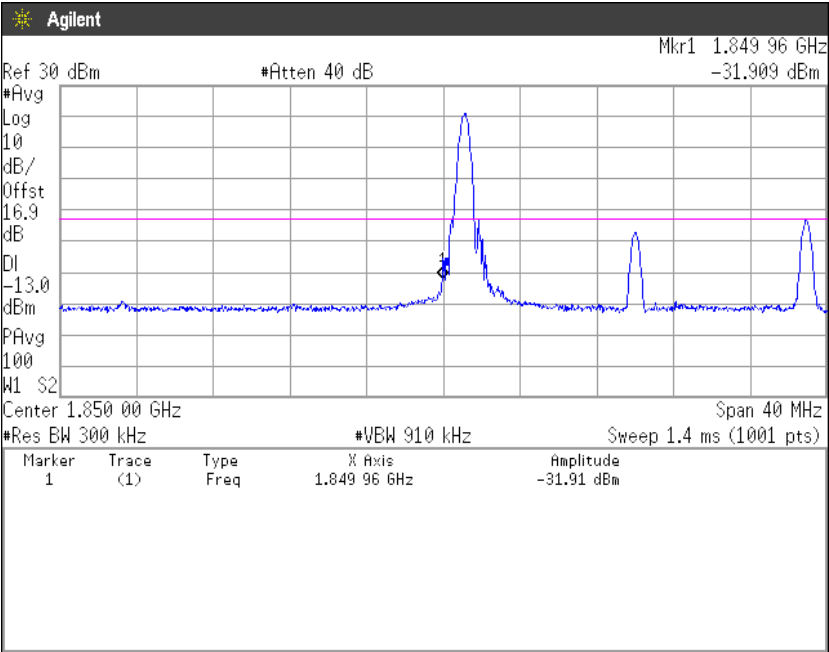
16QAM, BW 15MHz, RB75-0
Channel: Low



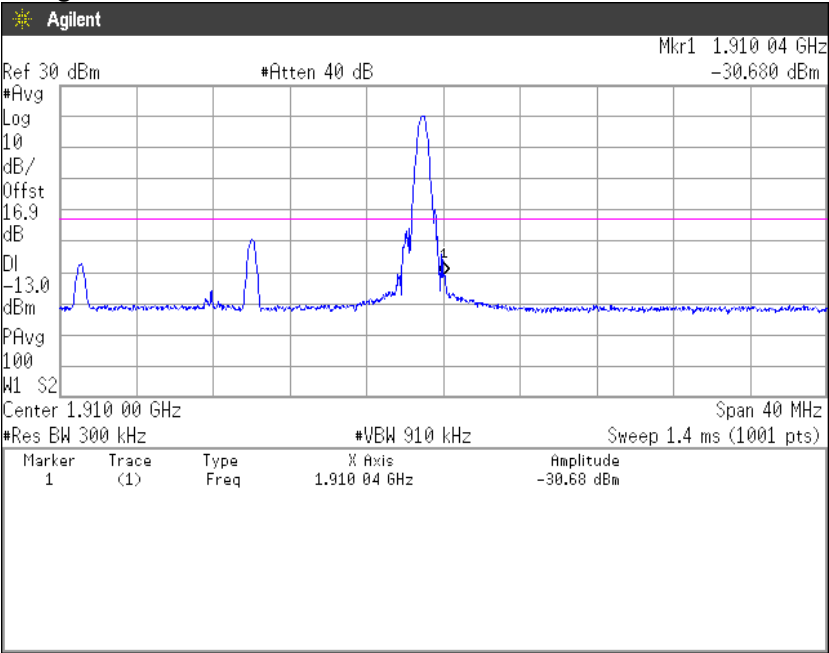
16QAM, BW 15MHz, RB75-0
Channel: High



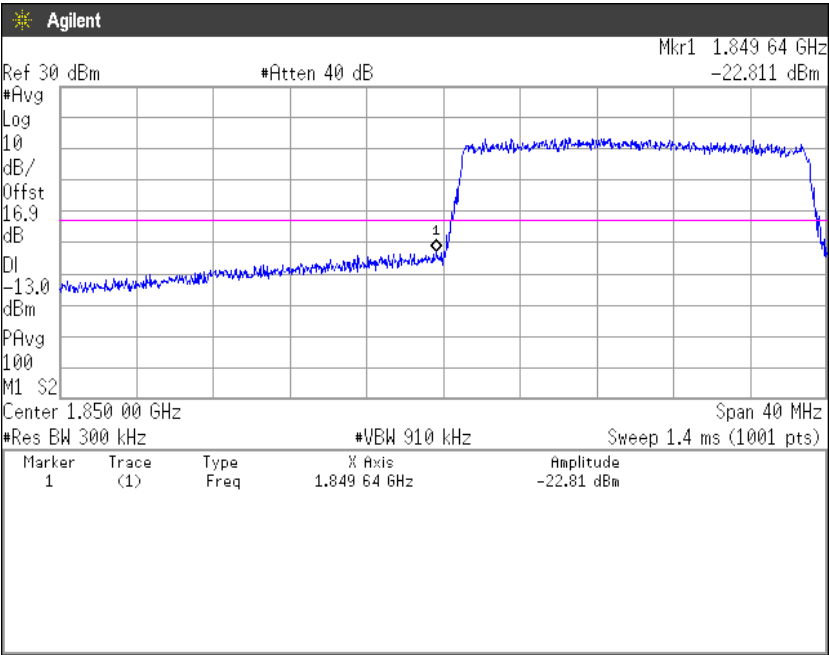
16QAM, BW 20MHz, RB1-0
Channel: Low



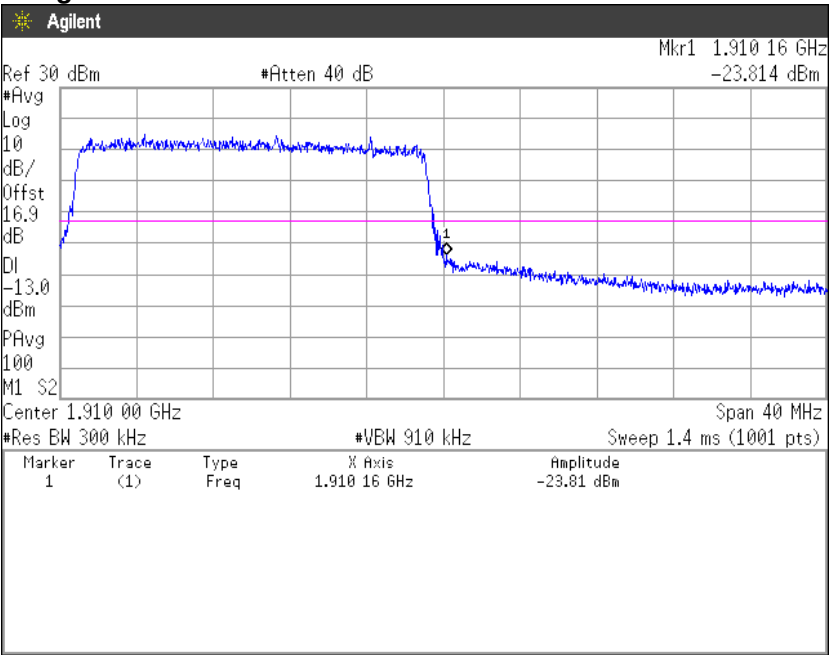
16QAM, BW 20MHz, RB1-99
Channel: High



16QAM, BW 20MHz, RB100-0
Channel: Low

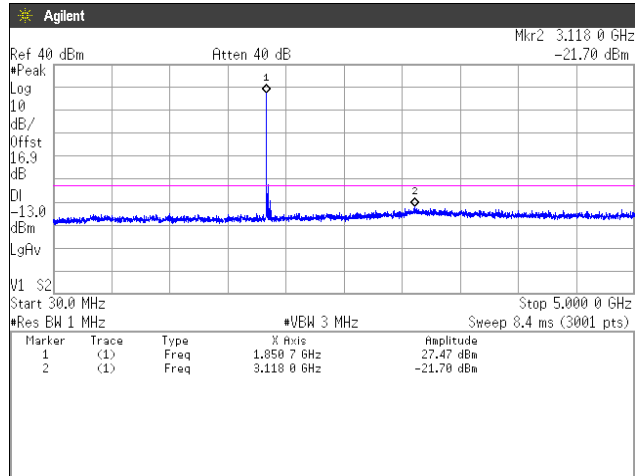
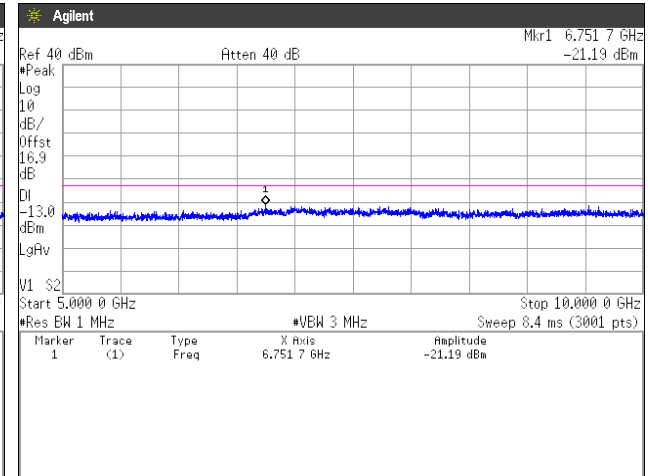
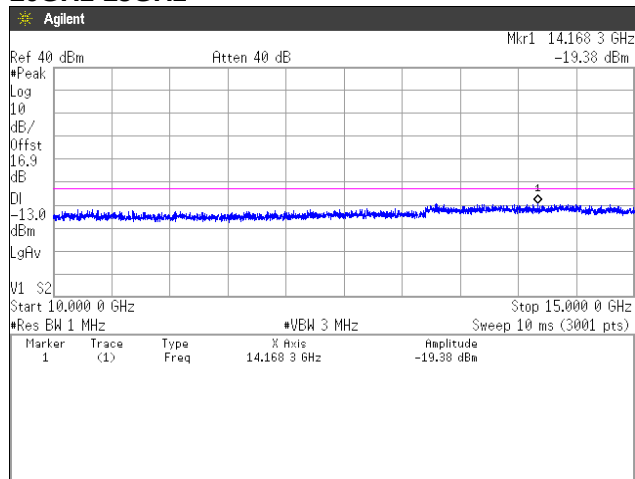
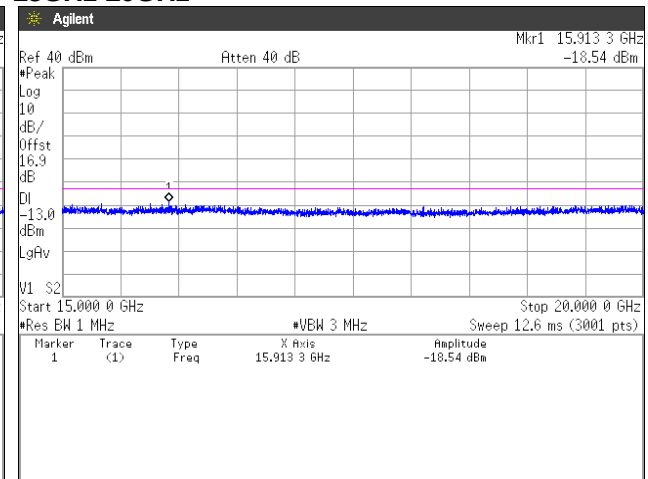


16QAM, BW 20MHz, RB100-0
Channel: High

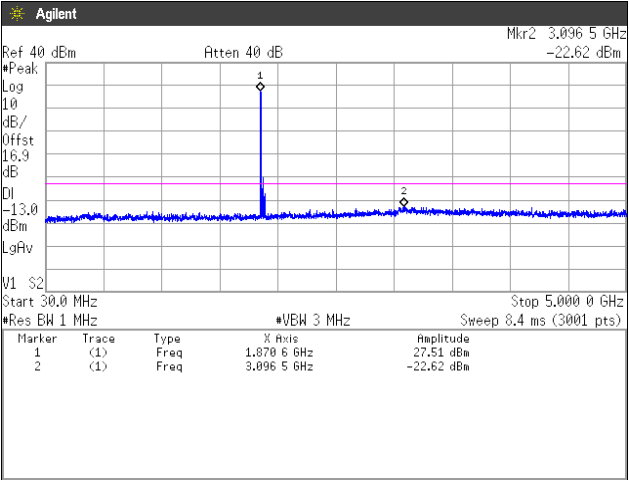


(Spurious Emissions)

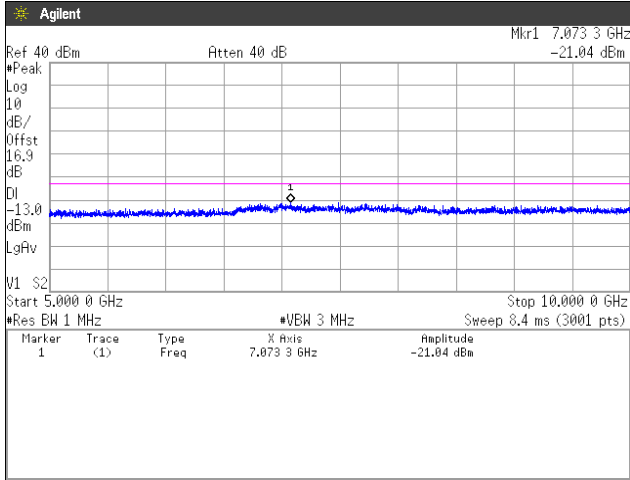
Note: Conducted spurious test was measured in the worst case of conducted output power.

QPSK, BW 20MHz**Channel: 18700****30MHz-5GHz****5GHz-10GHz****10GHz-15GHz****15GHz-20GHz**

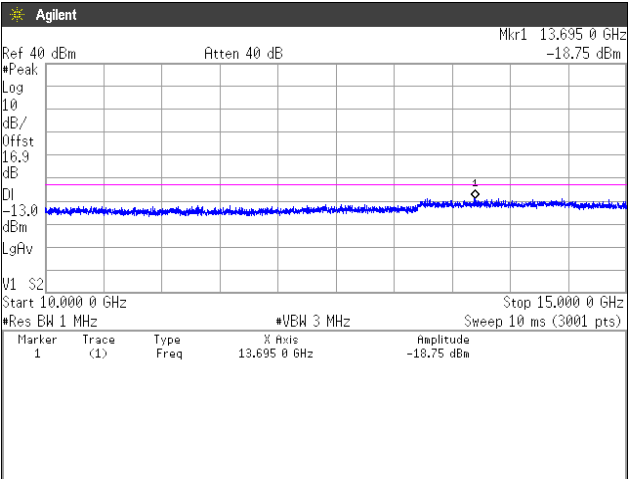
Channel: 18900
30MHz-5GHz



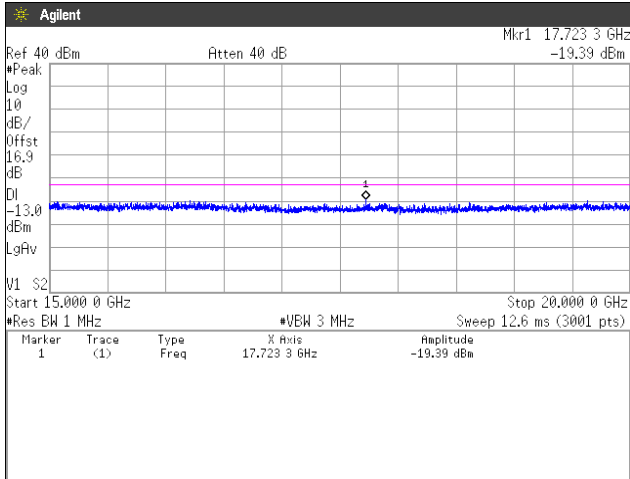
5GHz-10GHz



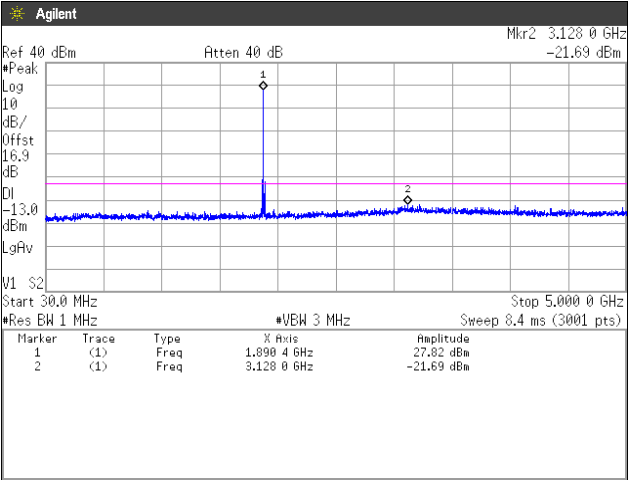
10GHz-15GHz



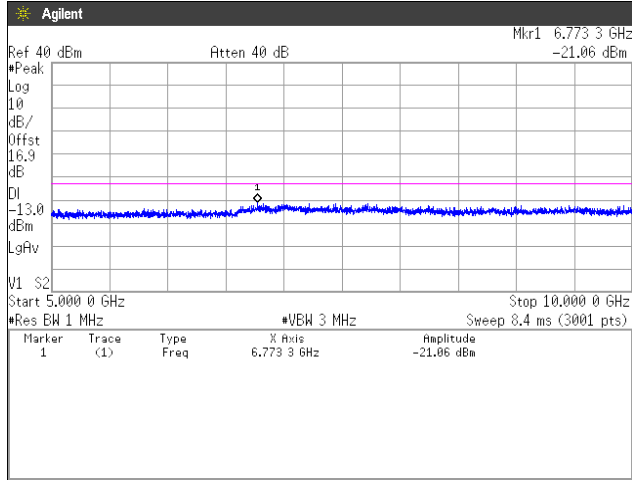
15GHz-20GHz



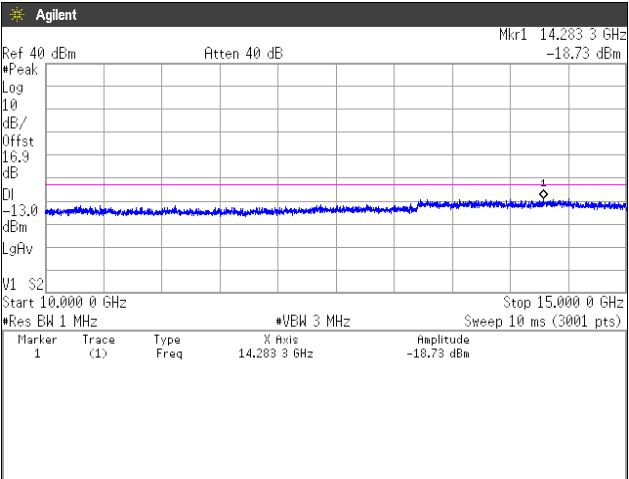
Channel: 19100
30MHz-5GHz



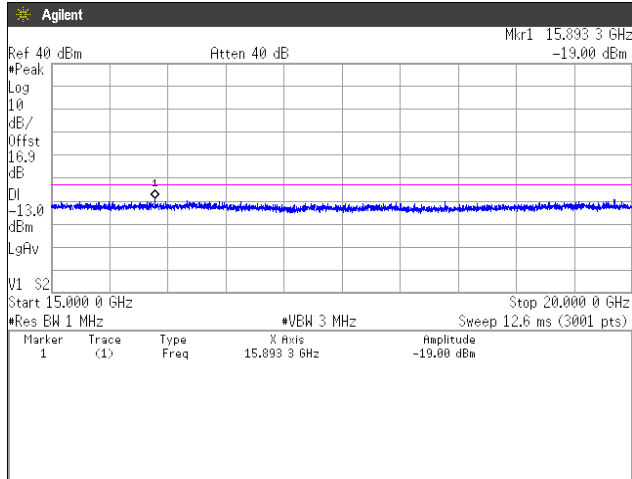
5GHz-10GHz



10GHz-15GHz



15GHz-20GHz



8. Radiated Emissions and Harmonic Emissions

8.1 Measurement procedure [FCC 24.238(a), 2.1053]

<Step 1>

The EUT and support equipment are placed on a 1 meter x 1 meter surface, 0.8 meter height styrene foam table. Radiated emission measurements are performed at 3 meter distance with the broadband antenna (Biconical antenna, Log periodic antenna and double ridged guide antenna). The antenna is positioned both the horizontal and vertical planes of polarization and height is varied 1 to 4 meters and stopped at height producing the maximum emission.

The bandwidth of the spectrum analyzer is set to 1MHz. The turntable is rotated by 360 degrees and stopped at azimuth of producing the maximum emission. The frequency is investigated up to 20GHz.

<Step 2>

The substitution antenna is replaced by the transmitter antenna (EUT).

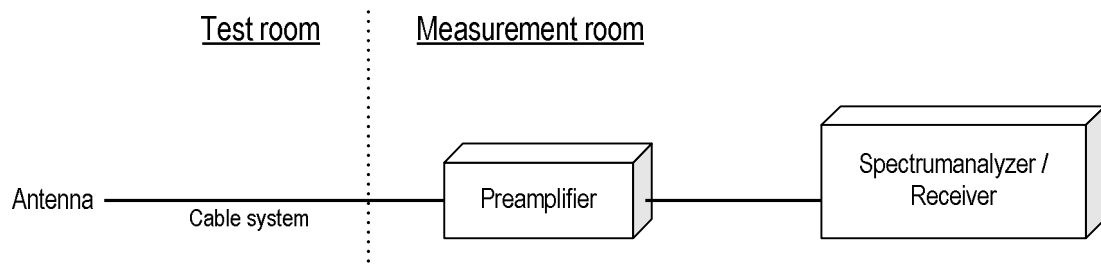
The frequency of the signal generator is adjusted to the measurement frequency.

Level of the signal generator is adjusted to the level that is obtained from step 1, and record the emission level of signal generator.

The spectrum analyzer is set to;

- a) RBW = 100kHz for below 1GHz and 1MHz for above 1GHz / VBW $\geq 3 \times$ RBW
- b) Detector = Peak
- c) Trace mode = Max hold
- d) Sweep time = auto-couple

- Test configuration



8.2 Calculation method

Result = Ant. Input - Cable loss + Antenna Gain

Margin = Limit – Result (EIRP)

Example:

Limit @ 3700.4MHz : -13.0dBm

Ant. Input = -55.6dBm Cable loss = 1.6dB Ant. Gain = 9.2dBi

Result = -55.6 - 1.6 + 9.2 = -49.3dBm

Margin = -13.0 - (-49.3) = 36.3dB

8.3 Limit

-13dBm or less

8.4 Test data

Date	: December 6, 2017	Test engineer	:	<u>Tadahiro Seino</u>
Temperature	: 23.5 [°C]			
Humidity	: 20.8 [%]			
Test place	: 3m Semi-anechoic chamber			
Date	: December 8, 2017	Test engineer	:	<u>Tadahiro Seino</u>
Temperature	: 21.6 [°C]			
Humidity	: 21.6 [%]			
Test place	: 3m Semi-anechoic chamber			
Date	: December 14, 2017	Test engineer	:	<u>Tadahiro Seino</u>
Temperature	: 20.2 [°C]			
Humidity	: 21.8 [%]			
Test place	: 3m Semi-anechoic chamber			
Date	: December 15, 2017	Test engineer	:	<u>Tadahiro Seino</u>
Temperature	: 20.5 [°C]			
Humidity	: 22.1 [%]			
Test place	: 3m Semi-anechoic chamber			
Date	: December 16, 2017	Test engineer	:	<u>Tadahiro Seino</u>
Temperature	: 20.6 [°C]			
Humidity	: 24.0 [%]			
Test place	: 3m Semi-anechoic chamber			
Date	: December 18, 2017	Test engineer	:	<u>Tadahiro Seino</u>
Temperature	: 20.2 [°C]			
Humidity	: 24.7 [%]			
Test place	: 3m Semi-anechoic chamber			

[GSM1900]**Channel: 512**

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBi]	Result [dBm]	Limit [dBm]	Margin [dB]
H	3700.4	-55.4	-57.7	1.6	8.8	-50.5	-13.0	37.5

Channel: 661

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBi]	Result [dBm]	Limit [dBm]	Margin [dB]
H	3760.0	-55.8	-59.9	1.6	8.7	-52.9	-13.0	39.9

Channel: 810

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBi]	Result [dBm]	Limit [dBm]	Margin [dB]
H	3819.6	-55.6	-58.5	1.7	8.7	-51.5	-13.0	38.5

[WCDMA Band II]**Channel: 9262**

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBi]	Result [dBm]	Limit [dBm]	Margin [dB]
H	3704.8	-54.9	-57.0	1.6	8.8	-49.8	-13.0	36.8

Channel: 9400

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBi]	Result [dBm]	Limit [dBm]	Margin [dB]
H	3760.0	-55.5	-58.2	1.6	8.7	-51.2	-13.0	38.2

Channel: 9538

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBi]	Result [dBm]	Limit [dBm]	Margin [dB]
H	3815.2	-55.1	-58.0	1.6	8.7	-51.0	-13.0	38.0

[LTE Band II]
QPSK, BW 1.4MHz
Channel: 18607

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBd]	Result [dBm]	Limit [dBm]	Margin [dB]
H	3701.4	-54.2	-54.2	1.6	8.8	-47.0	-13.0	34.0

Channel: 18900

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBd]	Result [dBm]	Limit [dBm]	Margin [dB]
H	3760.0	-53.2	-51.5	1.6	8.7	-44.5	-13.0	31.5

Channel: 19193

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBd]	Result [dBm]	Limit [dBm]	Margin [dB]
H	3818.6	-54.5	-53.3	1.7	8.7	-46.3	-13.0	33.3

16QAM, BW 1.4MHz
Channel: 18607

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBd]	Result [dBm]	Limit [dBm]	Margin [dB]
H	3701.4	-54.2	-53.8	1.6	8.8	-46.6	-13.0	33.6

Channel: 18900

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBd]	Result [dBm]	Limit [dBm]	Margin [dB]
H	3760.0	-53.1	-51.0	1.6	8.7	-44.0	-13.0	31.0

Channel: 19193

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBd]	Result [dBm]	Limit [dBm]	Margin [dB]
H	3818.6	-54.4	-53.0	1.7	8.7	-46.0	-13.0	33.0

QPSK, BW 3MHz**Channel: 18615**

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBd]	Result [dBm]	Limit [dBm]	Margin [dB]
H	3703.0	-54.1	-54.0	1.6	8.8	-46.8	-13.0	33.8

Channel: 18900

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBd]	Result [dBm]	Limit [dBm]	Margin [dB]
H	3760.0	-54.2	-53.8	1.6	8.7	-46.8	-13.0	33.8

Channel: 19185

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBd]	Result [dBm]	Limit [dBm]	Margin [dB]
H	3817.0	-54.5	-54.5	1.7	8.7	-47.5	-13.0	34.5

16QAM, BW 3MHz**Channel: 18615**

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBd]	Result [dBm]	Limit [dBm]	Margin [dB]
H	3703.0	-53.8	-53.1	1.6	8.8	-45.9	-13.0	32.9

Channel: 18900

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBd]	Result [dBm]	Limit [dBm]	Margin [dB]
H	3760.0	-53.6	-53.6	1.6	8.7	-46.6	-13.0	33.6

Channel: 19185

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBd]	Result [dBm]	Limit [dBm]	Margin [dB]
H	3817.0	-54.4	-55.1	1.7	8.7	-48.1	-13.0	35.1

QPSK, BW 5MHz**Channel: 18625**

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBd]	Result [dBm]	Limit [dBm]	Margin [dB]
H	3705.0	-54.0	-53.5	1.6	8.8	-46.3	-13.0	33.3

Channel: 18900

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBd]	Result [dBm]	Limit [dBm]	Margin [dB]
H	3760.0	-53.5	-52.5	1.6	8.7	-45.5	-13.0	32.5

Channel: 19175

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBd]	Result [dBm]	Limit [dBm]	Margin [dB]
H	3815.0	-54.4	-55.6	1.6	8.7	-48.6	-13.0	35.6

16QAM, BW 5MHz**Channel: 18625**

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBd]	Result [dBm]	Limit [dBm]	Margin [dB]
H	3705.0	-54.1	-54.0	1.6	8.8	-46.8	-13.0	33.8

Channel: 18900

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBd]	Result [dBm]	Limit [dBm]	Margin [dB]
H	3760.0	-52.9	-50.7	1.6	8.7	-43.7	-13.0	30.7

Channel: 19175

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBd]	Result [dBm]	Limit [dBm]	Margin [dB]
H	3815.0	-54.4	-55.6	1.6	8.7	-48.6	-13.0	35.6

QPSK, BW 10MHz**Channel: 18650**

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBd]	Result [dBm]	Limit [dBm]	Margin [dB]
H	3710.0	-53.3	-52.9	1.6	8.8	-45.7	-13.0	32.7

Channel: 18900

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBd]	Result [dBm]	Limit [dBm]	Margin [dB]
H	3760.0	-53.5	-52.1	1.6	8.7	-45.1	-13.0	32.1

Channel: 19150

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBd]	Result [dBm]	Limit [dBm]	Margin [dB]
H	3810.0	-54.1	-54.9	1.6	8.7	-47.9	-13.0	34.9

16QAM, BW 10MHz**Channel: 18650**

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBd]	Result [dBm]	Limit [dBm]	Margin [dB]
H	3710.0	-52.3	-48.4	1.6	8.8	-41.2	-13.0	28.2

Channel: 18900

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBd]	Result [dBm]	Limit [dBm]	Margin [dB]
H	3760.0	-53.7	-52.4	1.6	8.7	-45.4	-13.0	32.4

Channel: 19150

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBd]	Result [dBm]	Limit [dBm]	Margin [dB]
H	3810.0	-54.0	-53.8	1.6	8.7	-46.8	-13.0	33.8

QPSK, BW 15MHz**Channel: 18675**

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBd]	Result [dBm]	Limit [dBm]	Margin [dB]
H	3715.0	-52.1	-48.5	1.6	8.8	-41.4	-13.0	28.4

Channel: 18900

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBd]	Result [dBm]	Limit [dBm]	Margin [dB]
H	3760.0	-53.6	-52.4	1.6	8.7	-45.4	-13.0	32.4

Channel: 19125

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBd]	Result [dBm]	Limit [dBm]	Margin [dB]
H	3805.0	-54.5	-55.2	1.6	8.6	-48.2	-13.0	35.2

16QAM, BW 15MHz**Channel: 18675**

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBd]	Result [dBm]	Limit [dBm]	Margin [dB]
H	3715.0	-52.6	-49.0	1.6	8.8	-41.9	-13.0	28.9

Channel: 18900

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBd]	Result [dBm]	Limit [dBm]	Margin [dB]
H	3760.0	-53.8	-53.0	1.6	8.7	-46.0	-13.0	33.0

Channel: 19125

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBd]	Result [dBm]	Limit [dBm]	Margin [dB]
H	3805.0	-54.8	-56.5	1.6	8.6	-49.5	-13.0	36.5

QPSK, BW 20MHz**Channel: 18700**

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBd]	Result [dBm]	Limit [dBm]	Margin [dB]
H	3720.0	-54.1	-53.4	1.6	8.8	-46.3	-13.0	33.3

Channel: 18900

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBd]	Result [dBm]	Limit [dBm]	Margin [dB]
H	3760.0	-53.2	-51.6	1.6	8.7	-44.6	-13.0	31.6

Channel: 19100

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBd]	Result [dBm]	Limit [dBm]	Margin [dB]
H	3800.0	-54.8	-56.6	1.6	8.6	-49.6	-13.0	36.6

16QAM, BW 20MHz**Channel: 18700**

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBd]	Result [dBm]	Limit [dBm]	Margin [dB]
H	3720.0	-53.1	-51.2	1.6	11.0	-41.9	-13.0	28.9

Channel: 18900

H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBd]	Result [dBm]	Limit [dBm]	Margin [dB]
H	3760.0	-53.7	-51.8	1.6	10.9	-42.6	-13.0	29.6

Channel: 19100

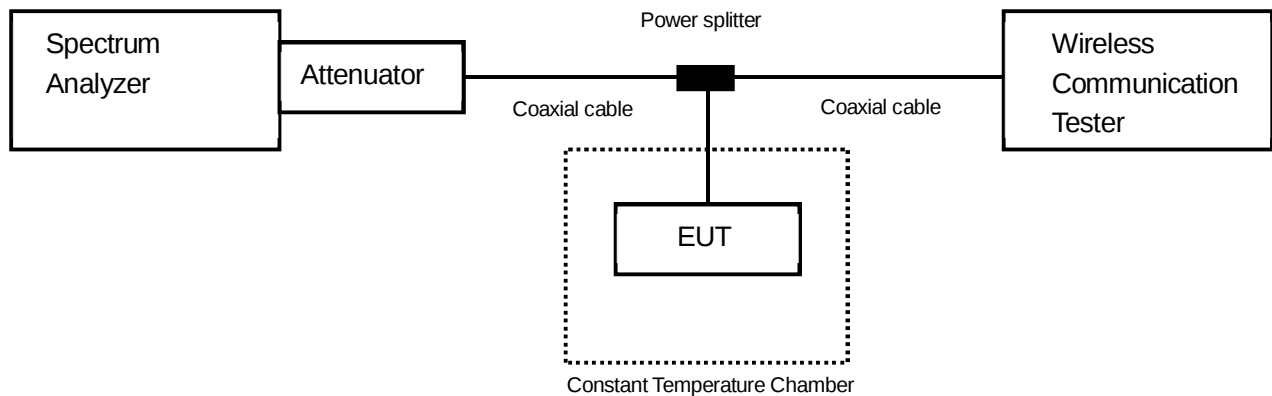
H/V	Frequency [MHz]	S.A Reading [dBm]	Ant. Input [dBm]	Cable loss [dB]	Ant.Gain [dBd]	Result [dBm]	Limit [dBm]	Margin [dB]
H	3800.0	-54.7	-56.5	1.6	10.8	-47.3	-13.0	34.3

9. Frequency Stability

9.1 Measurement procedure [FCC 24.235, 2.1055]

The EUT was placed inside of a constant temperature chamber as the temperature in the chamber was varied between -30°C and +50°C. The temperature was incremented by 10°C intervals and the unit was allowed to stabilize at each measurement. The frequency drift was measured with the normal Temperature and voltage tolerance and it is presented as the ppm unit.

- Test configuration



9.2 Limit

±2.5ppm

9.3 Measurement result

Date : November 29, 2017
 Temperature : 24.0 [°C]
 Humidity : 34.1 [%]
 Test place : Shielded room No.4

Test engineer : Chiaki Kanno

[GSM1900]

Channel: 661

Limit: $\pm 0.00025\% = \pm 2.5\text{ppm}$					
Power Supply [V]	Temperature [°C]	Measurements Frequency [Hz]	Frequency Tolerance [ppm]	Limit [ppm]	Result
3.80	25(Ref.)	1,879,999,971	0.00000	± 2.5	Pass
	50	1,879,999,973	0.00100	± 2.5	Pass
	40	1,879,999,969	-0.00096	± 2.5	Pass
	30	1,879,999,972	0.00062	± 2.5	Pass
	20	1,879,999,970	-0.00013	± 2.5	Pass
	10	1,879,999,976	0.00303	± 2.5	Pass
	0	1,879,999,974	0.00193	± 2.5	Pass
	-10	1,879,999,970	-0.00039	± 2.5	Pass
	-20	1,879,999,964	-0.00352	± 2.5	Pass
	-30	1,879,999,960	-0.00551	± 2.5	Pass
3.42	25	1,879,999,968	-0.00123	± 2.5	Pass
4.18	25	1,879,999,967	-0.00194	± 2.5	Pass

[WCDMA Band II]

Channel: 9400

Limit: $\pm 0.00025\% = \pm 2.5\text{ppm}$					
Power Supply [V]	Temperature [°C]	Measurements Frequency [Hz]	Frequency Tolerance [ppm]	Limit [ppm]	Result
3.80	25(Ref.)	1,879,999,996	0.00000	± 2.5	Pass
	50	1,879,999,995	-0.00051	± 2.5	Pass
	40	1,879,999,996	0.00012	± 2.5	Pass
	30	1,879,999,995	-0.00014	± 2.5	Pass
	20	1,880,000,005	0.00513	± 2.5	Pass
	10	1,879,999,995	-0.00046	± 2.5	Pass
	0	1,879,999,996	-0.00009	± 2.5	Pass
	-10	1,880,000,005	0.00470	± 2.5	Pass
	-20	1,879,999,995	-0.00020	± 2.5	Pass
	-30	1,880,000,005	0.00476	± 2.5	Pass
3.42	25	1,879,999,996	-0.00006	± 2.5	Pass
4.18	25	1,879,999,995	-0.00020	± 2.5	Pass

[LTE Band II]
QPSK, BW 20MHz
Channel: 18900

Limit: $\pm 0.00025\% = \pm 2.5\text{ppm}$					
Power Supply [V]	Temperature [°C]	Measurements Frequency [Hz]	Frequency Tolerance [ppm]	Limit [ppm]	Result
3.80	25(Ref.)	1,879,999,992	0.00000	± 2.5	Pass
	50	1,879,999,991	-0.00051	± 2.5	Pass
	40	1,879,999,992	0.00008	± 2.5	Pass
	30	1,879,999,992	-0.00029	± 2.5	Pass
	20	1,879,999,992	-0.00017	± 2.5	Pass
	10	1,879,999,993	0.00028	± 2.5	Pass
	0	1,879,999,993	0.00036	± 2.5	Pass
	-10	1,879,999,993	0.00038	± 2.5	Pass
	-20	1,879,999,989	-0.00146	± 2.5	Pass
	-30	1,879,999,992	0.00013	± 2.5	Pass
3.42	25	1,879,999,990	-0.00125	± 2.5	Pass
4.18	25	1,879,999,991	-0.00061	± 2.5	Pass

Calculation;

Frequency Tolerance (ppm) = $\frac{\text{Measurements Frequency (Hz)} - \text{Reference Frequency (Hz)}}{\text{Reference Frequency (Hz)}} \times 1000000$

10. Uncertainty of measurement

Expanded uncertainties stated are calculated with a coverage Factor $k=2$.

Please note that these results are not taken into account when measurement uncertainty considerations contained in ETSI TR 100 028-0011 determining compliance or non-compliance with test result.

Test item	Measurement uncertainty
Conducted emission, AMN (9kHz – 150kHz)	$\pm 3.8\text{dB}$
Conducted emission, AMN (150kHz – 30MHz)	$\pm 3.3\text{dB}$
Radiated emission (9kHz – 30MHz)	$\pm 3.0\text{dB}$
Radiated emission (30MHz – 1000MHz)	$\pm 4.7\text{dB}$
Radiated emission (1GHz – 6GHz)	$\pm 4.9\text{dB}$
Radiated emission (6GHz – 18GHz)	$\pm 5.2\text{dB}$
Radiated emission (18GHz – 40GHz)	$\pm 5.8\text{dB}$

11. Laboratory Information

1. Location

Name: Yonezawa Testing Center
 Address: 5-4149-7, Hachimanpara, Yonezawa-shi, Yamagata, 992-1128 Japan
 Phone: +81-238-28-2881
 Fax: +81-238-28-2888

2. Accreditation and Registration

- 1) VLAC
Accreditation No.: VLAC-013
- 2) NVLAP
LAB CODE: 200306-0
- 3) BSMI
Laboratory Code: SL2-IN-E-6018, SL2-A1-E-6018

4) Industry Canada

Site number	Facility	Expiration date
4224A-4	3m Semi-anechoic chamber	2020-11-27
4224A-5	10m Semi-anechoic chamber No.1	2020-11-27
4224A-6	10m Semi-anechoic chamber No.2	2019-12-14

5) VCCI Council

Registration number	Expiration date
A-0166	2019-07-03

Appendix A. Test equipment

Antenna port conducted test

Equipment	Company	Model No.	Serial No.	Cal. Due	Cal. Date
Spectrum analyzer	Agilent Technologies	E4440A	US44302655	Jun. 30, 2018	Jun. 28, 2017
Attenuator	Weinschel	56-10	J4993	Nov. 30, 2017 Dec. 31, 2018	Nov. 1, 2016 Dec. 4, 2017
Microwave cable	HUBER+SUHNER	SUCOFLEX 104	199119/4	Feb. 28, 2018	Feb. 2, 2017
Power divider	ANRITSU	K240B	1301239	Jul. 31, 2018	Jul. 21, 2017
Wideband Radio Frequency Tester	ROHDE&SCHWARZ	CMW500	126079	Oct. 31, 2018	Oct. 13, 2017
Temperature and humidity chamber	ESPEC	PL1KP	14007261	Jan. 31, 2018	Jan. 20, 2017

Radiated emission

Equipment	Company	Model No.	Serial No.	Cal. Due	Cal. Date
EMI Receiver	ROHDE&SCHWARZ	ESCI	100765	Sep. 30, 2018	Sep. 13, 2017
Spectrum analyzer	Agilent Technologies	E4447A	MY46180188	Mar. 31, 2018	Mar. 15, 2017
Spectrum analyzer	Agilent Technologies	E4440A	US40420937	Oct. 31, 2018	Oct. 19, 2017
Preamplifier	ANRITSU	MH648A	M96057	Feb. 28, 2018	Feb. 1, 2017
Biconical antenna	Schwarzbeck	VHA9103/BBA9106	2155	Jul. 31, 2018	Jul. 18, 2017
Log periodic antenna	Schwarzbeck	UHALP9108A	0560	Jul. 31, 2018	Jul. 18, 2017
Attenuator	TME	CFA-01NPJ-6	N/A(S275)	Feb. 28, 2018	Feb. 3, 2017
Attenuator	TME	CFA-01NPJ-3	N/A(S272)	Feb. 28, 2018	Feb. 2, 2017
Preamplifier	TSJ	MLA-100M18-B02-40	1929118	Feb. 28, 2018	Feb. 3, 2017
Attenuator	AEROFLEX	26A-10	081217-08	May 31, 2018	May 24, 2017
Double ridged guide antenna	ETS LINDGREN	3117	00052315	Feb. 28, 2018	Feb. 23, 2017
Attenuator	Agilent Technologies	8491B	MY39268633	Feb. 28, 2018	Feb. 2, 2017
Double ridged guide antenna	A.H.Systems Inc.	SAS-574	469	Aug. 31, 2018	Aug. 8, 2017
Preamplifier	TSJ	MLA-1840-B03-35	1240332	Aug. 31, 2018	Aug. 8, 2017
Band rejection filter	Micro-Tronics	BRC50720	014	Nov. 30, 2017 Dec. 31, 2018	Nov. 1, 2016 Dec. 5, 2017
High Pass Filter	Wainwright	WHKX2.8/18G-6SS	1	Jul. 31, 2018	Jul. 20, 2017
Signal generator	ROHDE&SCHWARZ	SMB100A	177525	Jun. 30, 2018	Jun. 12, 2017
RF power amplifier	R&K	CGA020M602-2633R	B40240	May 31, 2018	May 26, 2017
Microwave cable	HUBER+SUHNER	SUCOFLEX102/2m	31648	Mar. 31, 2018	Mar. 13, 2017
Dipole antenna	Schwarzbeck	VHAP	1021	Aug. 31, 2018	Aug. 2, 2017
Dipole antenna	Schwarzbeck	UHAP	993	Aug. 31, 2018	Aug. 2, 2017
Double ridged guide antenna	EMCO	3115	00058532	Dec. 31, 2017	Dec. 6, 2016
Wideband Radio Frequency Tester	ROHDE&SCHWARZ	CMW500	126079	Oct. 31, 2018	Oct. 13, 2017
Microwave cable	HUBER+SUHNER	SUCOFLEX104/9m	MY30037/4	Feb. 28, 2018	Feb. 3, 2017
		SUCOFLEX104/1m	my24610/4	Feb. 28, 2018	Feb. 3, 2017
		SUCOFLEX104/8m	SN MY30031/4	Feb. 28, 2018	Feb. 2, 2017
		SUCOFLEX104	MY32976/4	Dec. 31, 2017	Dec. 2, 2016
		SUCOFLEX104/1.5m	MY19309/4	Feb. 28, 2018	Feb. 3, 2017
		SUCOFLEX104/7m	41625/6	Feb. 28, 2018	Feb. 3, 2017
PC	DELL	DIMENSION E521	75465BX	N/A	N/A
Software	TOYO Corporation	EP5/RE-AJ	0611193/V5.6.0	N/A	N/A
Absorber	RIKEN	PFP30	N/A	N/A	N/A
3m Semi an-echoic Chamber	TOKIN	N/A	N/A(9002-NSA)	May 31, 2018	May 30, 2017
3m Semi an-echoic Chamber	TOKIN	N/A	N/A(9002-SVSWR)	May 31, 2018	May 31, 2017

*: The calibrations of the above equipment are traceable to NIST or equivalent standards of the reference organizations.