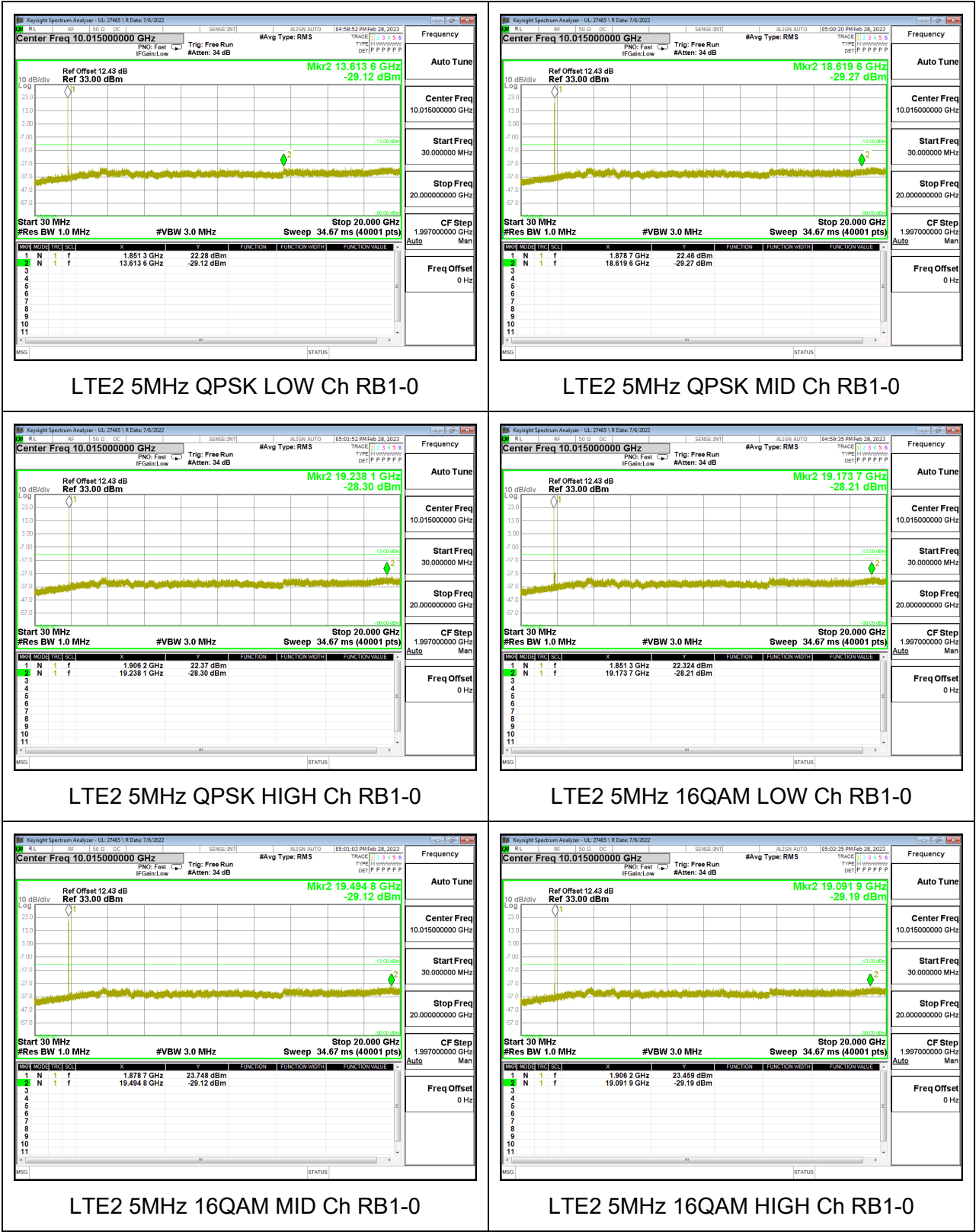
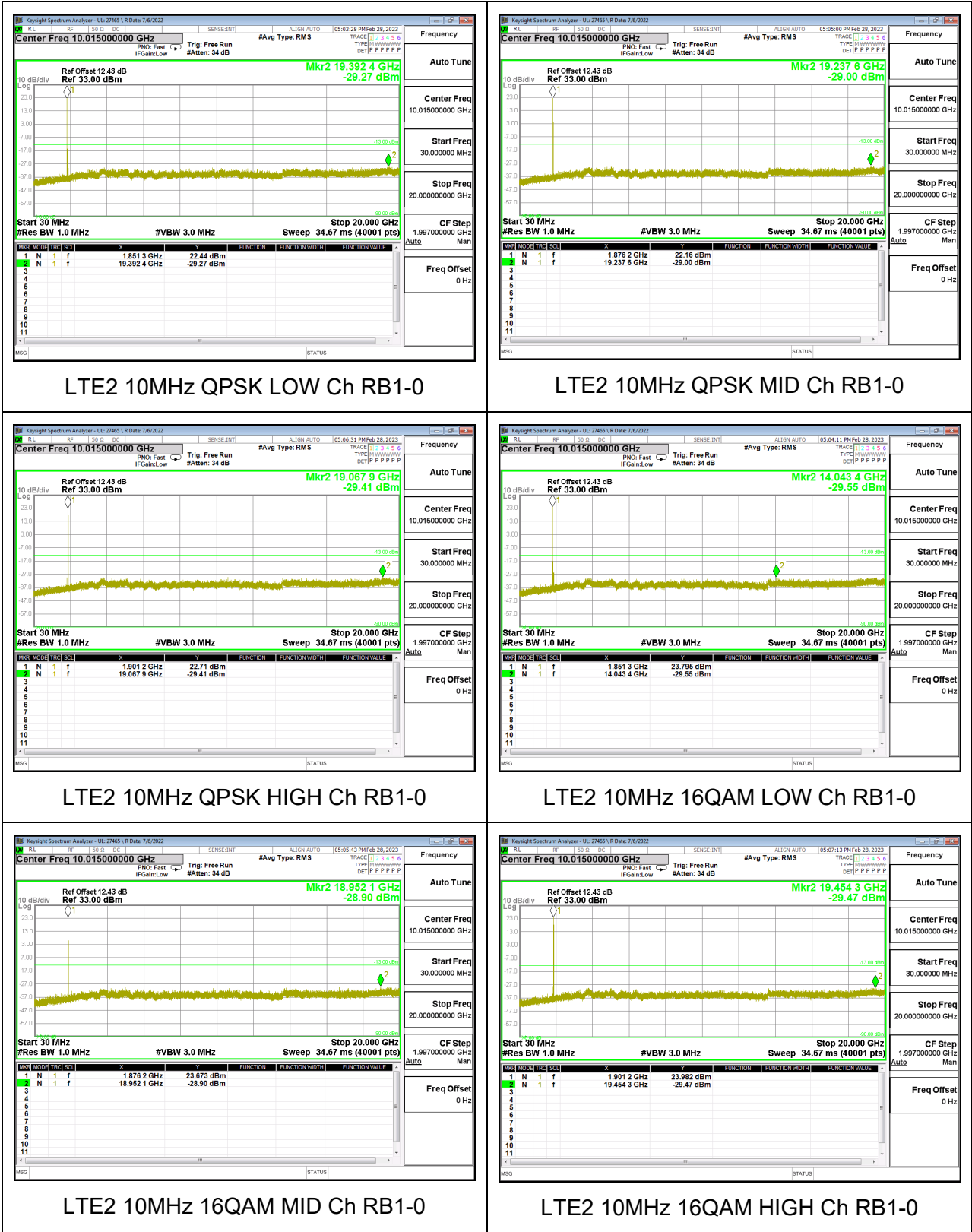
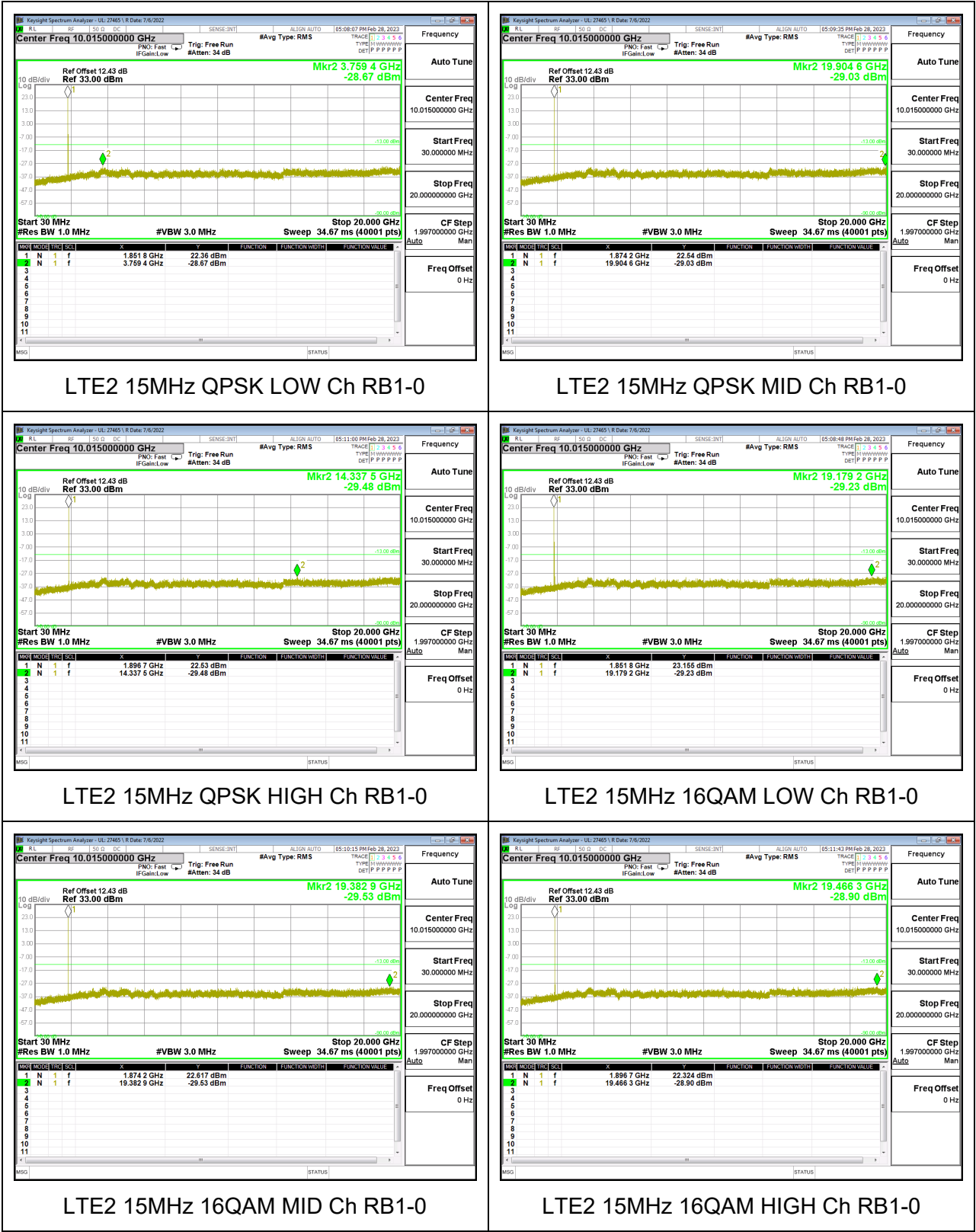








Keylight Spectrum Analyzer - UL 27405 V1 R Date: 7/6/2022

Center Freq 10.015000000 GHz

Ref Offset 12.43 dB

Ref 33.00 dBm

Mkr2 14.337 5 GHz

-29.48 dBm

Start 30 MHz

#Res BW 1.0 MHz

#VBW 3.0 MHz

Sweep 34.67 ms (40001 pts)

Stop 20.000 GHz

CF Step 1.997000000 GHz

Auto

Man

Freq Offset 0 Hz

MSG

STATUS

MN	MODE	TRC	SCN	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	1.896 7 GHz	22.53 dBm			
2	N	1	f	14.337 5 GHz	-29.48 dBm			

LTE2 15MHz QPSK HIGH Ch RB1-0

Keylight Spectrum Analyzer - UL 27405 V1 R Date: 7/6/2022

Center Freq 10.015000000 GHz

Ref Offset 12.43 dB

Ref 33.00 dBm

Mkr2 19.179 2 GHz

-29.23 dBm

Start 30 MHz

#Res BW 1.0 MHz

#VBW 3.0 MHz

Sweep 34.67 ms (40001 pts)

Stop 20.000 GHz

CF Step 1.997000000 GHz

Auto

Man

Freq Offset 0 Hz

MSG

STATUS

MN	MODE	TRC	SCN	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	1.851 8 GHz	23.155 dBm			
2	N	1	f	19.179 2 GHz	-29.23 dBm			

LTE2 15MHz 16QAM LOW Ch RB1-0

Keylight Spectrum Analyzer - UL 27405 V1 R Date: 7/6/2022

Center Freq 10.015000000 GHz

Ref Offset 12.43 dB

Ref 33.00 dBm

Mkr2 19.382 9 GHz

-29.53 dBm

Start 30 MHz

#Res BW 1.0 MHz

#VBW 3.0 MHz

Sweep 34.67 ms (40001 pts)

Stop 20.000 GHz

CF Step 1.997000000 GHz

Auto

Man

Freq Offset 0 Hz

MSG

STATUS

MN	MODE	TRC	SCN	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	1.874 2 GHz	22.617 dBm			
2	N	1	f	19.382 9 GHz	-29.53 dBm			

LTE2 15MHz 16QAM MID Ch RB1-0

Keylight Spectrum Analyzer - UL 27405 V1 R Date: 7/6/2022

Center Freq 10.015000000 GHz

Ref Offset 12.43 dB

Ref 33.00 dBm

Mkr2 19.466 3 GHz

-28.90 dBm

Start 30 MHz

#Res BW 1.0 MHz

#VBW 3.0 MHz

Sweep 34.67 ms (40001 pts)

Stop 20.000 GHz

CF Step 1.997000000 GHz

Auto

Man

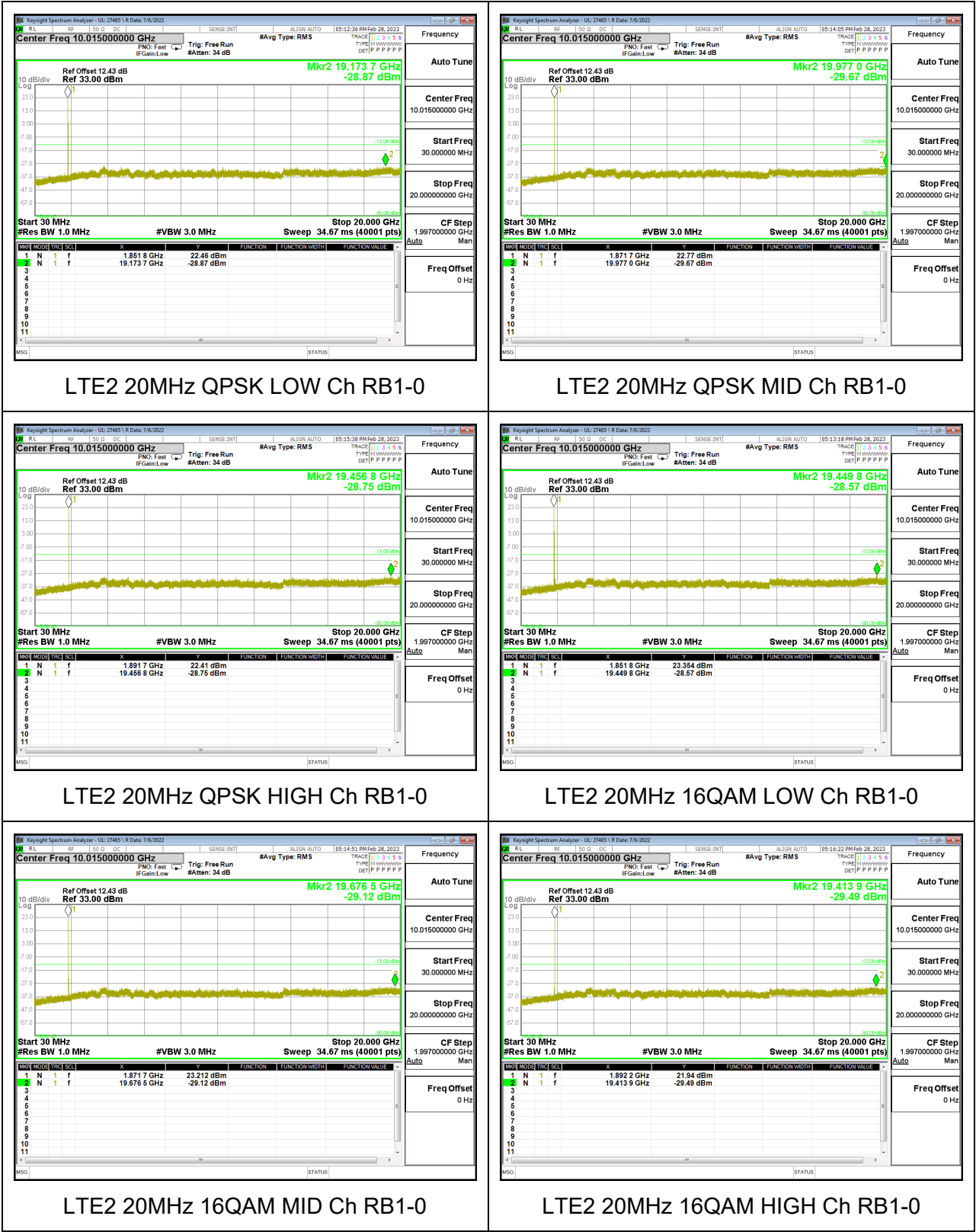
Freq Offset 0 Hz

MSG

STATUS

MN	MODE	TRC	SCN	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	1.896 7 GHz	22.324 dBm			
2	N	1	f	19.466 3 GHz	-28.90 dBm			

LTE2 15MHz 16QAM HIGH Ch RB1-0

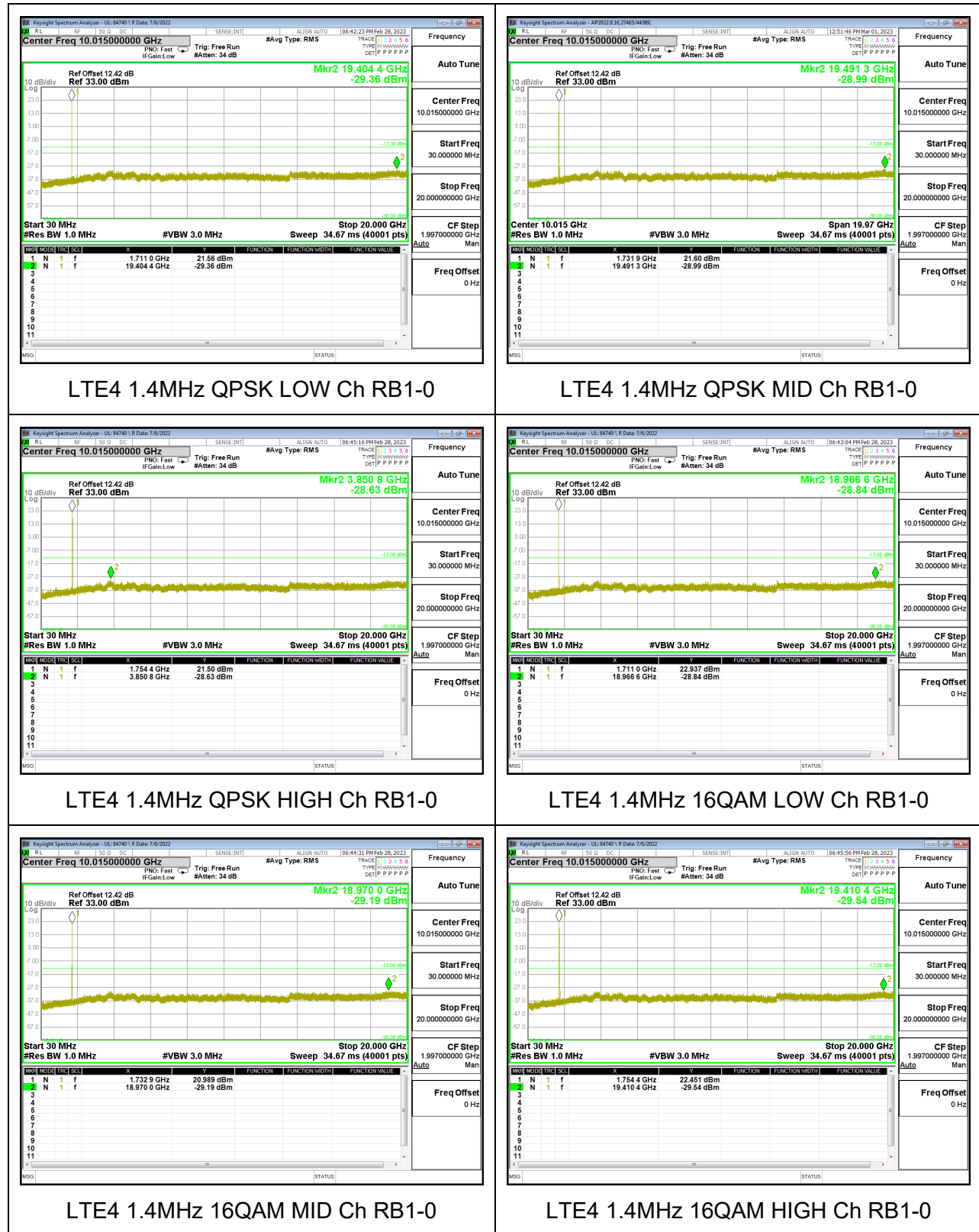


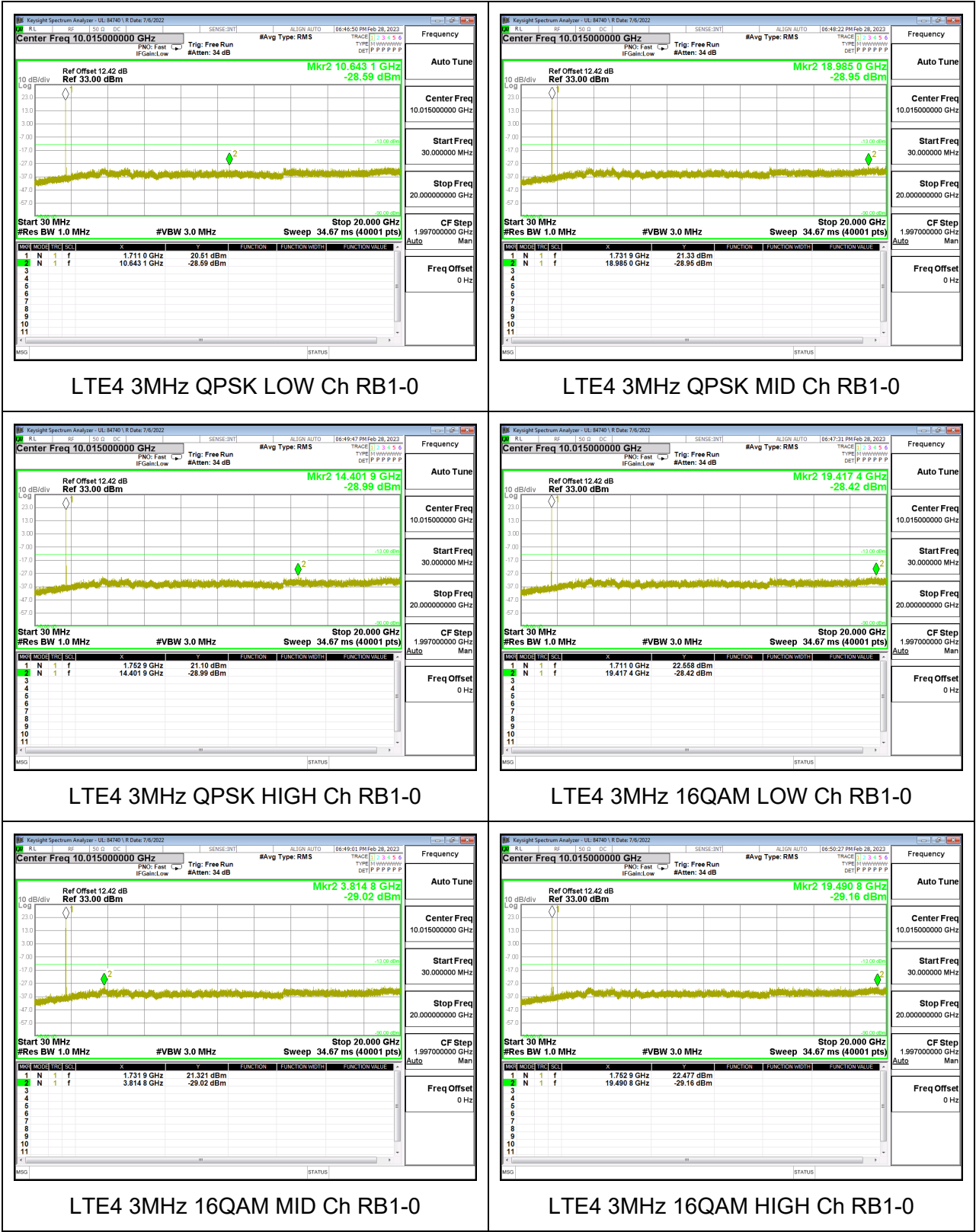
9.3.6. LTE4**LIMITS**

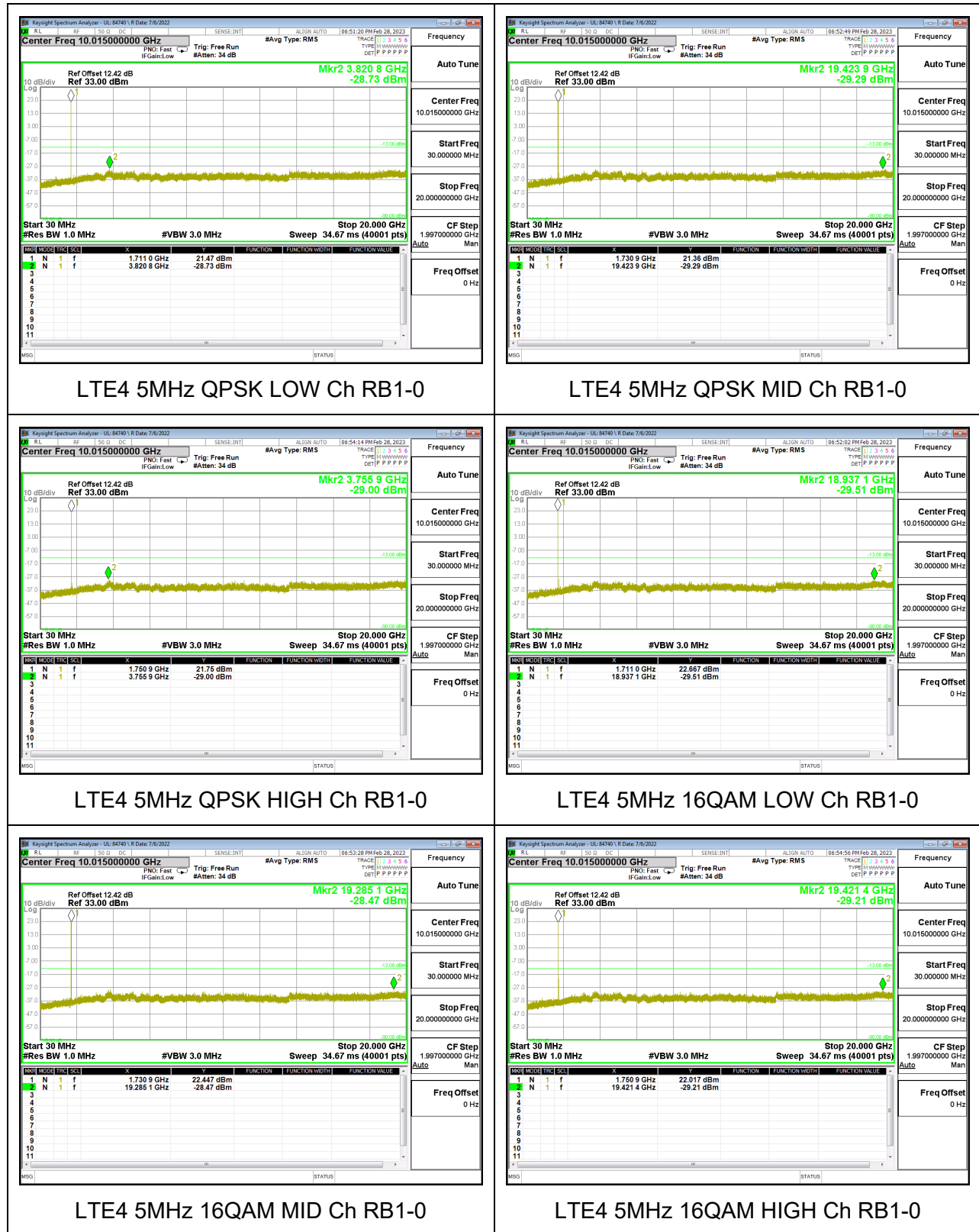
FCC: §27.53(h)

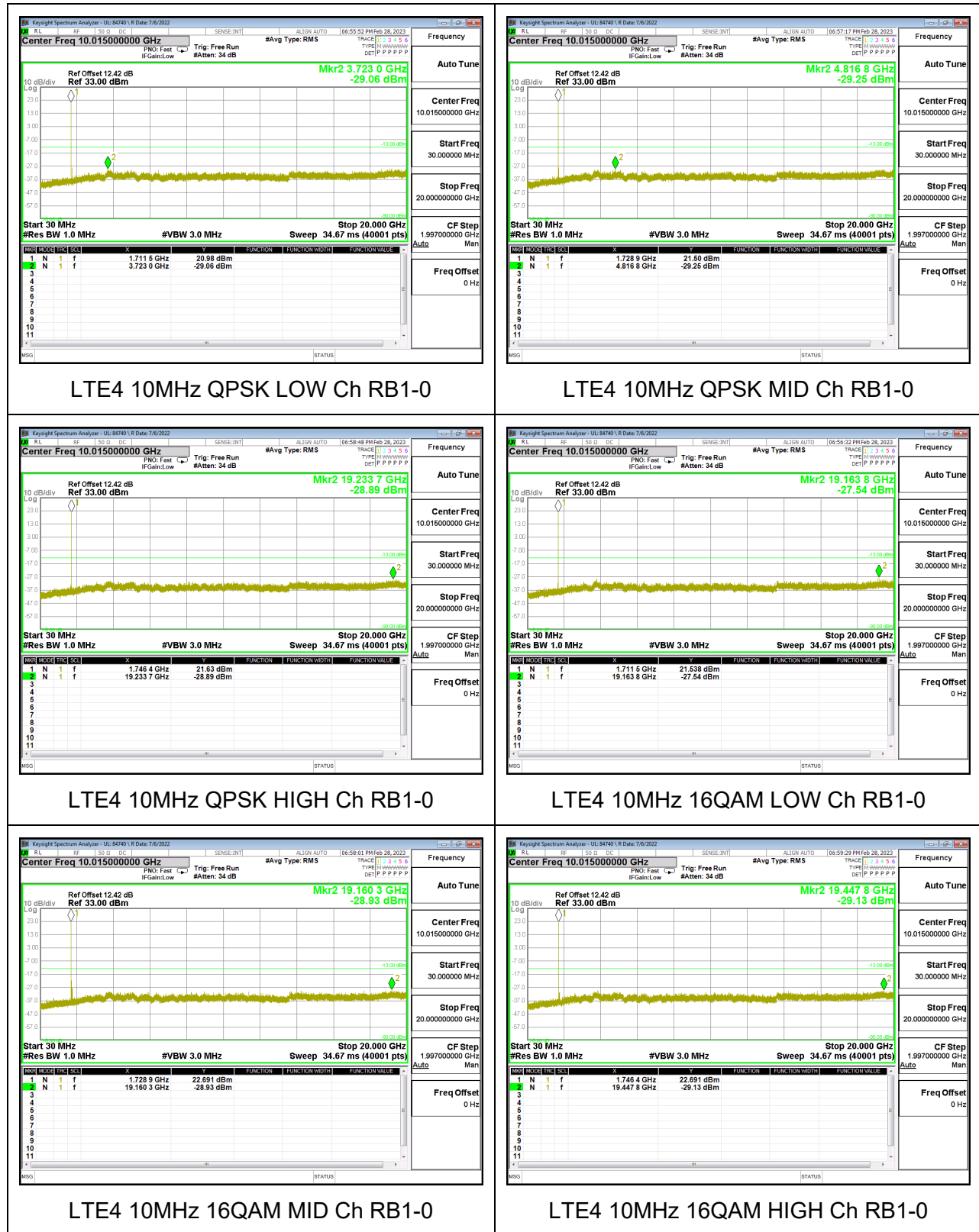
The minimum permissible attenuation level of any spurious emissions is $43 + 10 \log (P)$ dB where transmitting power (P) in Watts.

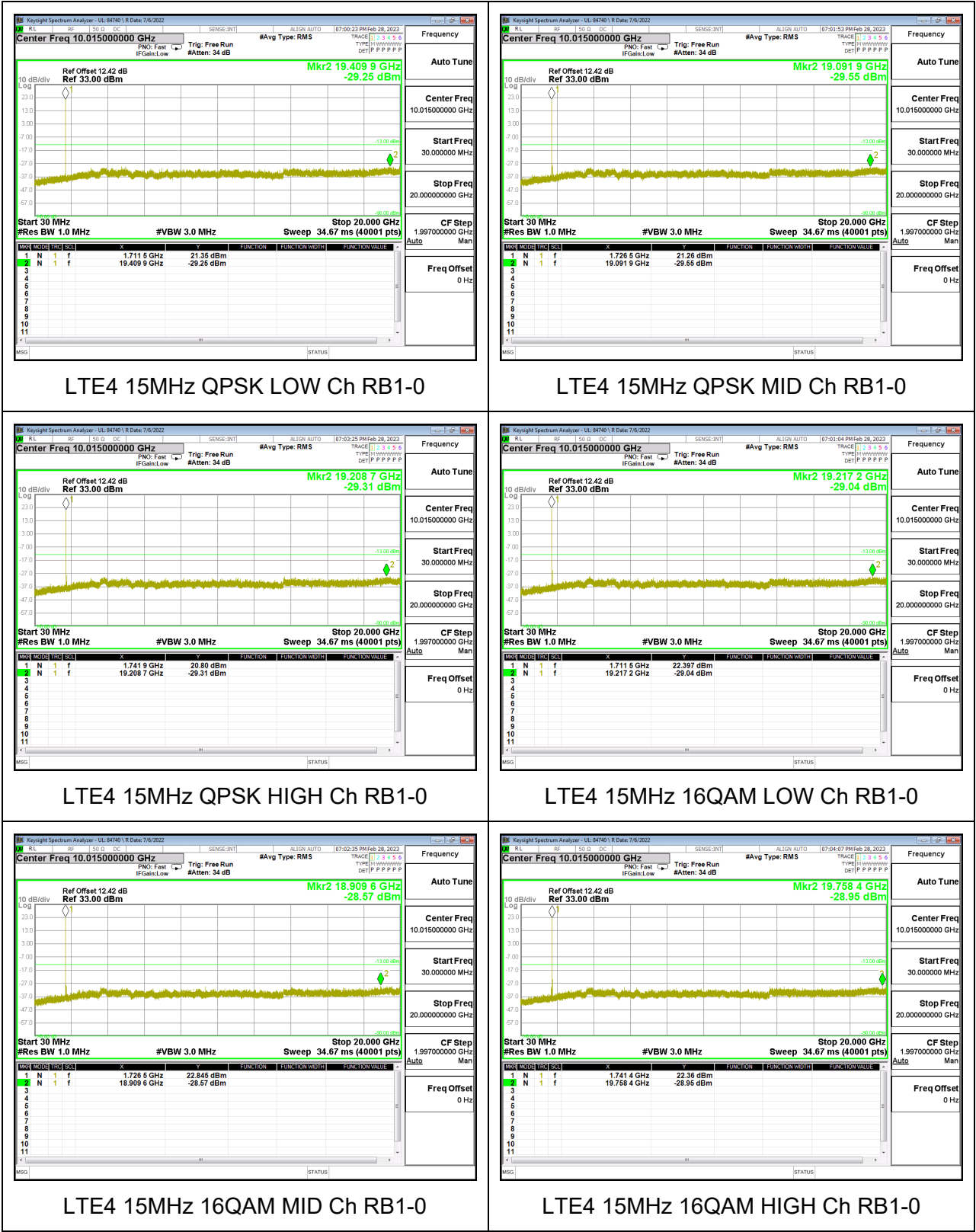
Test Engineer ID:	84740/44389	Test Date:	2023-02-28	EUT Serial Number:	QV7700ADFR
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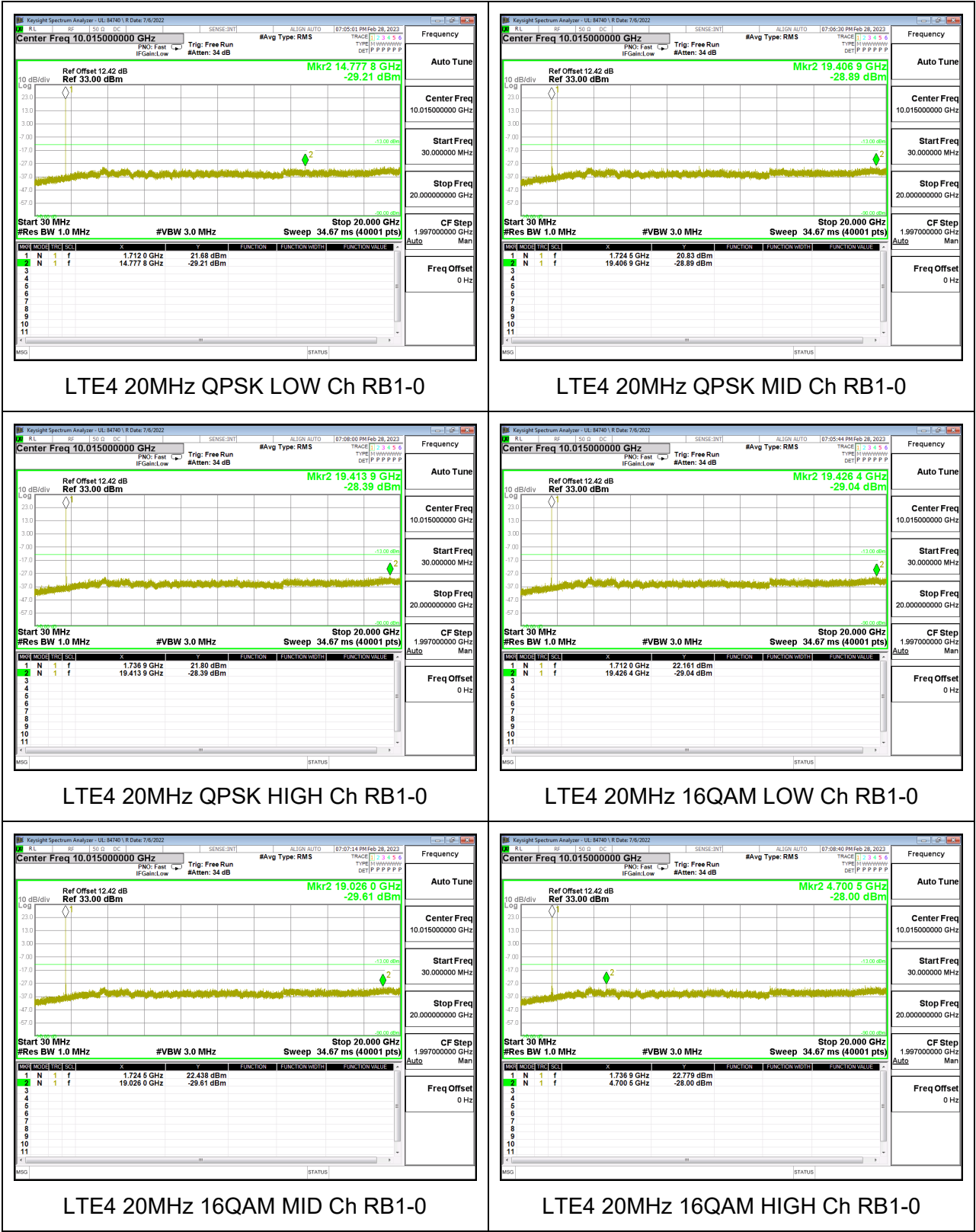










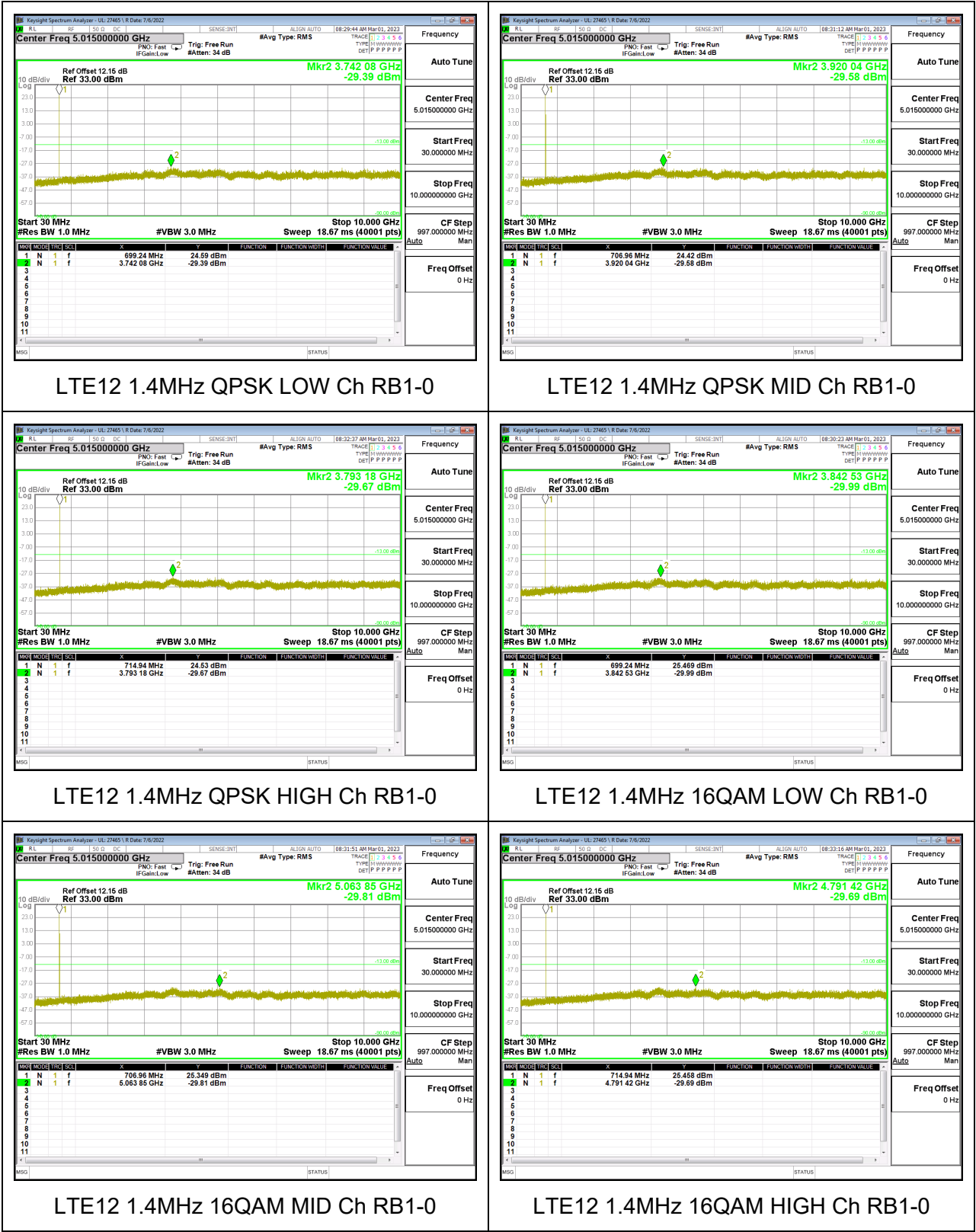


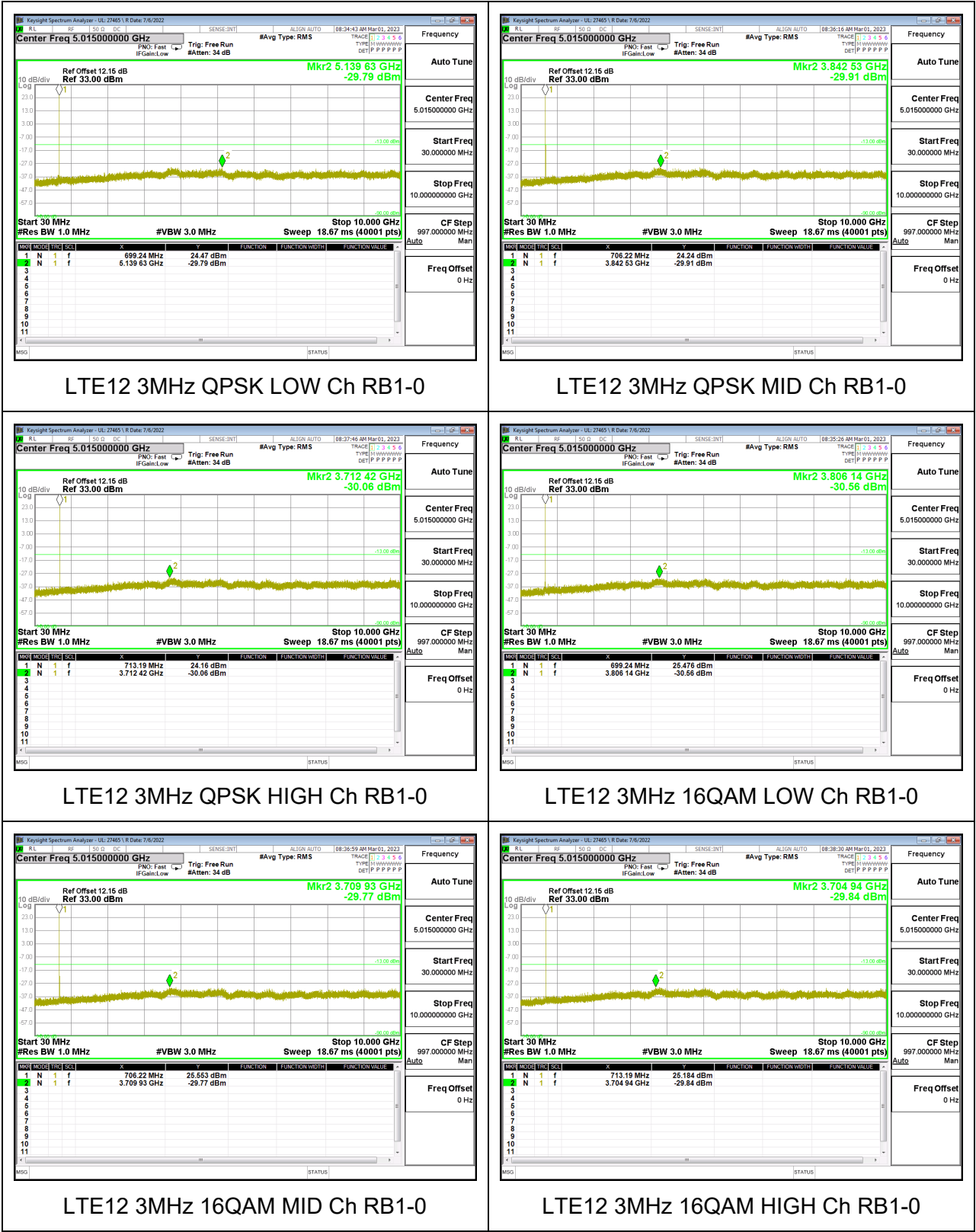
9.3.7. LTE12**LIMITS**

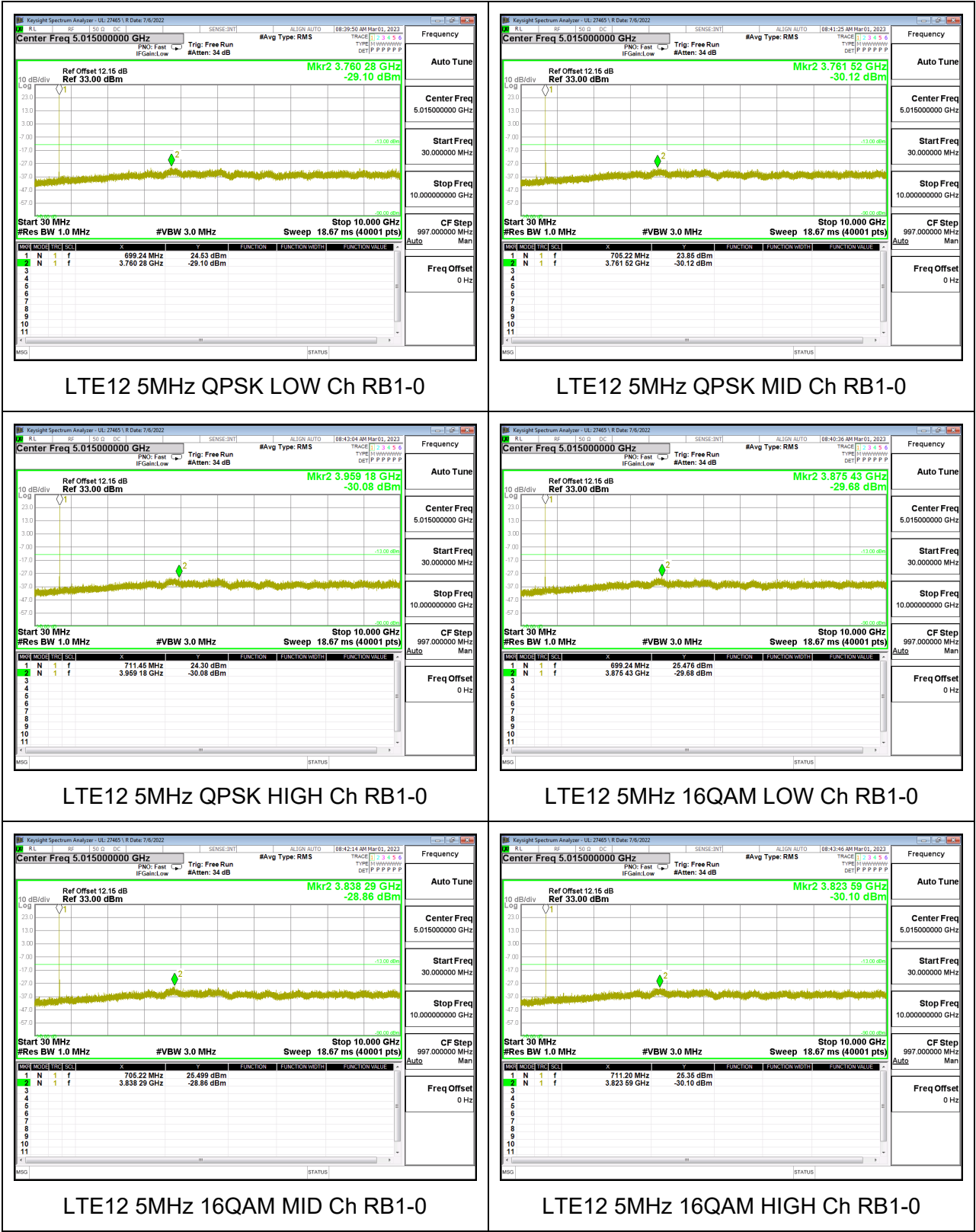
FCC: §27.53 (g)

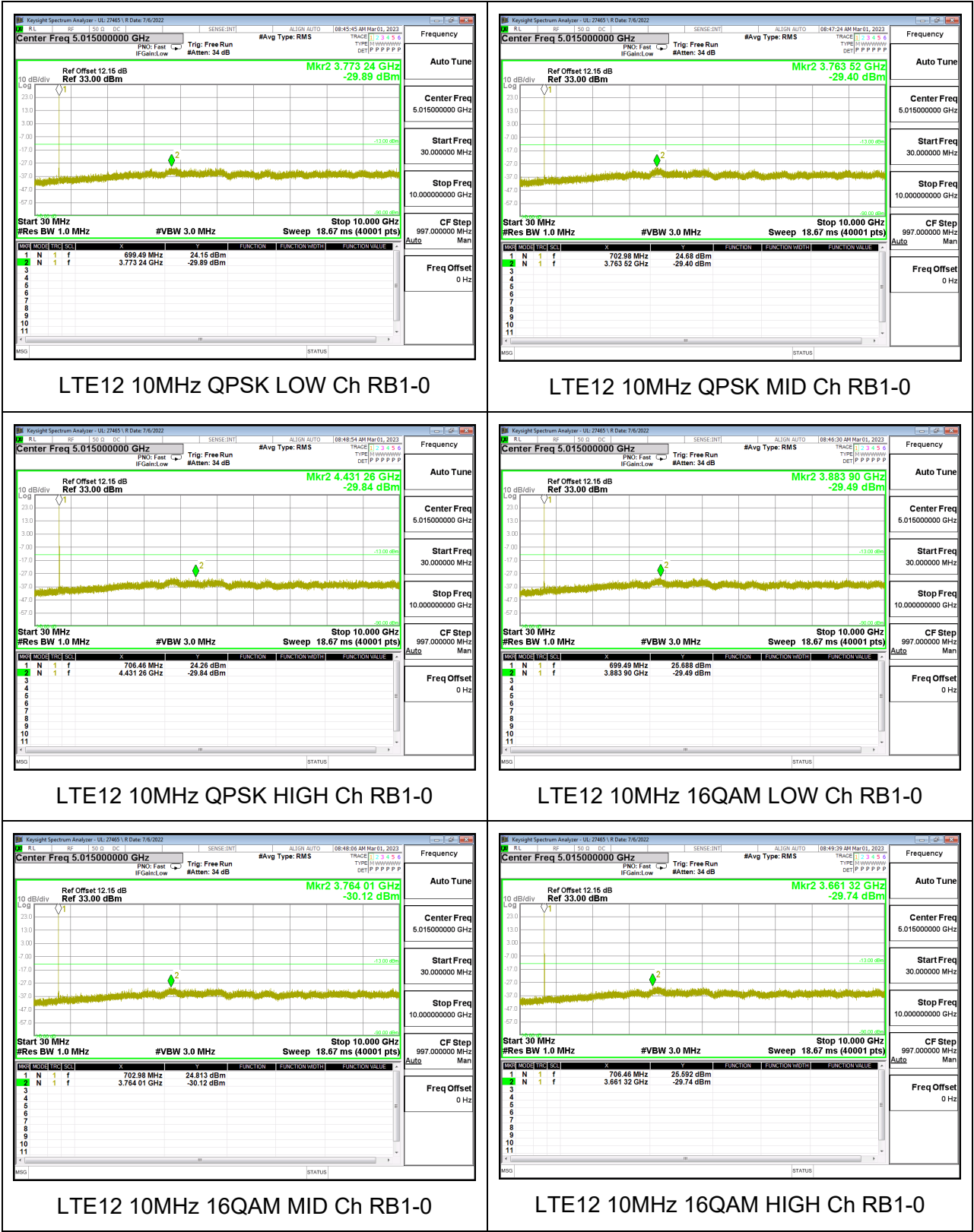
The minimum permissible attenuation level of any spurious emissions is $43 + 10 \log (P)$ dB where transmitting power (P) in Watts.

Test Engineer ID:	27465/44389	Test Date:	2023-03-01	EUT Serial Number:	QV7700ADFR
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9.4. FREQUENCY STABILITY

TEST PROCEDURE

Use CMW 500 with Frequency Error measurement capability.

(vii) Temp. = -30°C to +50°C

(viii) Voltage = (85% - 115%)

Low voltage, 3.23VDC, Normal, 3.8VDC and High voltage, 4.37VDC.

End Voltage, 3.2VDC.

Frequency Stability vs Temperature:

The EUT is placed inside a temperature chamber. The temperature is set to 20°C and allowed to stabilize. After sufficient soak time, the transmitting frequency error is measured. The temperature is increased by 10 degrees, allowed to stabilize and soak, and then the measurement is repeated. This is repeated until +50°C is reached.

Frequency Stability vs Voltage:

The peak frequency error is recorded (worst-case).

RESULTS

9.4.1. GSM850**LIMITS**

FCC: §22.355

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Test Engineer ID:	27465/44389	Test Date:	2023-02-27	EUT Serial Number:	QV7700ADFR
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GPRS

Band	850	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		824.2	848.8		2.5	Within Authorized Frequency Block (Hz)
		Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	
Temperature	Voltage					
Normal (20°C)	Normal	824.2000	848.8000			
Extreme (50°C)		824.2000	848.8000	25.1	0.030	Yes
Extreme (40°C)		824.2000	848.8000	29.08	0.035	Yes
Extreme (30°C)		824.2000	848.8000	29.18	0.035	Yes
Extreme (10°C)		824.2000	848.8000	25.32	0.030	Yes
Extreme (0°C)		824.2000	848.8000	32.49	0.039	Yes
Extreme (-10°C)		824.2000	848.8000	27.75	0.033	Yes
Extreme (-20°C)		824.2000	848.8000	29.86	0.036	Yes
Extreme (-30°C)		824.2000	848.8000	31.83	0.038	Yes
20°C	End Point Voltage	824.2000	848.8000	28.7	0.034	Yes

9.4.2. GSM1900**LIMITS**

FCC: §24.235

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Test Engineer ID:	84740/44389	Test Date:	2023-02-27	EUT Serial Number:	QV7700ADFR
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GPRS

Band	1900	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		1850	1910		2.5	
		Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Temperature	Voltage					
Normal (20°C)	Normal	1850.2000	1909.8000			
Extreme (50°C)		1850.2000	1909.8000	16.82	0.009	Yes
Extreme (40°C)		1850.2001	1909.8001	26.96	0.014	Yes
Extreme (30°C)		1850.2000	1909.8000	22.23	0.012	Yes
Extreme (10°C)		1850.2001	1909.8001	32.88	0.017	Yes
Extreme (0°C)		1850.2001	1909.8001	24.96	0.013	Yes
Extreme (-10°C)		1850.2001	1909.8001	30.47	0.016	Yes
Extreme (-20°C)		1850.2001	1909.8001	31.98	0.017	Yes
Extreme (-30°C)		1850.2001	1909.8001	32.01	0.017	Yes
20°C	End Point Voltage	1850.2001	1909.8001	28.19	0.015	Yes

9.4.4. WCDMA2**LIMITS**

FCC: §24.235

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Test Engineer ID:	84740/44389	Test Date:	2023-02-27	EUT Serial Number:	QV7700ADFR
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REL 99

Band	2	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		1850	1910		2.5	
		Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Temperature	Voltage					
Normal (20°C)	Normal	1852.4000	1907.6000			
Extreme (50°C)		1852.4000	1907.6000	11.27	0.006	Yes
Extreme (40°C)		1852.4000	1907.6000	12.35	0.007	Yes
Extreme (30°C)		1852.4000	1907.6000	10.61	0.006	Yes
Extreme (10°C)		1852.4000	1907.6000	9.18	0.005	Yes
Extreme (0°C)		1852.4000	1907.6000	10.84	0.006	Yes
Extreme (-10°C)		1852.4000	1907.6000	11.43	0.006	Yes
Extreme (-20°C)		1852.4000	1907.6000	13.12	0.007	Yes
Extreme (-30°C)		1852.4000	1907.6000	11.07	0.006	Yes
20°C	End Point Voltage	1852.4000	1907.6000	7	0.004	Yes

9.4.5. WCDMA4**LIMITS**

FCC: §27.54

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Test Engineer ID:	27465/44389	Test Date:	2023-02-28	EUT Serial Number:	QV7700ADFR
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REL 99

Band	4	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		1710	1755		2.5	
Temperature	Voltage	Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Normal (20°C)	Normal	1712.4000	1752.6000			
Extreme (50°C)		1712.4000	1752.6000	27.75	0.016	Yes
Extreme (40°C)		1712.4000	1752.6000	24.11	0.014	Yes
Extreme (30°C)		1712.4000	1752.6000	16.7	0.010	Yes
Extreme (10°C)		1712.4000	1752.6000	12.98	0.007	Yes
Extreme (0°C)		1712.4000	1752.6000	20.57	0.012	Yes
Extreme (-10°C)		1712.4000	1752.6000	24.24	0.014	Yes
Extreme (-20°C)		1712.4000	1752.6000	23.24	0.013	Yes
Extreme (-30°C)		1712.4000	1752.6000	17.51	0.010	Yes
20°C	End Point Voltage	1712.4000	1752.6000	17.19	0.010	Yes

9.4.6. LTE2**LIMITS**

FCC: §24.235

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Test Engineer ID:	84740/44389	Test Date:	2023-02-24	EUT Serial Number:	QV7700ADFR
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QPSK (20MHz)

Band	2	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		1850	1910		2.5	Within Authorized Frequency Block (Hz)
		Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	
Temperature	Voltage					
Normal (20°C)	Normal	1860.0000	1900.0000			
Extreme (50°C)		1860.0000	1900.0000	-4.3	-0.002	Yes
Extreme (40°C)		1860.0000	1900.0000	-4.32	-0.002	Yes
Extreme (30°C)		1860.0000	1900.0000	-3.66	-0.002	Yes
Extreme (10°C)		1860.0000	1900.0000	-4.39	-0.002	Yes
Extreme (0°C)		1860.0000	1900.0000	-4.6	-0.002	Yes
Extreme (-10°C)		1860.0000	1900.0000	4.75	0.003	Yes
Extreme (-20°C)		1860.0000	1900.0000	3.46	0.002	Yes
Extreme (-30°C)		1860.0000	1900.0000	-3.87	-0.002	Yes
20°C	End Point Voltage	1860.0000	1900.0000	-5.38	-0.003	Yes

9.4.7. LTE4**LIMITS**

FCC: §27.54

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Test Engineer ID:	84740/44389	Test Date:	2023-02-24	EUT Serial Number:	QV7700ADFR
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QPSK (20MHz)

Band	4	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		1710	1755		2.5	
Temperature	Voltage	Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Normal (20°C)	Normal	1720.0000	1745.0000			
Extreme (50°C)		1720.0000	1745.0000	-4.86	-0.003	Yes
Extreme (40°C)		1720.0000	1745.0000	-5.99	-0.003	Yes
Extreme (30°C)		1720.0000	1745.0000	-3.93	-0.002	Yes
Extreme (10°C)		1720.0000	1745.0000	-5.05	-0.003	Yes
Extreme (0°C)		1720.0000	1745.0000	4.14	0.002	Yes
Extreme (-10°C)		1720.0000	1745.0000	4.65	0.003	Yes
Extreme (-20°C)		1720.0000	1745.0000	-4.89	-0.003	Yes
Extreme (-30°C)		1720.0000	1745.0000	-3.7	-0.002	Yes
20°C	End Point Voltage	1720.0000	1745.0000	-6.41	-0.004	Yes

9.4.8. LTE12**LIMITS**

FCC: §27.54

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Test Engineer ID:	27465/44389	Test Date:	2023-02-27	EUT Serial Number:	QV7700ADFR
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QPSK (10MHz)

Band	12	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		699	716		2.5	
Temperature	Voltage	Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Normal (20°C)	Normal	704.0000	711.0000			
Extreme (50°C)		704.0000	711.0000	2.72	0.004	Yes
Extreme (40°C)		704.0000	711.0000	-3.2	-0.005	Yes
Extreme (30°C)		704.0000	711.0000	-2.86	-0.004	Yes
Extreme (10°C)		704.0000	711.0000	3.95	0.006	Yes
Extreme (0°C)		704.0000	711.0000	1.53	0.002	Yes
Extreme (-10°C)		704.0000	711.0000	2.51	0.004	Yes
Extreme (-20°C)		704.0000	711.0000	2.95	0.004	Yes
Extreme (-30°C)		704.0000	711.0000	-1.22	-0.002	Yes
20°C	End Point Voltage	704.0000	711.0000	-3.17	-0.004	Yes

9.5. PEAK TO AVERAGE RATIO

LIMIT

In addition, the peak to average power ratio (PAPR) of the transmitter shall not exceed 13 dB for more than 0.1% of the time and shall use a signal corresponding to the highest PAPR during periods of continuous transmission.

RESULTS

Antenna 1 was used to measure as the worst case; full resource block (FRB) for each bandwidth was used to measure as the worst case. The results from all CCDF measurements are passed with 13dB peak-to-average power ratio criteria.

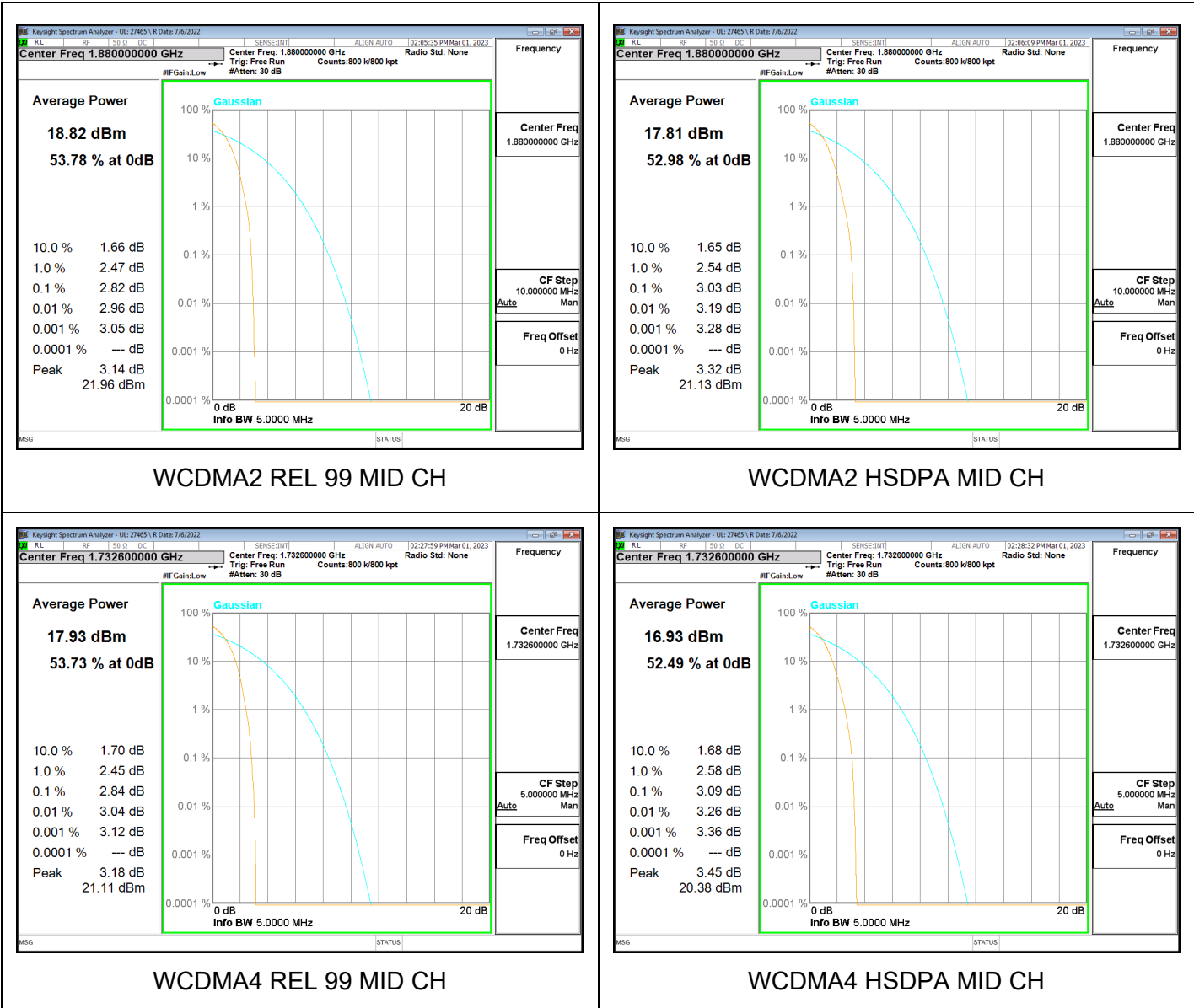
9.5.1. GSM

Test Engineer ID:	27465/44389	Test Date:	2023-03-03	EUT Serial Number:	QV7700ADFR
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Band	Frequency (MHz)	Modulation	Conducted Power (dBm)		Peak-to-Average Power Ratio (dB)
			Peak	Average	
GSM850	836.5	GPRS	32.04	31.91	0.13
		EGPRS	29.85	26.51	3.34
GSM1900	1880.0	GPRS	27.16	26.86	0.30
		EGPRS	29.31	26.06	3.25
Duty Cycle Correction Factor (dB) =		0.00			
Peak-to-Average Power Ratio= Peak Reading - Average Reading - Duty Cycle Correction Factor					

9.5.2. WCDMA

Test Engineer ID:	27465/44389	Test Date:	2023-03-03	EUT Serial Number:	QV7700ADFR
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9.5.3. LTE

Test Engineer ID:		27465/44389	Test Date:		2023-03-01	EUT Serial Number:		QV7700ADFR
Band	Bandwidth (MHz)	Frequency (MHz)	RB Allocation	RB OffSet	Modulation	Conducted Power (dBm)		Peak-to-Average Power Ratio (dB)
						Peak	Average	
LTE Band 4	1.4MHz	1732.5	6	0	QPSK	22.40	18.01	4.39
					16QAM	23.35	18.03	5.32
	3MHz		15	0	QPSK	22.64	18.05	4.59
					16QAM	23.66	18.04	5.62
	5MHz		25	0	QPSK	22.87	18.19	4.68
					16QAM	23.95	18.16	5.79
	10MHz		50	0	QPSK	22.95	18.19	4.76
					16QAM	23.99	18.19	5.80
	15MHz		75	0	QPSK	23.11	18	5.11
					16QAM	24.08	18.03	6.05
	20MHz		100	0	QPSK	22.97	18.05	4.92
					16QAM	23.98	18.06	5.92
Duty Cycle Correction Factor (dB) =			0.00					
Peak-to-Average Power Ratio= Peak Reading - Average Reading - Duty Cycle Correction Factor								

10. RADIATED TEST RESULTS

Radiated measurement using the Field Strength Method

Using the test configuration shown in Figure 6 below, We measure the radiated emissions directly from the EUT and convert the measured field strength or received power to ERP or EIRP, as required, for comparison to the applicable limits. As stated in 5.5.1 of ANSI C63.26-2015, the field strength measurement method using a test site validated to the requirements of ANSI C63.4 is an alternative to the substitution measurement method.

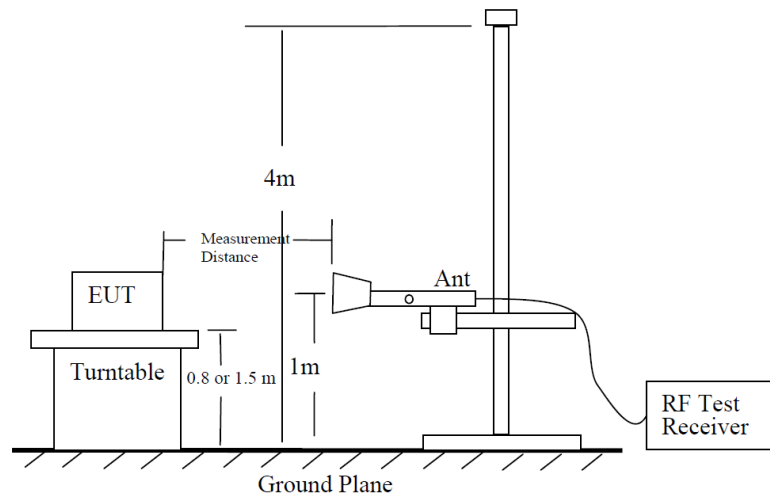


Figure 6 —Test site-up for radiated ERP and/or EIRP measurements

Radiated Power Measurement Calculation According to ANSI C63.26-2015

- a) $E \text{ (dB}\mu\text{V/m)} = \text{Measured amplitude level (dB}\mu\text{V)} + \text{Cable Loss (dB)} + \text{Antenna Factor (dB/m)}.$
- b) $E \text{ (dB}\mu\text{V/m)} = \text{Measured amplitude level (dBm)} + 107 + \text{Cable Loss (dB)} + \text{Antenna Factor (dB/m)}.$
- c) $E \text{ (dB}\mu\text{V/m)} = \text{EIRP (dBm)} - 20\log(D) + 104.8$; where D is the measurement distance (in the far field region) in m.
- d) $\text{EIRP (dBm)} = E \text{ (dB}\mu\text{V/m)} + 20\log(D) - 104.8$; where D is the measurement distance (in the far field region) in m.

So, from d)

The measuring distance is usually at 3m, then $20 \cdot \log(3) = 9.5424$

Then, $\text{EIRP (dBm)} = E \text{ (dB}\mu\text{V/m)} + 9.5424 - 104.8 = E \text{ (dB}\mu\text{V/m)} - 95.2576$

Note: Confidence check of each chamber is performed daily to see if any degradation from expected/normal reading reference data. Ambient check of each chamber is performed monthly.

10.1. FIELD STRENGTH OF SPURIOUS RADIATION, ABOVE 1GHz

RULE PARTS

FCC: §22.917(a), §24.238(a), §27.53 (h), §27.53 (g)

LIMITS

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log (P)$ dB.

TEST PROCEDURE

KDB 971168 D01 v03r01/D02 v02/r01

All tests above 1GHz were done with a Resolution Bandwidth of 1MHz, and a Video Bandwidth of 3MHz

NOTE1:

Sample SN used for all scans in section 10.1: **QV7700C9FR**

RESULTS

10.1.1. GSM 850

GPRS Low Channel

