

TEST REPORT

CERTIFICATE OF CONFORMITY

Standard: 47 CFR FCC Part 96
47 CFR FCC Part 2
Report No.: RFBCM-N-WTW-P23100614-12
FCC ID: Q3N-RS38
Product: Mobile Computer
Brand: CIPHERLAB
Model No.: RS38
Received Date: 2023/11/12
Test Date: 2024/1/8 ~ 2024/8/1
Issued Date: 2024/8/14

Applicant: Cipherlab Co., Ltd.

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FCC Registration / 788550 / TW0003 for Test Location(1)

Designation Number: 281270 / TW0032 for Test Location(2)

Approved by:

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Date:

2024/8/14

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Prepared by : Polly Chien / Specialist



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Release Control Record

Issue No.	Description	Date Issued
RFBCMNI-WTW-P23100614-12	Original release.	2024/8/14

1 Certificate

Product: Mobile Computer

Brand: CIPHERLAB

Test Model: RS38

Sample Status: Engineering sample

Applicant: Cipherlab Co., Ltd.

Test Date: 2024/1/8 ~ 2024/8/1

Standard: 47 CFR FCC Part 96
47 CFR FCC Part 2

Measurement ANSI/TIA/EIA-603-E 2016

procedure: ANSI C63.26-2015

KDB 971168 D01 Power Meas License Digital Systems v03r01

KDB 940660 D01 Part 96 CBRS Eqpt v03

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report.

2 Summary of Test Results

Standard / Clause	Test Item	Result	Remark
Part 2.1046 Part 96.41(b)	Maximum EIRP	Pass	Meet the requirement of limit.
Part 2.1047	Modulation Characteristics	Pass	Meet the requirement of limit.
Part 2.1046 Part 96.41(b)	Maximum Power Spectral Density	N/A	This device is End User Device.
Part 96.41(g)	Peak to Average Ratio	Pass	Meet the requirement of limit.
Part 2.1049	Bandwidth	Pass	Meet the requirement of limit.
Part 2.1051 Part 96.41(e)	Conducted Spurious Emissions	Pass	Meet the requirement of limit.
Part 2.1053 Part 96.41(e)	Radiated Spurious Emissions below 1GHz	Pass	Minimum passing margin is -0.66 dB at 36.79 MHz
Part 2.1053 Part 96.41(e)	Radiated Spurious Emissions above 1GHz	Pass	Minimum passing margin is -0.24 dB at 7380.00 MHz
Part 2.1055	Frequency Stability	Pass	Meet the requirement of limit.

Note: Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Parameter	Specification	Uncertainty (±)
Effective Radiated Power and Equivalent Isotropically Radiated Power	-	1.371 dB
Bandwidth	-	960 Hz
Conducted Spurious Emissions	-	2.12 dB
Radiated Spurious Emissions below 1GHz	9 kHz ~ 30 MHz	3 dB
	30 MHz ~ 1 GHz	2.93 dB
Radiated Spurious Emissions above 1GHz	1 GHz ~ 18 GHz	1.76 dB
	18 GHz ~ 40 GHz	1.77 dB
Frequency Stability	-	0.176 ppm

The other instruments specified are routine verified to remain within the calibrated levels, no measurement uncertainty is required to be calculated.

2.2 Supplementary Information

There is not any deviation from the test standards for the test method, and no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Mobile Computer	
Brand	CIPHERLAB	
Test Model	RS38	
Status of EUT	Engineering sample	
Power Supply Rating	3.87 Vdc (from battery) 5 Vdc (from adapter or host equipment)	
Operating Frequency	LTE Band 42 (Channel Bandwidth 5MHz)	3552.5MHz ~ 3597.5MHz
	LTE Band 42 (Channel Bandwidth 10MHz)	3555.0MHz ~ 3595.0MHz
	LTE Band 42 (Channel Bandwidth 15MHz)	3557.5MHz ~ 3592.5MHz
	LTE Band 42 (Channel Bandwidth 20MHz)	3560.0MHz ~ 3590.0MHz
	LTE Band 43 (Channel Bandwidth 5MHz)	3652.5MHz ~ 3672.5MHz
	LTE Band 43 (Channel Bandwidth 10MHz)	3655.0MHz ~ 3670.0MHz
	LTE Band 43 (Channel Bandwidth 15MHz)	3657.5MHz ~ 3667.5MHz
	LTE Band 43 (Channel Bandwidth 20MHz)	3660.0MHz ~ 3665.0MHz
	LTE Band 48 (Channel Bandwidth 5MHz)	3552.5MHz ~ 3697.5MHz
	LTE Band 48 (Channel Bandwidth 10MHz)	3555.0MHz ~ 3695.0MHz
	LTE Band 48 (Channel Bandwidth 15MHz)	3557.5MHz ~ 3692.5MHz
	LTE Band 48 (Channel Bandwidth 20MHz)	3560.0MHz ~ 3690.0MHz
EUT Category	End User Device	

Note:

1. EUT Overview

Mode	Bandwidth	TX Frequency Range (MHz)	Modulation	Max. EIRP (W)	Max. EIRP (dBm)	Emission Designator
LTE Band 48	5 MHz	3552.5 ~ 3697.5	QPSK	0.121	20.81	4M49G7D
			16QAM	0.096	19.82	4M50D7W
			64QAM	0.077	18.84	4M50D7W
			256QAM	0.038	15.85	4M51D7W
	10 MHz	3555 ~ 3695	QPSK	0.12	20.8	8M98G7D
			16QAM	0.096	19.82	8M99D7W
			64QAM	0.075	18.76	8M98D7W
			256QAM	0.039	15.88	8M98D7W
	15 MHz	3557.5 ~ 3692.5	QPSK	0.124	20.93	13M5G7D
			16QAM	0.097	19.85	13M5D7W
			64QAM	0.078	18.91	13M5D7W
			256QAM	0.039	15.87	13M5D7W
	20 MHz	3560 ~ 3690	QPSK	0.124	20.95	18M0G7D
			16QAM	0.098	19.91	18M0D7W
			64QAM	0.079	18.96	18M0D7W
			256QAM	0.039	15.91	18M0D7W

2. LTE Band 48 overlaps the entire frequency range of LTE Band 42 and LTE Band 43. Therefore, test data provided in this report covers LTE Band 48 as well as LTE Band 42 and LTE Band 43.

3. The EUT uses following accessories.

Item	Brand	Model	Specification
Adapter	Channel WELL Technology	2AEA010BC3D	AC Input: 100-240 Vac, 50/60 Hz, 0.35 A DC Output: 5.0 Vdc, 2.0 A, 10.0 W
Reader 1	Zebra	SE4770	-
Reader 2	Zebra	SE4100	-
Reader 3	Zebra	SE5500	-
1st Battery	CIPHERLAB	BA-0174A5	3.87 Vdc, 4500 mAh, 17.42 Wh
2nd Battery	Chongqing VDL Electronics Co., Ltd	341322PM4	3.85 Vdc, 90 mAh
USB To Type C Cable	SUNCA CO., LTD	1Q11512211-XJ	0.9 m

* After pretesting, Reader 1 and 1st Battery were the worst case and chosen for final test.

4. The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or user's manual.

3.2 Antenna Description of EUT

1. The antenna information is listed as below.

Antenna Type	LDS					
Antenna Connector	spring					
Item	Band	Freq. Range (MHz)	Gain (dBi)			
			Ant. 0	Ant. 5	Ant. 6	Ant. 7
	LTE Band 42	3400~3600		-1		-2.5
	LTE Band 43	2600~3800		-1		-2.5
	LTE Band 48	3550~3700		-1		-2.5

*The above Antenna information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.

3.3 Test Mode Applicability and Tested Channel Detail

Pre-Scan:	EUT can be used in the following ways: X-axis/ Y-axis/ Z-axis. Pre-scan these ways and find the worst case as a representative test condition.
Worst Case:	X-axis/ Y-axis/ Z-axis Worst Condition: Z-axis

3.3.1 LTE Band 48

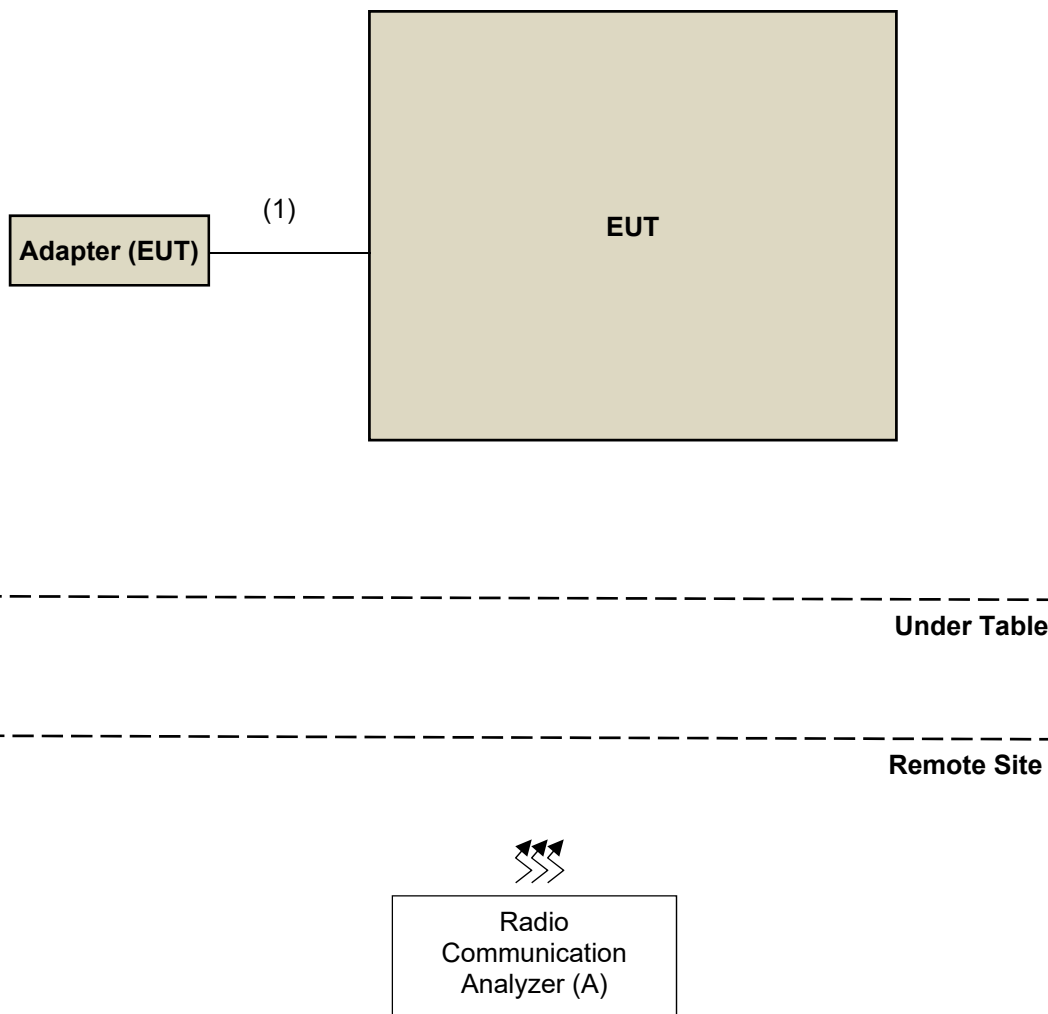
Test Item	Tested Channel	Channel Bandwidth	Modulation	Mode
Maximum EIRP	55265(3552.50 MHz) 55990(3625.00 MHz) 56715(3697.50 MHz)	5 MHz	QPSK / 16QAM / 64QAM / 256QAM	1 RB Half RB Full RB
	55290(3555.00 MHz) 55990(3625.00 MHz) 56690(3695.00 MHz)	10 MHz	QPSK / 16QAM / 64QAM / 256QAM	1 RB Half RB Full RB
	55315(3557.50 MHz) 55990(3625.00 MHz) 56665(3692.50 MHz)	15 MHz	QPSK / 16QAM / 64QAM / 256QAM	1 RB Half RB Full RB
	55340(3560.00 MHz) 55990(3625.00 MHz) 56640(3690.00 MHz)	20 MHz	QPSK / 16QAM / 64QAM / 256QAM	1 RB Half RB Full RB
Modulation Characteristics	55990(3625.00 MHz)	20 MHz	QPSK / 16QAM / 64QAM / 256QAM	Full RB
Peak to Average Ratio	55265(3552.50 MHz) 55990(3625.00 MHz) 56715(3697.50 MHz)	5 MHz	QPSK / 16QAM / 64QAM / 256QAM	1 RB
	55290(3555.00 MHz) 55990(3625.00 MHz) 56690(3695.00 MHz)	10 MHz	QPSK / 16QAM / 64QAM / 256QAM	1 RB
	55315(3557.50 MHz) 55990(3625.00 MHz) 56665(3692.50 MHz)	15 MHz	QPSK / 16QAM / 64QAM / 256QAM	1 RB
	55340(3560.00 MHz) 55990(3625.00 MHz) 56640(3690.00 MHz)	20 MHz	QPSK / 16QAM / 64QAM / 256QAM	1 RB
Bandwidth	55265(3552.50 MHz) 55990(3625.00 MHz) 56715(3697.50 MHz)	5 MHz	QPSK / 16QAM / 64QAM / 256QAM	Full RB
	55290(3555.00 MHz) 55990(3625.00 MHz) 56690(3695.00 MHz)	10 MHz	QPSK / 16QAM / 64QAM / 256QAM	Full RB
	55315(3557.50 MHz) 55990(3625.00 MHz) 56665(3692.50 MHz)	15 MHz	QPSK / 16QAM / 64QAM / 256QAM	Full RB
	55340(3560.00 MHz) 55990(3625.00 MHz) 56640(3690.00 MHz)	20 MHz	QPSK / 16QAM / 64QAM / 256QAM	Full RB

Test Item	Tested Channel	Channel Bandwidth	Modulation	Mode
Conducted Spurious Emissions	55265(3552.50 MHz) 55990(3625.00 MHz) 56715(3697.50 MHz)	5 MHz	QPSK	1 RB Full RB
	55290(3555.00 MHz) 55990(3625.00 MHz) 56690(3695.00 MHz)	10 MHz	QPSK	1 RB Full RB
	55315(3557.50 MHz) 55990(3625.00 MHz) 56665(3692.50 MHz)	15 MHz	QPSK	1 RB Full RB
	55340(3560.00 MHz) 55990(3625.00 MHz) 56640(3690.00 MHz)	20 MHz	QPSK	1 RB Full RB
Radiated Spurious Emissions below 1GHz	56640(3690.00 MHz)	20 MHz	QPSK	1 RB
Radiated Spurious Emissions above 1GHz	55265(3552.50 MHz) 55990(3625.00 MHz) 56715(3697.50 MHz)	5 MHz	QPSK	1 RB
	55340(3560.00 MHz) 55990(3625.00 MHz) 56640(3690.00 MHz)	20 MHz	QPSK	1 RB
Frequency Stability	55265(3552.50 MHz) 56715(3697.50 MHz)	5 MHz	QPSK	Full RB
	55290(3555.00 MHz) 56690(3695.00 MHz)	10 MHz	QPSK	Full RB
	55315(3557.50 MHz) 56665(3692.50 MHz)	15 MHz	QPSK	Full RB
	55340(3560.00 MHz) 56640(3690.00 MHz)	20 MHz	QPSK	Full RB
Note 1. LTE B42 (3550~3600MHz) and LTE B43 (3600~3700MHz) are also covered by LTE B48.				

3.4 Test Program Used and Operation Descriptions

There is no need to controlling software during the test, and the EUT can be paired with the Radio Communication Analyzer to test the connection when it is powered on.

3.5 Connection Diagram of EUT and Peripheral Devices



3.6 Configuration of Peripheral Devices and Cable Connections

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A	Radio Communication Analyzer	Anritsu	MT8821C	6201462755	N/A	Provided by Lab

ID	Cable Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1	USB To Type C Cable	1	0.9	Y	0	Accessory of EUT

4 Test Instruments

The calibration interval of the all test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

4.1 Maximum EIRP

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
PXA Signal Analyzer Keysight	N9030B	MY57140938	2023/3/16 2024/3/20	2024/3/15 2025/3/19
Radio Communication Analyzer Anritsu	MT8821C	6201462755	2023/3/3 2024/3/13	2024/3/2 2025/3/12
Software BV	ADT_RF Test Software V7.6.5.4	N/A	N/A	N/A

Notes:

1. The test was performed in Oven room.
2. Tested Date: 2024/1/23 ~ 2024/6/30

4.2 Modulation Characteristics

Refer to section 4.1 to get the tested date and information of the instruments.

4.3 Peak to Average Ratio

Refer to section 4.1 to get the tested date and information of the instruments.

4.4 Bandwidth

Refer to section 4.1 to get the tested date and information of the instruments.

4.5 Conducted Spurious Emissions

Refer to section 4.1 to get the tested date and information of the instruments.

4.6 Radiated Spurious Emissions below 1GHz

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Antenna Tower Max-Full	MFT-151SS-0.5T	N/A	N/A	N/A
Bi_Log Antenna Schwarzbeck	VULB 9168	9168-1213	2023/10/13	2024/10/12
EMI Test Receiver R&S	ESR3	102782	2023/12/7	2024/12/6
Loop Antenna Electro-Metrics	EM-6879	269	2023/9/23	2024/9/22
Loop Antenna TESEQ	HLA 6121	45745	2023/8/8	2024/8/7
MXA Signal Analyzer Keysight	N9020B	MY60110513	2023/12/22	2024/12/21
Preamplifier EMCI	EMC330N	980782	2023/1/16	2024/1/15
	EMC001340	980201	2023/9/27	2024/9/26
RF Coaxial Cable EMCI	EMCCFD400-NM-NM-500	201233	2023/1/16	2024/1/15
	EMCCFD400-NM-NM-3000	201235	2023/1/16	2024/1/15
	EMCCFD400-NM-NM-9000	201236(with PAD)	2023/1/16	2024/1/15
Software BV ADT	ADT_Radiated_ V7.6.15.9.5	N/A	N/A	N/A
Turn Table Max-Full	MF-7802BS	N/A	N/A	N/A
Turn Table Controller Max-Full	MF-7802BS	MF780208674	N/A	N/A

Notes:

1. The test was performed in WM - 966 chamber 8.
2. Tested Date: 2024/1/8

4.7 Radiated Spurious Emissions above 1GHz

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Antenna Tower Max-Full	MFT-151SS-0.5T	N/A	N/A	N/A
EMI Test Receiver R&S	ESR3	102782	2023/12/7	2024/12/6
Horn Antenna RFSPIN	DRH18-E	210103A18E	2023/11/12	2024/11/11
Horn Antenna Schwarzbeck	BBHA 9170	9170-1049	2023/11/12	2024/11/11
MXA Signal Analyzer Keysight	N9020B	MY60110513	2023/12/22	2024/12/21
Preamplifier EMCI	EMC118A45SE	980808	2023/12/28	2024/12/27
	EMC184045SE	980788	2024/1/15	2025/1/14
RF Coaxial Cable EMCI	EMC101G-KM-KM-2000	201254	2024/1/15	2025/1/14
	EMC101G-KM-KM-3000	201258	2024/1/15	2025/1/14
	EMC101G-KM-KM-5000	201261	2024/1/15	2025/1/14
	EMC104-SM-SM-1000	210102	2024/1/15	2025/1/14
	EMC104-SM-SM-3000	201231	2024/1/15	2025/1/14
	EMC104-SM-SM-9000	201243	2024/1/15	2025/1/14
Software BV ADT	ADT_Radiated_ V7.6.15.9.5	N/A	N/A	N/A
Turn Table Max-Full	MF-7802BS	N/A	N/A	N/A
Turn Table Controller Max-Full	MF-7802BS	MF780208674	N/A	N/A

Notes:

1. The test was performed in WM - 966 chamber 8.
2. Tested Date: 2024/2/6

4.8 Frequency Stability

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
3-channel DC power supply JIN YIH Technology	ODP3033	ODP30332128138	N/A	N/A
Digital Multimeter Fluke	8050A	4660081	2024/6/14	2025/6/13
PXA Signal Analyzer Keysight	N9030B	MY57140938	2024/3/20	2025/3/19
Radio Communication Analyzer Anritsu	MT8821C	6261806803	2024/2/15	2025/2/14
Software BV	ADT_RF Test Software V7.6.5.4	N/A	N/A	N/A
Temperature & Humidity Chamber Terchy	HRM-120RF	931022	2023/12/19	2024/12/18

Notes:

1. The test was performed in Oven room.
2. Tested Date: 2024/8/1

5 Limits of Test Items

5.1 Maximum EIRP

Device Category	Maximum EIRP (dBm/10 MHz)
End User Device	23
Category A CBSD	30
Category B CBSD	47

5.2 Modulation Characteristics

A curve or equivalent data which shows that the equipment will meet the modulation requirements of the rules under which the equipment is to be licensed.

5.3 Peak to Average Ratio

In measuring transmissions in this band using an average power technique, the peak to-average ratio (PAR) of the transmission may not exceed 13 dB.

5.4 Bandwidth

According to FCC 47 CFR part 2.1049, the occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5% of the total mean power radiated by a given emission.

5.5 Conducted Spurious Emissions

The conducted power of any emission outside the fundamental emission (whether in or outside of the authorized band) shall not exceed -13 dBm/MHz within 0 to B MHz (where B is the bandwidth in MHz of the assigned channel or multiple contiguous channels of the End User Device) above the upper CBSD-assigned channel edge and within 0 to B MHz below the lower CBSD-assigned channel edge. At all frequencies greater than B MHz above the upper CBSD assigned channel edge and less than B MHz below the lower CBSD-assigned channel edge, the conducted power of any end user device emission shall not exceed -25 dBm/MHz.

Additional protection levels: The conducted power of emissions below 3540 MHz or above 3710 MHz shall not exceed -25 dBm/MHz, and the conducted power of emissions below 3530 MHz or above 3720 MHz shall not exceed -40 dBm/MHz.

5.6 Radiated Spurious Emissions below 1GHz

The power of any emissions below 3530 MHz or above 3720 MHz shall not exceed -40 dBm/MHz.

5.7 Radiated Spurious Emissions above 1GHz

The power of any emissions below 3530 MHz or above 3720 MHz shall not exceed -40 dBm/MHz.

5.8 Frequency Stability

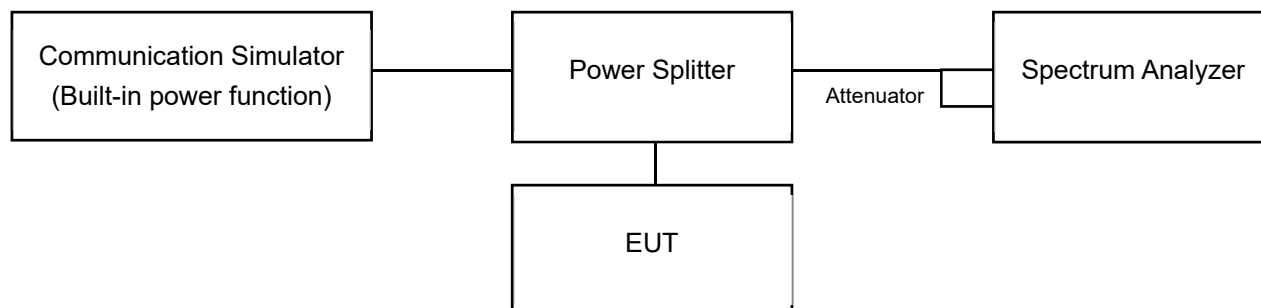
The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation (authorized frequency block).

6 Test Arrangements

6.1 Maximum EIRP

6.1.1 Test Setup

Conducted Power Measurement:



6.1.2 Test Procedure

Conducted Power Measurement:

The EUT is configured by emulator to set data modulation and maximum power using WWAN technology and link to spectrum analyzer measurements. Set the EUT to transmit under low, middle and high channel and record the power level shown on spectrum analyzer. Power measurements use detector average (rms).

Measurement method refers to ANSI C63.26 section 5.2.4.4.

- Set span to 2 × to 3 × the OBW.
- Set RBW = 1% to 5% of the OBW.
- Set VBW ≥ 3 × RBW.
- Set number of measurement points in sweep ≥ 2 × span / RBW.
- Set Sweep time = auto-couple.
- Detector = power averaging (rms).
- Set sweep trigger to “free run.”
- Trace average at least 100 traces in power averaging (rms) mode.
- Use the Band/Channel Power function to determine the integrated power per 10 MHz bandwidth and full bandwidth, according to the 47 CFR FCC Part 96 standard.
- If Duty cycle < 98%, Add 10 log (1/duty cycle) to the measured power level to compute the average power during continuous transmission.

Maximum EIRP / ERP

The relevant equation for determining the maximum ERP or EIRP from the measured RF output power is given in Equation as follows:

$$\text{EIRP} = P_{\text{Meas}} + G_T$$

$$\text{ERP} = P_{\text{Meas}} + G_T - 2.15$$

where

ERP or EIRP effective radiated power or equivalent isotropically radiated power, respectively

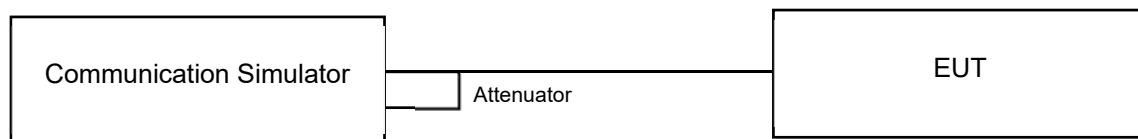
(expressed in the same units as P_{Meas} , e.g., dBm or dBW)

P_{Meas} measured transmitter output power or PSD, in dBm or dBW

G_T gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP)

6.2 Modulation Characteristics

6.2.1 Test Setup

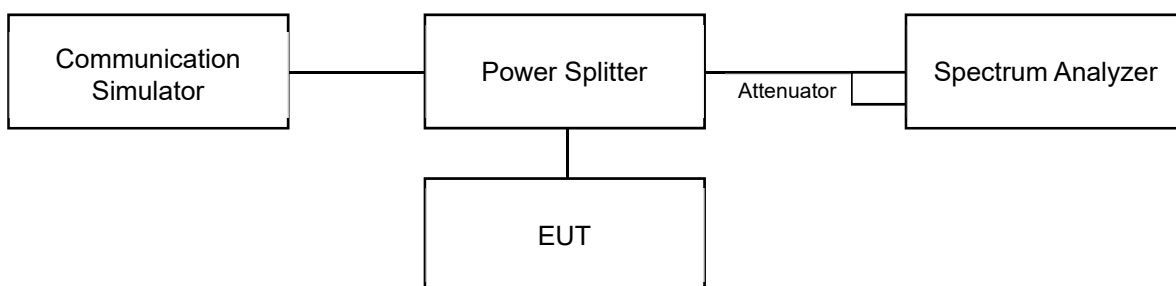


6.2.2 Test Procedure

Connect the EUT to Communication Simulator via the antenna connector, the frequency band is set as EUT supported Modulation and Channels, the EUT output is matched with 50 ohm load, the waveform quality and constellation of the EUT was tested.

6.3 Peak to Average Ratio

6.3.1 Test Setup

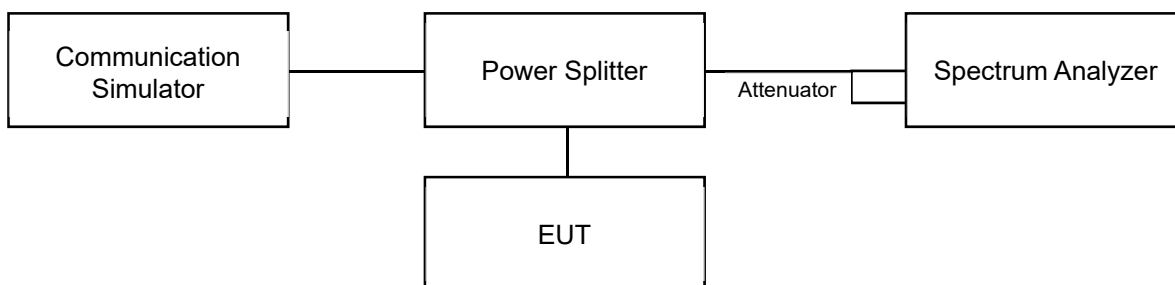


6.3.2 Test Procedure

- Set resolution/measurement bandwidth $\geq$ signal's occupied bandwidth;
- Set the number of counts to a value that stabilizes the measured CCDF curve;
- Record the maximum PAPR level associated with a probability of 0.1%.

6.4 Bandwidth

6.4.1 Test Setup



6.4.2 Test Procedure

For the 26 dBc bandwidth measurement method, please refer to section 5.4.3 of ANSI C63.26.

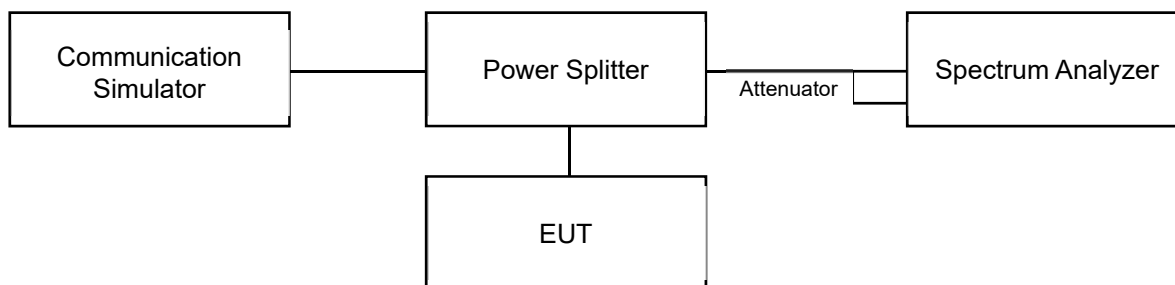
- a. The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the spectrum analyzer shall be wide enough to see sufficient roll off of the signal to make the measurement.
- b. The nominal RBW shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set $\geq 3 \times$ RBW.
- c. Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation. See guidance provided in 4.2.3.
- d. The dynamic range of the spectrum analyzer at the selected RBW shall be more than 10 dB below the target “-X dB” requirement, i.e., if the requirement calls for measuring the -26 dB OBW, the spectrum analyzer noise floor at the selected RBW shall be at least 36 dB below the reference level.
- e. Set spectrum analyzer detection mode to peak, and the trace mode to max hold.
- f. Determine the following reference values: Set the EUT to transmit a modulated signal. Allow the trace to stabilize. Set the spectrum analyzer marker to the highest level of the displayed trace (this is the reference value).
- g. Determine the “-X dB amplitude” as equal to (Reference Value - X). Alternatively, this calculation can be performed on the spectrum analyzer using the delta-marker measurement function.
- h. Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display such that each marker is at or slightly below the “-X dB amplitude” determined in step f). If a marker is below this “-X dB amplitude” value it should be as close as possible to this value. The OBW is the positive frequency difference between the two markers.
- i. The OBW shall be reported by providing plot(s) of the measuring instrument display, to include markers depicting the relevant frequency and amplitude information (e.g., marker table). The frequency and amplitude axis and scale shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

For the occupied bandwidth measurement method, please refer to section 5.4.4 of ANSI C63.26.

- a. The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the spectrum analyzer shall be wide enough to see sufficient roll off of the signal to make the measurement.
- b. The nominal RBW shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set $\geq 3 \times$ RBW.
- c. Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation. See guidance provided in 4.2.3.
- d. The dynamic range of the spectrum analyzer at the selected RBW shall be more than 10 dB below the target “-X dB” requirement, i.e., if the requirement calls for measuring the -26 dB OBW, the spectrum analyzer noise floor at the selected RBW shall be at least 36 dB below the reference level.
- e. Set spectrum analyzer detection mode to peak, and the trace mode to max hold.
- f. Determine the reference value by either of the following:
 - g. 1) Set the EUT to transmit a modulated signal. Allow the trace to stabilize. Set the spectrum analyzer marker to the highest level of the displayed trace (this is the reference value).
 - h. 2) Set the EUT to transmit an unmodulated carrier. Set the spectrum analyzer marker to the level of the carrier.
- i. Determine the “-X dB amplitude” as equal to (Reference Value - X). Alternatively, this calculation can be performed on the spectrum analyzer using the delta-marker measurement function.
- j. If the reference value was determined using an unmodulated carrier, turn the EUT modulation on, then either clear the existing trace or start a new trace on the spectrum analyzer and allow the new trace to stabilize. Otherwise the trace from step f) shall be used for step i).
- k. Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display such that each marker is at or slightly below the “-X dB amplitude” determined in step f). If a marker is below this “-X dB amplitude” value it should be as close as possible to this value. The OBW is the positive frequency difference between the two markers. The spectral envelope can cross the “-X dB amplitude” at multiple points. The lowest or highest frequency shall be selected as the frequencies that are the farthest away from the center frequency at which the spectral envelope crosses the “-X dB amplitude.”
- l. The OBW shall be reported by providing plot(s) of the measuring instrument display, to include markers depicting the relevant frequency and amplitude information (e.g., marker table). The frequency and amplitude axis and scale shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

6.5 Conducted Spurious Emissions

6.5.1 Test Setup



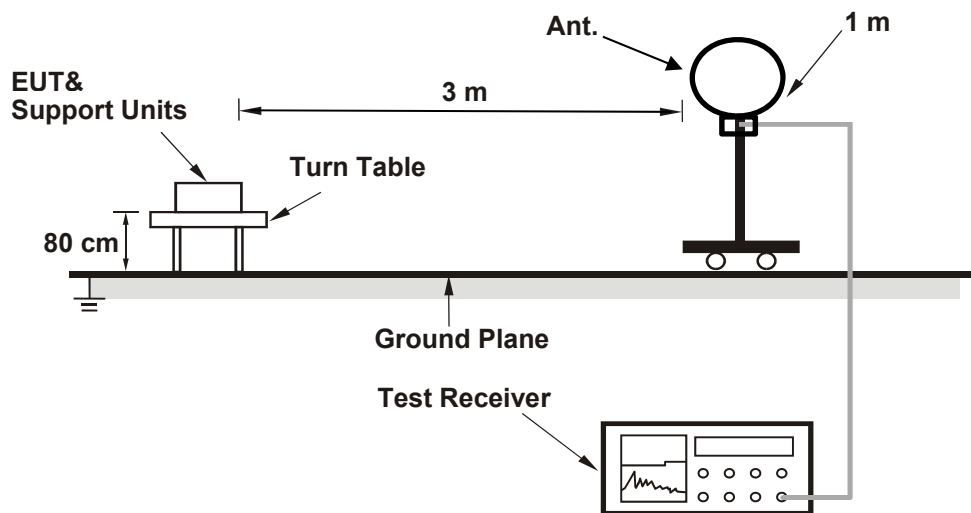
6.5.2 Test Procedure

- Measurement refer to ANSI C63.26 section 5.7.
- All measurements were done at 3 channels: low, middle and high operational frequency range.
- Measuring frequency range is from 9 kHz up to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower. 20 dB attenuation pad is connected with spectrum.
- The fundamental frequency above 1 GHz, the spectrum set RBW = 1 MHz, VBW = 3 MHz, Detector = Average.
- The fundamental frequency below 1 GHz, the spectrum set RBW $\geq$ 100 kHz, VBW $\geq$ 3 x RBW, Detector = Average.
- Measuring frequency band edge, narrow RBW (no less than 1% of the OBW) is used for conducted emission measurement.
- For the emissions measurement method, certain channel BW modes demonstrate compliance by integrating with the smaller RBW allowed by the rule.
- e.g. Where Reference RBW = 1 MHz and a smaller RBW = 100 kHz is used, worst-case integrated BW power = [Max Measured Value (dBm) with RBW = 100 kHz] + $10 \cdot \log(1000/100)$. To compensate for this integration before comparison to the limit, the limit line was reduced by 10 dB accordingly.
- Record the maximum power value test plot.

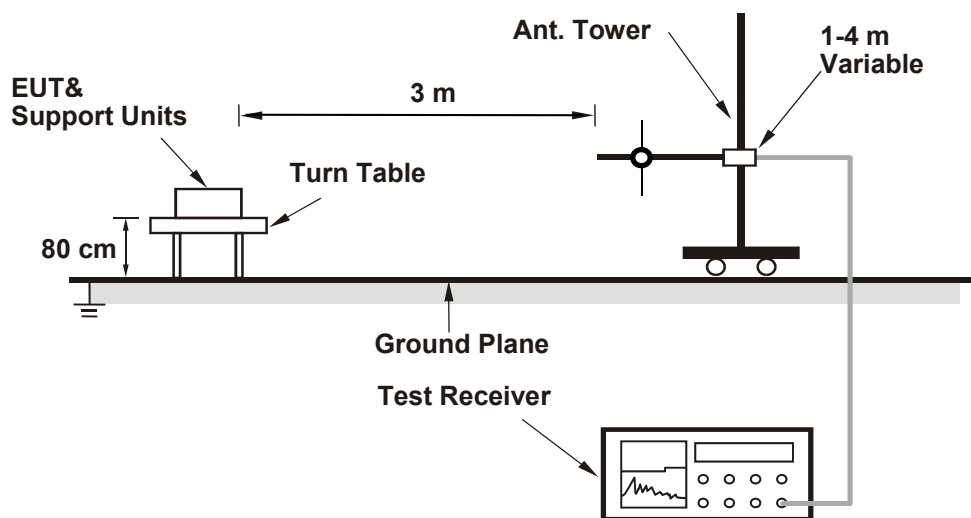
6.6 Radiated Spurious Emissions below 1GHz

6.6.1 Test Setup

For Radiated emission below 30 MHz



For Radiated emission above 30 MHz



For the actual test configuration, please refer to the attached file (Test Setup Photo).

6.6.2 Test Procedure

The EUT is configured by emulator to set data modulation and maximum power using WWAN technology.

- a. In the semi-anechoic chamber, EUT placed on the 0.8 m (below or equal 1 GHz) height of turn table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1 m to 4 m to find the maximum polar radiated power. The "Read Value" is the spectrum reading the maximum power value.
- b. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- c. Perform a field strength measurement and record the worse read value, is the field strength value via a spectrum reading obtained corrected for antenna factor, cable loss and pre-amplifier factor and then mathematically convert the measured field strength level to EIRP/ERP level.
- d. Following ANSI C63.26 section 5.5 and 5.2.7
- e. $EIRP (dBm) = E (dB\mu V/m) + 20\log(D) - 104.8$; where D is the measurement distance (in the far field region) in m.
- f. $ERP (dBm) = E (dB\mu V/m) + 20\log(D) - 104.8 - 2.15$; where D is the measurement distance (in the far field region) in m.

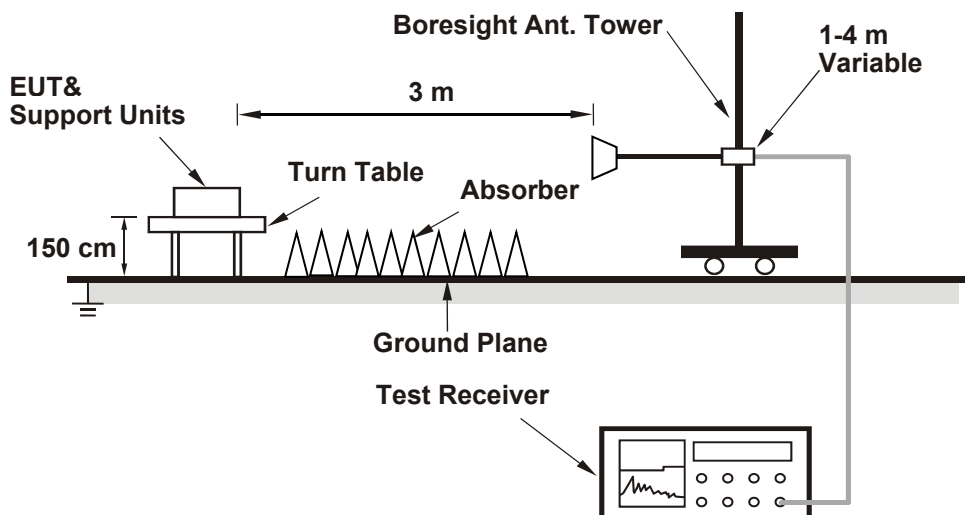
Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz/3 MHz. Set detector = average.
2. The amplitude of spurious emissions in the range 9 kHz to 30 MHz which are attenuated more than 20 dB below the permissible value need not be reported.

6.7 Radiated Spurious Emissions above 1GHz

6.7.1 Test Setup

For radiated emission above 1 GHz



For the actual test configuration, please refer to the attached file (Test Setup Photo).

6.7.2 Test Procedure

The EUT is configured by emulator to set data modulation and maximum power using WWAN technology.

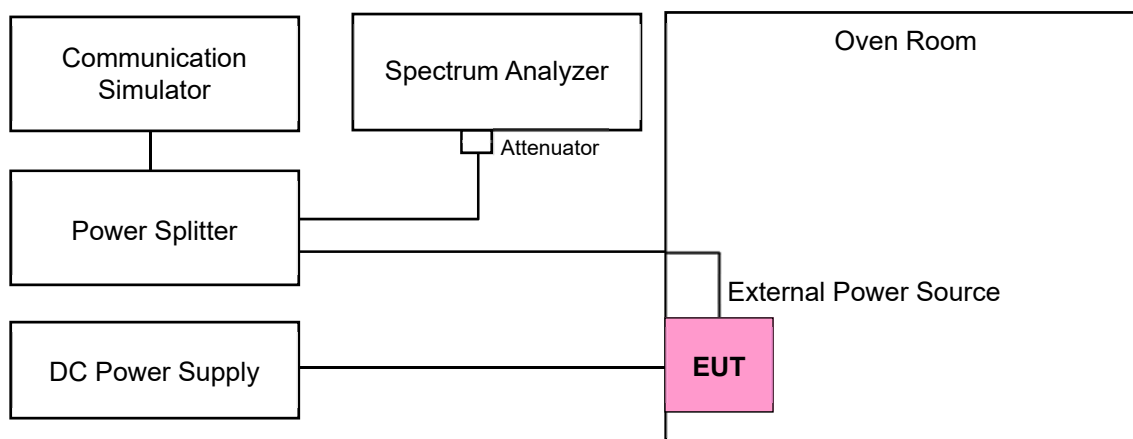
- In the semi-anechoic chamber, EUT placed on the 1.5 m height of turn table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1 m to 4 m to find the maximum polar radiated power. The "Read Value" is the spectrum reading the maximum power value.
- The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- Perform a field strength measurement and record the worse read value, is the field strength value via a spectrum reading obtained corrected for antenna factor, cable loss and pre-amplifier factor and then mathematically convert the measured field strength level to EIRP/ERP level.
- Following ANSI C63.26 section 5.5 and 5.2.7
- $EIRP (dBm) = E (dB\mu V/m) + 20\log(D) - 104.8$; where D is the measurement distance (in the far field region) in m.
- $ERP (dBm) = E (dB\mu V/m) + 20\log(D) - 104.8 - 2.15$; where D is the measurement distance (in the far field region) in m.

Note:

- The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz/3 MHz. Set detector = average.

6.8 Frequency Stability

6.8.1 Test Setup



6.8.2 Test Procedure

The EUT is configured by emulator to set data modulation and maximum power using WWAN technology.

- Device is placed at the oven room. The oven room could control the temperatures and humidity. Power warm up is at least 15 min and power applied should perform before recording frequency error.
- EUT is connected the external power supply to control the DC input power. The test voltage range is from minimum to maximum working voltage. Each step shall be record the frequency error rate.
- The temperature range step is 10 degrees in this test items. All temperature levels shall be hold the $\pm 0.5^{\circ}\text{C}$ during the measurement testing. The each temperature step shall be at least 0.5 hours, consider the EUT could be test under the stability condition.

Note: The frequency error was recorded frequency error from the communication simulator.

7 Test Results of Test Item

7.1 Maximum EIRP

Input Power:	3.87 Vdc	Environmental Conditions:	23°C, 74% RH	Tested By:	Noah Chang
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7.1.1 LTE Band 48

LTE Band 48 - Ant 5, Channel Bandwidth: 5 MHz

Modulation	RB Size	RB Offset	Measurement Conducted Power (dBm)		
			CH 55265	CH 55990	CH 56715
			3552.5 MHz	3625 MHz	3697.5 MHz
QPSK	1	0	21.81	21.73	21.50
	1	12	21.73	21.65	21.34
	1	24	21.72	21.63	21.48
	12	0	20.89	20.80	20.57
	12	6	20.84	20.69	20.54
	12	13	20.75	20.67	20.38
	25	0	20.80	20.50	20.43
16QAM	1	0	20.82	20.68	20.56
	1	12	20.75	20.56	20.41
	1	24	20.72	20.61	20.54
	12	0	19.93	19.80	19.63
	12	6	19.83	19.64	19.56
	12	13	19.75	19.65	19.39
	25	0	19.86	19.57	19.49
64QAM	1	0	19.84	19.65	19.48
	1	12	19.79	19.59	19.41
	1	24	19.74	19.61	19.57
	12	0	18.85	18.75	18.64
	12	6	18.91	18.68	18.57
	12	13	18.80	18.60	18.41
	25	0	18.82	18.55	18.42
256QAM	1	0	16.82	16.59	16.54
	1	12	16.72	16.70	16.56
	1	24	16.74	16.67	16.50
	12	0	16.75	16.60	16.50
	12	6	16.85	16.51	16.45
	12	13	16.73	16.69	16.55
	25	0	16.76	16.74	16.62

Output Power

Modulation	Minimum Cond. Power (dBm)	Maximum Cond. Power (dBm)	Minimum EIRP (dBm)	Maximum EIRP (dBm)	EIRP Limit (dBm)
QPSK	20.38	21.81	19.38	20.81	23.00
16QAM	19.39	20.82	18.39	19.82	23.00
64QAM	18.41	19.84	17.41	18.84	23.00
256QAM	16.45	16.85	15.45	15.85	23.00

Note: EIRP (dBm) = Cond. Power (dBm) + Antenna Gain (dBi) + Array Gain (if applicable)

LTE Band 48 - Ant 5, Channel Bandwidth: 10 MHz

Modulation	RB Size	RB Offset	Measurement Conducted Power (dBm)		
			CH 55290	CH 55990	CH 56690
			3555 MHz	3625 MHz	3695 MHz
QPSK	1	0	21.80	21.68	21.51
	1	24	21.77	21.67	21.40
	1	49	21.77	21.64	21.58
	25	0	20.90	20.74	20.64
	25	12	20.76	20.65	20.56
	25	25	20.75	20.58	20.34
	50	0	20.78	20.53	20.51
16QAM	1	0	20.82	20.60	20.56
	1	24	20.75	20.64	20.47
	1	49	20.77	20.65	20.50
	25	0	19.82	19.83	19.59
	25	12	19.78	19.62	19.50
	25	25	19.78	19.52	19.39
	50	0	19.86	19.55	19.48
64QAM	1	0	19.76	19.68	19.48
	1	24	19.74	19.60	19.41
	1	49	19.74	19.59	19.53
	25	0	18.83	18.79	18.62
	25	12	18.77	18.64	18.54
	25	25	18.72	18.58	18.39
	50	0	18.79	18.55	18.44
256QAM	1	0	16.77	16.59	16.60
	1	24	16.78	16.77	16.45
	1	49	16.72	16.61	16.44
	25	0	16.87	16.58	16.57
	25	12	16.88	16.62	16.41
	25	25	16.82	16.61	16.45
	50	0	16.83	16.81	16.66

Output Power

Modulation	Minimum Cond. Power (dBm)	Maximum Cond. Power (dBm)	Minimum EIRP (dBm)	Maximum EIRP (dBm)	EIRP Limit (dBm)
QPSK	20.34	21.8	19.34	20.8	23.00
16QAM	19.39	20.82	18.39	19.82	23.00
64QAM	18.39	19.76	17.39	18.76	23.00
256QAM	16.41	16.88	15.41	15.88	23.00

Note: EIRP (dBm) = Cond. Power (dBm) + Antenna Gain (dBi) + Array Gain (if applicable)

LTE Band 48 - Ant 5, Channel Bandwidth: 15 MHz, Output Power: Full Power

Modulation	RB Size	RB Offset	Measurement Conducted Power (dBm)		
			CH 55315	CH 55990	CH 56665
			3557.5 MHz	3625 MHz	3692.5 MHz
QPSK	1	0	21.93	21.72	21.51
	1	37	21.79	21.64	21.47
	1	74	21.84	21.65	21.57
	36	0	20.85	20.83	20.70
	36	19	20.84	20.70	20.58
	36	39	20.81	20.63	20.42
	75	0	20.82	20.58	20.57
16QAM	1	0	20.85	20.69	20.58
	1	37	20.79	20.75	20.56
	1	74	20.78	20.73	20.51
	36	0	19.92	19.67	19.53
	36	19	19.83	19.62	19.48
	36	39	19.84	19.63	19.54
	75	0	19.85	19.84	19.59
64QAM	1	0	19.86	19.73	19.61
	1	37	19.91	19.80	19.59
	1	74	19.84	19.65	19.59
	36	0	18.86	18.80	18.61
	36	19	18.83	18.70	18.58
	36	39	18.81	18.66	18.45
	75	0	18.79	18.69	18.56
256QAM	1	0	16.87	16.72	16.58
	1	37	16.82	16.65	16.64
	1	74	16.83	16.71	16.61
	36	0	16.83	16.69	16.59
	36	19	16.82	16.68	16.53
	36	39	16.75	16.70	16.53
	75	0	16.77	16.67	16.57

Output Power

Modulation	Minimum Cond. Power (dBm)	Maximum Cond. Power (dBm)	Minimum EIRP (dBm)	Maximum EIRP (dBm)	EIRP Limit (dBm)
QPSK	20.42	21.93	19.42	20.93	23.00
16QAM	19.48	20.85	18.48	19.85	23.00
64QAM	18.45	19.91	17.45	18.91	23.00
256QAM	16.53	16.87	15.53	15.87	23.00

Note: EIRP (dBm) = Cond. Power (dBm) + Antenna Gain (dBi) + Array Gain (if applicable)

LTE Band 48 - Ant 5, Channel Bandwidth: 20 MHz, Output Power: Full Power

Modulation	RB Size	RB Offset	Measurement Conducted Power (dBm)		
			CH 55340	CH 55990	CH 56640
			3560 MHz	3625 MHz	3690 MHz
QPSK	1	0	21.95	21.93	21.82
	1	50	21.91	21.86	21.75
	1	99	21.89	21.86	21.71
	50	0	20.78	20.68	20.60
	50	25	20.65	20.56	20.59
	50	50	20.57	20.46	20.50
	100	0	20.75	20.73	20.59
16QAM	1	0	20.91	20.69	20.63
	1	50	20.88	20.80	20.61
	1	99	20.87	20.76	20.56
	50	0	19.93	19.70	19.62
	50	25	19.91	19.68	19.53
	50	50	19.85	19.72	19.56
	100	0	19.95	19.86	19.69
64QAM	1	0	19.96	19.75	19.62
	1	50	19.93	19.81	19.59
	1	99	19.92	19.73	19.61
	50	0	18.92	18.86	18.61
	50	25	18.91	18.74	18.63
	50	50	18.88	18.69	18.46
	100	0	18.86	18.73	18.59
256QAM	1	0	16.91	16.77	16.68
	1	50	16.88	16.75	16.65
	1	99	16.87	16.78	16.66
	50	0	16.85	16.71	16.67
	50	25	16.83	16.72	16.63
	50	50	16.81	16.76	16.62
	100	0	16.82	16.69	16.65

Output Power					
Modulation	Minimum Cond. Power (dBm)	Maximum Cond. Power (dBm)	Minimum EIRP (dBm)	Maximum EIRP (dBm)	EIRP Limit (dBm)
QPSK	20.46	21.95	19.46	20.95	23.00
16QAM	19.53	20.91	18.53	19.91	23.00
64QAM	18.46	19.96	17.46	18.96	23.00
256QAM	16.62	16.91	15.62	15.91	23.00

Note: EIRP (dBm) = Cond. Power (dBm) + Antenna Gain (dBi) + Array Gain (if applicable)

LTE Band 48 - Ant 5, Channel Bandwidth: 15 MHz, Output Power: dBm/10 MHz

Modulation	RB Size	RB Offset	Measurement Conducted Power (dBm)		
			CH 55315	CH 55990	CH 56665
			3557.5 MHz	3625 MHz	3692.5 MHz
QPSK	1	0	21.78	21.59	21.41
	1	37	21.64	21.52	21.36
	1	74	21.72	21.53	21.46
	36	0	20.70	20.68	20.60
	36	19	20.74	20.57	20.43
	36	39	20.64	20.50	20.29
	75	0	20.66	20.48	20.41
16QAM	1	0	20.68	20.55	20.44
	1	37	20.64	20.61	20.43
	1	74	20.62	20.57	20.38
	36	0	19.77	19.50	19.42
	36	19	19.66	19.46	19.36
	36	39	19.70	19.46	19.39
	75	0	19.69	19.70	19.48
64QAM	1	0	19.76	19.61	19.47
	1	37	19.74	19.70	19.48
	1	74	19.71	19.48	19.43
	36	0	18.74	18.69	18.49
	36	19	18.70	18.53	18.43
	36	39	18.71	18.54	18.34
	75	0	18.65	18.56	18.43
256QAM	1	0	16.75	16.57	16.42
	1	37	16.65	16.53	16.51
	1	74	16.73	16.57	16.46
	36	0	16.69	16.57	16.48
	36	19	16.71	16.53	16.39
	36	39	16.65	16.58	16.38
	75	0	16.63	16.50	16.45

Output Power

Modulation	Minimum Cond. Power (dBm)	Maximum Cond. Power (dBm)	Minimum EIRP (dBm)	Maximum EIRP (dBm)	EIRP Limit (dBm)
QPSK	20.29	21.78	19.29	20.78	23.00
16QAM	19.36	20.68	18.36	19.68	23.00
64QAM	18.34	19.76	17.34	18.76	23.00
256QAM	16.38	16.75	15.38	15.75	23.00

Note: EIRP (dBm) = Cond. Power (dBm) + Antenna Gain (dBi) + Array Gain (if applicable)

LTE Band 48 - Ant 5, Channel Bandwidth: 20 MHz, Output Power: dBm/10 MHz

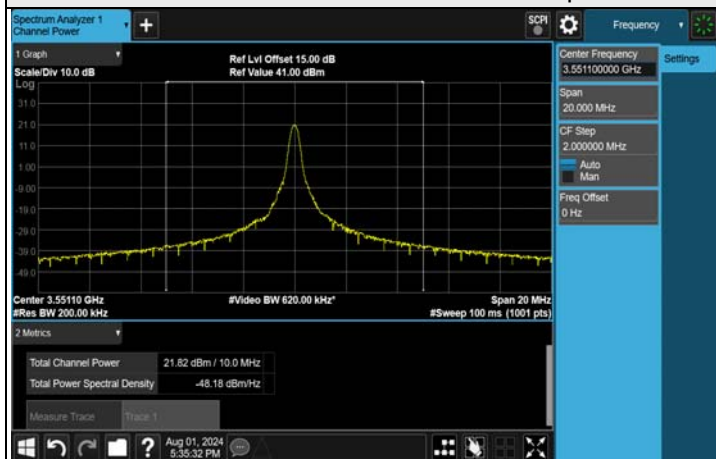
Modulation	RB Size	RB Offset	Measurement Conducted Power (dBm)		
			CH 55340	CH 55990	CH 56640
			3560 MHz	3625 MHz	3690 MHz
QPSK	1	0	21.82	21.80	21.68
	1	50	21.78	21.73	21.62
	1	99	21.75	21.73	21.58
	50	0	20.64	20.54	20.47
	50	25	20.51	20.43	20.45
	50	50	20.43	20.32	20.36
	100	0	20.61	20.59	20.45
16QAM	1	0	20.77	20.55	20.49
	1	50	20.74	20.67	20.47
	1	99	20.74	20.63	20.43
	50	0	19.79	19.57	19.49
	50	25	19.78	19.54	19.39
	50	50	19.72	19.59	19.43
	100	0	19.82	19.73	19.56
64QAM	1	0	19.83	19.61	19.48
	1	50	19.80	19.67	19.46
	1	99	19.79	19.60	19.47
	50	0	18.79	18.73	18.48
	50	25	18.78	18.60	18.50
	50	50	18.75	18.56	18.32
	100	0	18.73	18.60	18.46
256QAM	1	0	16.77	16.64	16.55
	1	50	16.74	16.61	16.52
	1	99	16.73	16.64	16.52
	50	0	16.71	16.58	16.53
	50	25	16.70	16.58	16.50
	50	50	16.67	16.63	16.49
	100	0	16.69	16.55	16.51

Output Power

Modulation	Minimum Cond. Power (dBm)	Maximum Cond. Power (dBm)	Minimum EIRP (dBm)	Maximum EIRP (dBm)	EIRP Limit (dBm)
QPSK	20.32	21.82	19.32	20.82	23.00
16QAM	19.39	20.77	18.39	19.77	23.00
64QAM	18.32	19.83	17.32	18.83	23.00
256QAM	16.49	16.77	15.49	15.77	23.00

Note: EIRP (dBm) = Cond. Power (dBm) + Antenna Gain (dBi) + Array Gain (if applicable)

Spectrum Plot of Worst Value



QPSK CH 55340 (3560 MHz)

Note: For the channel bandwidth is less than or equal to 10 MHz, the full power test data please refer to the power per 10 MHz corresponding to the channel bandwidth.

LTE Band 48 - Ant 7, Channel Bandwidth: 5 MHz

Modulation	RB Size	RB Offset	Measurement Conducted Power (dBm)		
			CH 55265	CH 55990	CH 56715
			3552.5 MHz	3625 MHz	3697.5 MHz
QPSK	1	0	21.05	20.86	20.76
	1	12	20.96	20.81	20.81
	1	24	20.92	20.83	20.77
	12	0	19.98	19.98	19.85
	12	6	19.95	19.88	19.91
	12	13	19.92	19.85	19.76
	25	0	19.91	19.98	19.76
16QAM	1	0	20.04	19.95	19.83
	1	12	19.90	19.86	19.79
	1	24	19.96	19.89	19.82
	12	0	18.97	18.98	18.81
	12	6	19.00	18.88	18.85
	12	13	18.93	18.91	18.73
	25	0	18.97	18.96	18.84
64QAM	1	0	19.03	18.90	18.76
	1	12	18.89	18.83	18.79
	1	24	18.89	18.86	18.79
	12	0	17.96	17.96	17.81
	12	6	17.93	17.94	17.87
	12	13	17.90	17.87	17.77
	25	0	17.94	17.95	17.75
256QAM	1	0	15.93	15.87	15.82
	1	12	16.01	15.90	15.75
	1	24	15.85	15.87	15.81
	12	0	15.87	15.79	15.71
	12	6	15.84	15.79	15.60
	12	13	15.84	15.73	15.54
	25	0	15.92	15.85	15.81

Output Power

Modulation	Minimum Cond. Power (dBm)	Maximum Cond. Power (dBm)	Minimum EIRP (dBm)	Maximum EIRP (dBm)	EIRP Limit (dBm)
QPSK	19.76	21.05	17.26	18.55	23.00
16QAM	18.73	20.04	16.23	17.54	23.00
64QAM	17.75	19.03	15.25	16.53	23.00
256QAM	15.54	16.01	13.04	13.51	23.00

Note: EIRP (dBm) = Cond. Power (dBm) + Antenna Gain (dBi) + Array Gain (if applicable)

LTE Band 48 - Ant 7, Channel Bandwidth: 10 MHz

Modulation	RB Size	RB Offset	Measurement Conducted Power (dBm)		
			CH 55290	CH 55990	CH 56690
			3555 MHz	3625 MHz	3695 MHz
QPSK	1	0	21.03	20.93	20.82
	1	24	21.01	20.91	20.73
	1	49	20.90	20.87	20.83
	25	0	20.03	20.01	19.83
	25	12	19.98	19.92	19.87
	25	25	20.00	19.83	19.87
	50	0	19.89	20.05	19.85
16QAM	1	0	20.03	19.94	19.77
	1	24	20.07	19.83	19.82
	1	49	19.99	19.87	19.83
	25	0	19.01	19.02	18.85
	25	12	18.98	18.94	18.81
	25	25	18.92	18.80	18.78
	50	0	18.94	19.04	18.81
64QAM	1	0	19.05	18.94	18.80
	1	24	19.05	18.90	18.80
	1	49	18.91	18.86	18.82
	25	0	17.99	17.98	17.80
	25	12	18.02	17.90	17.78
	25	25	17.96	17.85	17.81
	50	0	17.98	18.01	17.78
256QAM	1	0	15.88	15.81	15.78
	1	24	15.95	15.98	15.86
	1	49	15.90	15.91	15.83
	25	0	15.95	15.87	15.75
	25	12	15.74	15.75	15.69
	25	25	15.77	15.82	15.51
	50	0	15.88	15.90	15.83

Output Power

Modulation	Minimum Cond. Power (dBm)	Maximum Cond. Power (dBm)	Minimum EIRP (dBm)	Maximum EIRP (dBm)	EIRP Limit (dBm)
QPSK	19.83	21.03	17.33	18.53	23.00
16QAM	18.78	20.07	16.28	17.57	23.00
64QAM	17.78	19.05	15.28	16.55	23.00
256QAM	15.51	15.98	13.01	13.48	23.00

Note: EIRP (dBm) = Cond. Power (dBm) + Antenna Gain (dBi) + Array Gain (if applicable)

LTE Band 48 - Ant 7, Channel Bandwidth: 15 MHz, Output Power: Full Power

Modulation	RB Size	RB Offset	Measurement Conducted Power (dBm)		
			CH 55315	CH 55990	CH 56665
			3557.5 MHz	3625 MHz	3692.5 MHz
QPSK	1	0	21.03	20.98	20.84
	1	37	21.05	20.95	20.78
	1	74	21.05	20.90	20.79
	36	0	20.07	20.08	19.95
	36	19	20.08	19.92	19.88
	36	39	19.96	19.93	19.79
	75	0	20.05	20.04	19.87
16QAM	1	0	20.01	19.85	19.82
	1	37	20.01	19.95	19.84
	1	74	19.88	19.90	19.89
	36	0	18.93	18.95	18.72
	36	19	18.85	18.74	18.66
	36	39	18.86	18.75	18.67
	75	0	18.99	18.98	18.85
64QAM	1	0	18.98	18.83	18.71
	1	37	18.92	18.91	18.76
	1	74	18.82	18.71	18.70
	36	0	17.95	17.82	17.69
	36	19	17.94	17.91	17.80
	36	39	17.81	17.82	17.79
	75	0	17.91	17.89	17.82
256QAM	1	0	16.06	16.01	15.94
	1	37	16.04	15.97	15.96
	1	74	16.06	15.98	15.92
	36	0	16.03	16.03	15.88
	36	19	16.05	16.04	15.99
	36	39	16.00	15.99	15.93
	75	0	16.09	15.93	15.80

Output Power

Modulation	Minimum Cond. Power (dBm)	Maximum Cond. Power (dBm)	Minimum EIRP (dBm)	Maximum EIRP (dBm)	EIRP Limit (dBm)
QPSK	19.79	21.05	17.29	18.55	23.00
16QAM	18.66	20.01	16.16	17.51	23.00
64QAM	17.69	18.98	15.19	16.48	23.00
256QAM	15.8	16.09	13.3	13.59	23.00

Note: EIRP (dBm) = Cond. Power (dBm) + Antenna Gain (dBi) + Array Gain (if applicable)

LTE Band 48 - Ant 7, Channel Bandwidth: 20 MHz, Output Power: Full Power

Modulation	RB Size	RB Offset	Measurement Conducted Power (dBm)		
			CH 55340	CH 55990	CH 56640
			3560 MHz	3625 MHz	3690 MHz
QPSK	1	0	21.12	21.03	20.91
	1	50	21.07	20.99	20.87
	1	99	21.05	20.96	20.89
	50	0	20.11	20.08	19.98
	50	25	20.09	20.02	19.95
	50	50	20.05	19.99	19.88
	100	0	20.08	20.07	19.91
16QAM	1	0	20.05	19.95	19.90
	1	50	20.03	20.03	19.91
	1	99	19.98	19.98	19.92
	50	0	19.03	18.95	18.81
	50	25	18.92	18.83	18.71
	50	50	18.91	18.85	18.69
	100	0	19.01	18.98	18.89
64QAM	1	0	18.98	18.88	18.76
	1	50	18.95	18.94	18.76
	1	99	18.89	18.81	18.70
	50	0	17.96	17.87	17.76
	50	25	17.95	17.93	17.85
	50	50	17.89	17.83	17.81
	100	0	17.98	17.91	17.82
256QAM	1	0	16.16	16.11	16.03
	1	50	16.13	16.07	15.99
	1	99	16.08	16.07	15.96
	50	0	16.12	16.08	15.97
	50	25	16.11	16.10	16.07
	50	50	16.07	16.03	15.97
	100	0	16.09	16.00	15.87

Output Power

Modulation	Minimum Cond. Power (dBm)	Maximum Cond. Power (dBm)	Minimum EIRP (dBm)	Maximum EIRP (dBm)	EIRP Limit (dBm)
QPSK	19.88	21.12	17.38	18.62	23.00
16QAM	18.69	20.05	16.19	17.55	23.00
64QAM	17.76	18.98	15.26	16.48	23.00
256QAM	15.87	16.16	13.37	13.66	23.00

Note: EIRP (dBm) = Cond. Power (dBm) + Antenna Gain (dBi) + Array Gain (if applicable)

LTE Band 48 - Ant 7, Channel Bandwidth: 15 MHz, Output Power: dBm/10 MHz

Modulation	RB Size	RB Offset	Measurement Conducted Power (dBm)		
			CH 55315	CH 55990	CH 56665
			3557.5 MHz	3625 MHz	3692.5 MHz
QPSK	1	0	20.88	20.86	20.69
	1	37	20.94	20.80	20.65
	1	74	20.92	20.73	20.64
	36	0	19.96	19.94	19.79
	36	19	19.94	19.75	19.72
	36	39	19.81	19.81	19.63
	75	0	19.95	19.90	19.76
16QAM	1	0	19.90	19.73	19.72
	1	37	19.90	19.83	19.69
	1	74	19.73	19.73	19.75
	36	0	18.82	18.85	18.62
	36	19	18.69	18.63	18.49
	36	39	18.75	18.65	18.57
	75	0	18.83	18.86	18.71
64QAM	1	0	18.85	18.67	18.61
	1	37	18.75	18.74	18.64
	1	74	18.66	18.55	18.60
	36	0	17.80	17.69	17.52
	36	19	17.82	17.74	17.65
	36	39	17.67	17.70	17.62
	75	0	17.76	17.75	17.70
256QAM	1	0	15.93	15.90	15.82
	1	37	15.88	15.85	15.82
	1	74	15.90	15.83	15.82
	36	0	15.90	15.86	15.77
	36	19	15.89	15.93	15.85
	36	39	15.89	15.83	15.76
	75	0	15.98	15.81	15.68

Output Power

Modulation	Minimum Cond. Power (dBm)	Maximum Cond. Power (dBm)	Minimum EIRP (dBm)	Maximum EIRP (dBm)	EIRP Limit (dBm)
QPSK	19.63	20.94	17.13	18.44	23.00
16QAM	18.49	19.9	15.99	17.4	23.00
64QAM	17.52	18.85	15.02	16.35	23.00
256QAM	15.68	15.98	13.18	13.48	23.00

Note: EIRP (dBm) = Cond. Power (dBm) + Antenna Gain (dBi) + Array Gain (if applicable)

LTE Band 48 - Ant 7, Channel Bandwidth: 20 MHz, Output Power: dBm/10 MHz

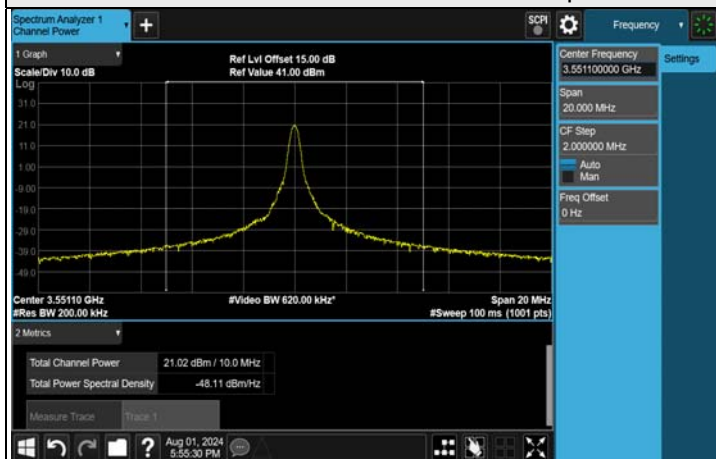
Modulation	RB Size	RB Offset	Measurement Conducted Power (dBm)		
			CH 55340	CH 55990	CH 56640
			3560 MHz	3625 MHz	3690 MHz
QPSK	1	0	21.02	20.86	20.78
	1	50	20.92	20.82	20.76
	1	99	20.88	20.86	20.73
	50	0	19.95	19.91	19.86
	50	25	19.94	19.88	19.81
	50	50	19.91	19.86	19.77
	100	0	19.96	19.96	19.80
16QAM	1	0	19.89	19.79	19.78
	1	50	19.89	19.87	19.78
	1	99	19.84	19.87	19.75
	50	0	18.90	18.82	18.68
	50	25	18.81	18.68	18.56
	50	50	18.74	18.73	18.56
	100	0	18.88	18.85	18.73
64QAM	1	0	18.82	18.78	18.64
	1	50	18.82	18.83	18.60
	1	99	18.75	18.66	18.56
	50	0	17.81	17.76	17.61
	50	25	17.84	17.76	17.70
	50	50	17.72	17.66	17.69
	100	0	17.82	17.74	17.67
256QAM	1	0	16.03	15.97	15.93
	1	50	16.01	15.97	15.82
	1	99	15.96	15.94	15.85
	50	0	15.96	15.93	15.83
	50	25	15.98	15.96	15.92
	50	50	15.90	15.90	15.83
	100	0	15.98	15.88	15.77

Output Power

Modulation	Minimum Cond. Power (dBm)	Maximum Cond. Power (dBm)	Minimum EIRP (dBm)	Maximum EIRP (dBm)	EIRP Limit (dBm)
QPSK	19.77	21.02	17.27	18.52	23.00
16QAM	18.56	19.89	16.06	17.39	23.00
64QAM	17.61	18.83	15.11	16.33	23.00
256QAM	15.77	16.03	13.27	13.53	23.00

Note: EIRP (dBm) = Cond. Power (dBm) + Antenna Gain (dBi) + Array Gain (if applicable)

Spectrum Plot of Worst Value



QPSK CH 55340 (3560 MHz)

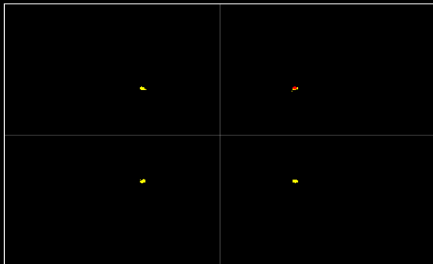
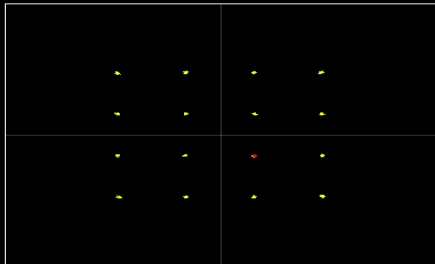
Note: For the channel bandwidth is less than or equal to 10 MHz, the full power test data please refer to the power per 10 MHz corresponding to the channel bandwidth.

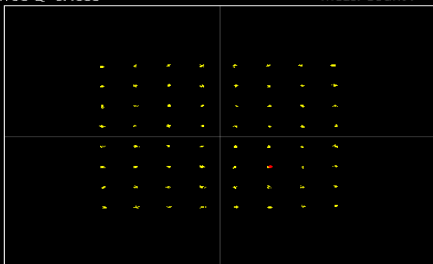
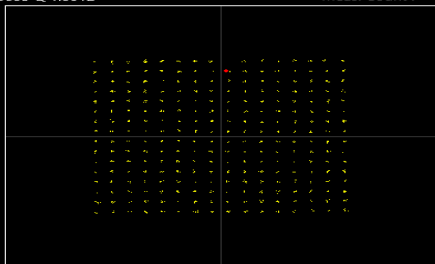
7.2 Modulation Characteristics

Input Power:	3.87 Vdc	Environmental Conditions:	22°C, 68% RH	Tested By:	Noah Chang
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7.2.1 LTE Band 48

LTE Band 48 - Ant 5, Channel Bandwidth: 20 MHz

Fundamental > Constellation 31 Symbol I 0.7079 Q 0.7188 Meas. Count : 1/ 1  <table><tr><td>EVM</td><td>Avg. 1.26</td><td>Max. 1.26</td><td>Min. 1.26 %(rms)</td><td>Limit ≤ 17.5 %(rms)</td></tr><tr><td>Peak Vector Error</td><td>21.91</td><td>21.91</td><td>21.91 %</td><td></td></tr><tr><td>Carrier Leakage</td><td>-47.27</td><td>-47.27</td><td>-47.27 dBc</td><td></td></tr><tr><td>IQ Imbalance</td><td>100.38</td><td>100.38</td><td>100.38 %(I/Q)</td><td></td></tr></table>	EVM	Avg. 1.26	Max. 1.26	Min. 1.26 %(rms)	Limit ≤ 17.5 %(rms)	Peak Vector Error	21.91	21.91	21.91 %		Carrier Leakage	-47.27	-47.27	-47.27 dBc		IQ Imbalance	100.38	100.38	100.38 %(I/Q)		Fundamental > Constellation 31 Symbol I 0.3275 Q -0.3162 Meas. Count : 1/ 1  <table><tr><td>EVM</td><td>Avg. 1.48</td><td>Max. 1.48</td><td>Min. 1.48 %(rms)</td><td>Limit ≤ 12.5 %(rms)</td></tr><tr><td>Peak Vector Error</td><td>29.88</td><td>29.88</td><td>29.88 %</td><td></td></tr><tr><td>Carrier Leakage</td><td>-45.85</td><td>-45.85</td><td>-45.85 dBc</td><td></td></tr><tr><td>IQ Imbalance</td><td>100.37</td><td>100.37</td><td>100.37 %(I/Q)</td><td></td></tr></table>	EVM	Avg. 1.48	Max. 1.48	Min. 1.48 %(rms)	Limit ≤ 12.5 %(rms)	Peak Vector Error	29.88	29.88	29.88 %		Carrier Leakage	-45.85	-45.85	-45.85 dBc		IQ Imbalance	100.37	100.37	100.37 %(I/Q)	
EVM	Avg. 1.26	Max. 1.26	Min. 1.26 %(rms)	Limit ≤ 17.5 %(rms)																																					
Peak Vector Error	21.91	21.91	21.91 %																																						
Carrier Leakage	-47.27	-47.27	-47.27 dBc																																						
IQ Imbalance	100.38	100.38	100.38 %(I/Q)																																						
EVM	Avg. 1.48	Max. 1.48	Min. 1.48 %(rms)	Limit ≤ 12.5 %(rms)																																					
Peak Vector Error	29.88	29.88	29.88 %																																						
Carrier Leakage	-45.85	-45.85	-45.85 dBc																																						
IQ Imbalance	100.37	100.37	100.37 %(I/Q)																																						
QPSK CH 55990 (3625 MHz)	16QAM CH 55990 (3625 MHz)																																								

Fundamental > Constellation 31 Symbol I 0.4798 Q -0.4688 Meas. Count : 1/ 1  <table><tr><td>EVM</td><td>Avg. 1.46</td><td>Max. 1.46</td><td>Min. 1.46 %(rms)</td><td>Limit ≤ 8.0 %(rms)</td></tr><tr><td>Peak Vector Error</td><td>18.71</td><td>18.71</td><td>18.71 %</td><td></td></tr><tr><td>Carrier Leakage</td><td>-43.42</td><td>-43.42</td><td>-43.42 dBc</td><td></td></tr><tr><td>IQ Imbalance</td><td>100.35</td><td>100.35</td><td>100.35 %(I/Q)</td><td></td></tr></table>	EVM	Avg. 1.46	Max. 1.46	Min. 1.46 %(rms)	Limit ≤ 8.0 %(rms)	Peak Vector Error	18.71	18.71	18.71 %		Carrier Leakage	-43.42	-43.42	-43.42 dBc		IQ Imbalance	100.35	100.35	100.35 %(I/Q)		Fundamental > Constellation 31 Symbol I 0.0605 Q 1.0012 Meas. Count : 1/ 1  <table><tr><td>EVM</td><td>Avg. 1.41</td><td>Max. 1.41</td><td>Min. 1.41 %(rms)</td><td>Limit</td></tr><tr><td>Peak Vector Error</td><td>9.19</td><td>9.19</td><td>9.19 %</td><td></td></tr><tr><td>Carrier Leakage</td><td>-42.45</td><td>-42.45</td><td>-42.45 dBc</td><td></td></tr><tr><td>IQ Imbalance</td><td>100.36</td><td>100.36</td><td>100.36 %(I/Q)</td><td></td></tr></table>	EVM	Avg. 1.41	Max. 1.41	Min. 1.41 %(rms)	Limit	Peak Vector Error	9.19	9.19	9.19 %		Carrier Leakage	-42.45	-42.45	-42.45 dBc		IQ Imbalance	100.36	100.36	100.36 %(I/Q)	
EVM	Avg. 1.46	Max. 1.46	Min. 1.46 %(rms)	Limit ≤ 8.0 %(rms)																																					
Peak Vector Error	18.71	18.71	18.71 %																																						
Carrier Leakage	-43.42	-43.42	-43.42 dBc																																						
IQ Imbalance	100.35	100.35	100.35 %(I/Q)																																						
EVM	Avg. 1.41	Max. 1.41	Min. 1.41 %(rms)	Limit																																					
Peak Vector Error	9.19	9.19	9.19 %																																						
Carrier Leakage	-42.45	-42.45	-42.45 dBc																																						
IQ Imbalance	100.36	100.36	100.36 %(I/Q)																																						
64QAM CH 55990 (3625 MHz)	256QAM CH 55990 (3625 MHz)																																								

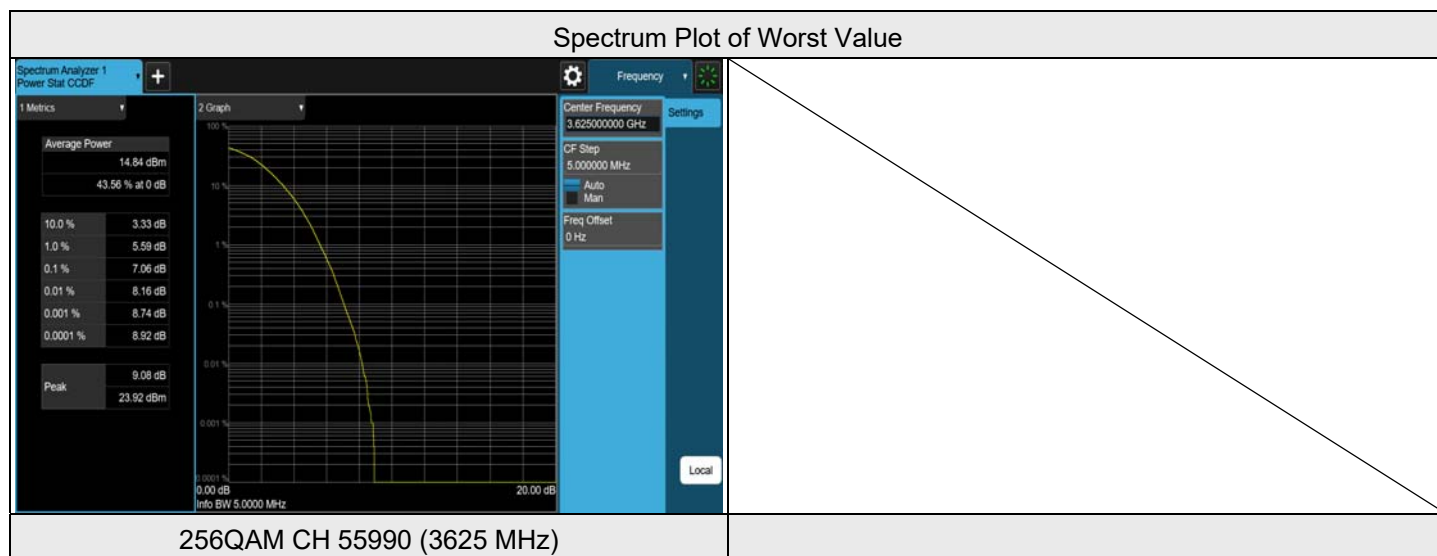
7.3 Peak to Average Ratio

Input Power:	3.87 Vdc	Environmental Conditions:	22°C, 68% RH	Tested By:	Noah Chang
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7.3.1 LTE Band 48

LTE Band 48 - Ant 5, Channel Bandwidth: 5 MHz

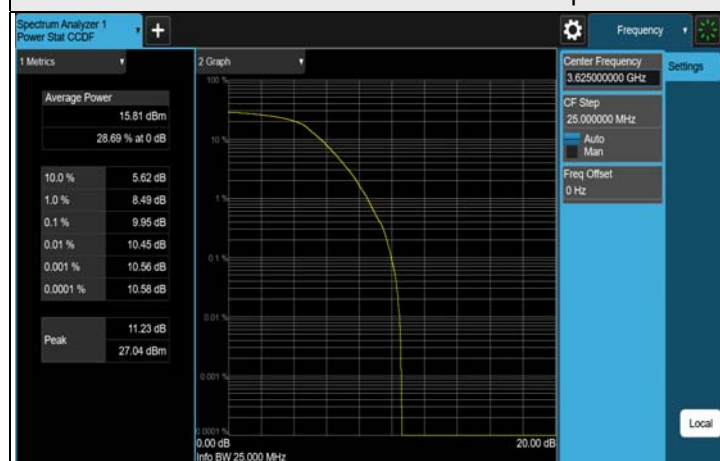
Modulation	Channel	Frequency (MHz)	Measurement Value(dB)	Limit (dB)	Result
QPSK	55265	3552.5	6.06	13	PASS
QPSK	55990	3625	5.53	13	PASS
QPSK	56715	3697.5	6.10	13	PASS
16QAM	55265	3552.5	6.81	13	PASS
16QAM	55990	3625	6.66	13	PASS
16QAM	56715	3697.5	6.92	13	PASS
64QAM	55265	3552.5	6.96	13	PASS
64QAM	55990	3625	7.02	13	PASS
64QAM	56715	3697.5	6.81	13	PASS
256QAM	55265	3552.5	7.05	13	PASS
256QAM	55990	3625	7.06	13	PASS
256QAM	56715	3697.5	6.91	13	PASS



LTE Band 48 - Ant 5, Channel Bandwidth: 15 MHz

Modulation	Channel	Frequency (MHz)	Measurement Value(dB)	Limit (dB)	Result
QPSK	55315	3557.5	5.78	13	PASS
QPSK	55990	3625	9.95	13	PASS
QPSK	56665	3692.5	5.91	13	PASS
16QAM	55315	3557.5	7.01	13	PASS
16QAM	55990	3625	6.34	13	PASS
16QAM	56665	3692.5	6.68	13	PASS
64QAM	55315	3557.5	6.92	13	PASS
64QAM	55990	3625	6.63	13	PASS
64QAM	56665	3692.5	6.84	13	PASS
256QAM	55315	3557.5	7.08	13	PASS
256QAM	55990	3625	7.24	13	PASS
256QAM	56665	3692.5	7.26	13	PASS

Spectrum Plot of Worst Value

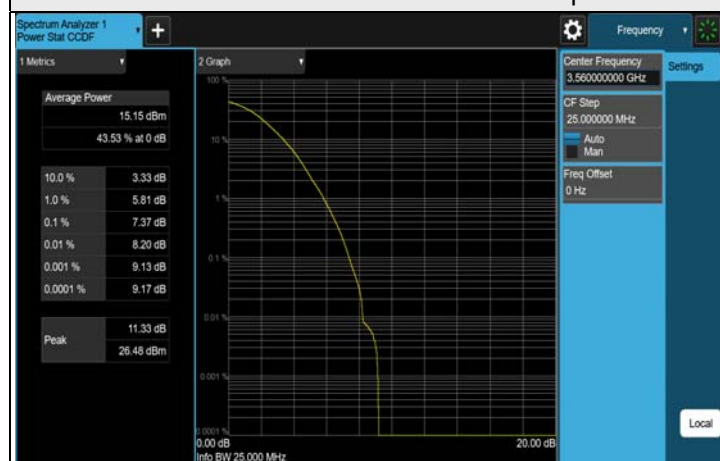


QPSK CH 55990 (3625 MHz)

LTE Band 48 - Ant 5, Channel Bandwidth: 20 MHz

Modulation	Channel	Frequency (MHz)	Measurement Value(dB)	Limit (dB)	Result
QPSK	55340	3560	5.92	13	PASS
QPSK	55990	3625	6.34	13	PASS
QPSK	56640	3690	6.36	13	PASS
16QAM	55340	3560	6.40	13	PASS
16QAM	55990	3625	6.34	13	PASS
16QAM	56640	3690	6.71	13	PASS
64QAM	55340	3560	6.87	13	PASS
64QAM	55990	3625	6.91	13	PASS
64QAM	56640	3690	6.92	13	PASS
256QAM	55340	3560	7.37	13	PASS
256QAM	55990	3625	7.09	13	PASS
256QAM	56640	3690	7.05	13	PASS

Spectrum Plot of Worst Value



256QAM CH 55340 (3560 MHz)

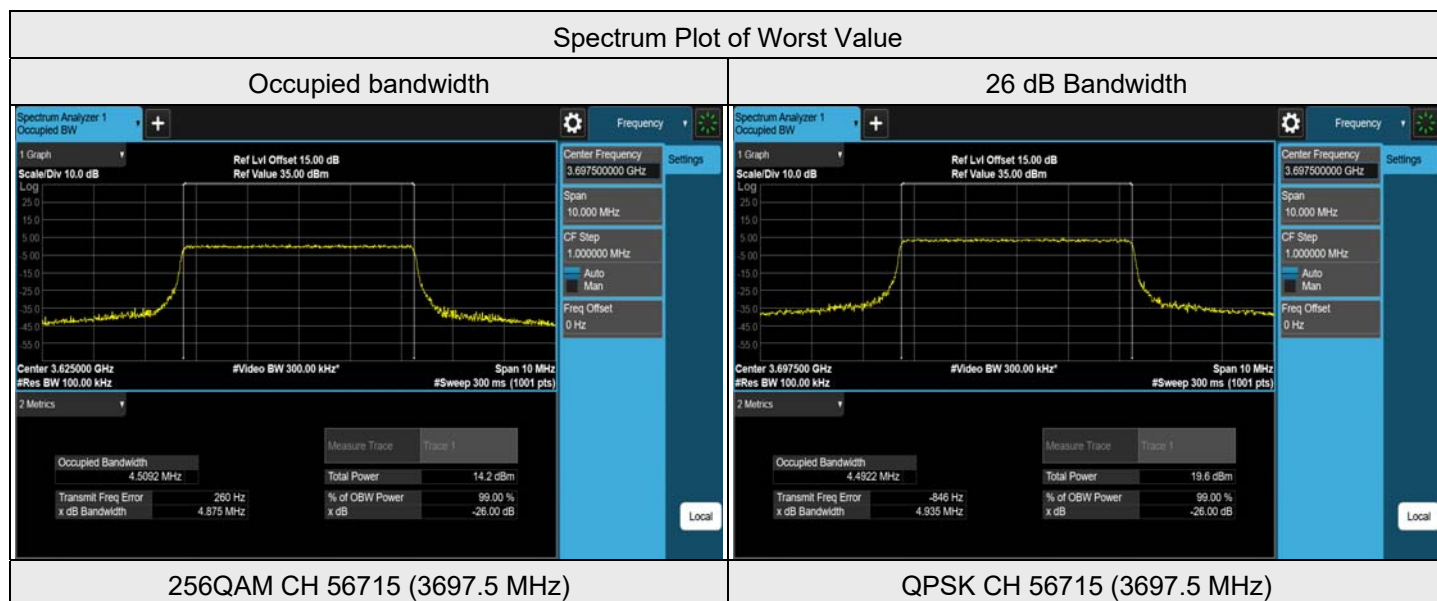
7.4 Bandwidth

Input Power:	3.87 Vdc	Environmental Conditions:	22°C, 68% RH	Tested By:	Noah Chang
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7.4.1 LTE Band 48

LTE Band 48 - Ant 5, Channel Bandwidth: 5 MHz

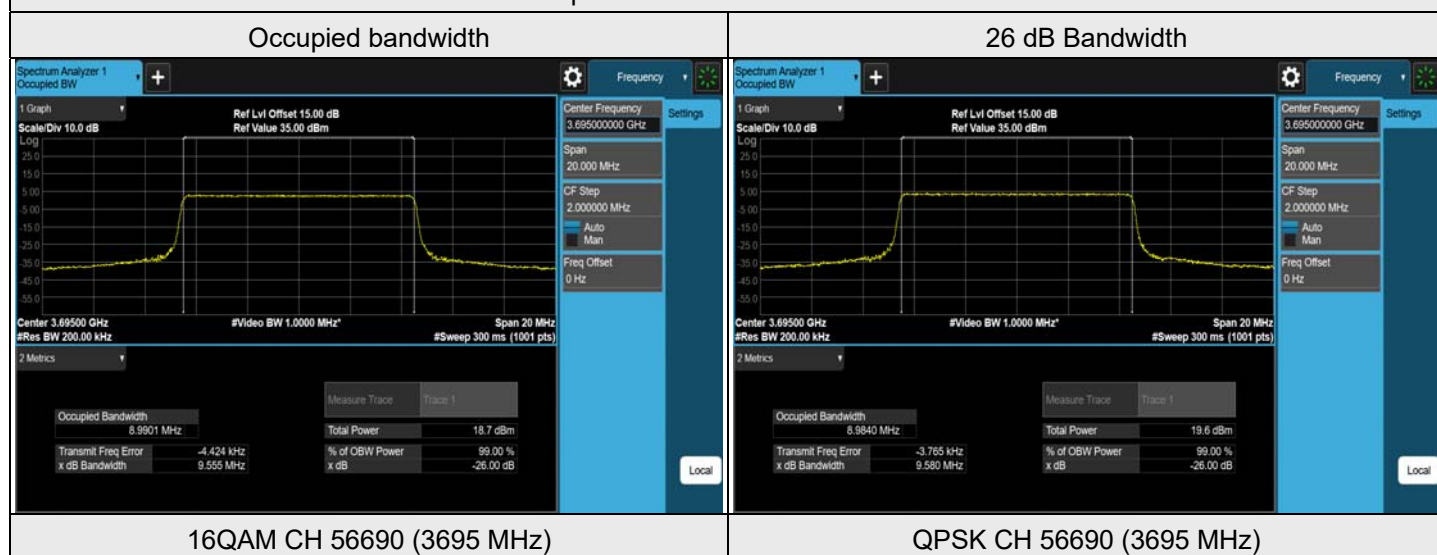
Modulation	Channel	Frequency (MHz)	Occupied Bandwidth (MHz)	26 dB Bandwidth (MHz)
QPSK	55265	3552.5	4.4886	4.838
QPSK	55990	3625	4.4918	4.902
QPSK	56715	3697.5	4.4922	4.935
16QAM	55265	3552.5	4.5020	4.867
16QAM	55990	3625	4.4869	4.858
16QAM	56715	3697.5	4.4892	4.872
64QAM	55265	3552.5	4.5009	4.865
64QAM	55990	3625	4.4932	4.853
64QAM	56715	3697.5	4.5030	4.898
256QAM	55265	3552.5	4.4956	4.862
256QAM	55990	3625	4.4896	4.890
256QAM	56715	3697.5	4.5092	4.875



LTE Band 48 - Ant 5, Channel Bandwidth: 10 MHz

Modulation	Channel	Frequency (MHz)	Occupied Bandwidth (MHz)	26 dB Bandwidth (MHz)
QPSK	55290	3555	8.9785	9.542
QPSK	55990	3625	8.9773	9.539
QPSK	56690	3695	8.9840	9.580
16QAM	55290	3555	8.9822	9.553
16QAM	55990	3625	8.9743	9.565
16QAM	56690	3695	8.9901	9.555
64QAM	55290	3555	8.9811	9.523
64QAM	55990	3625	8.9699	9.522
64QAM	56690	3695	8.9817	9.536
256QAM	55290	3555	8.9757	9.553
256QAM	55990	3625	8.9770	9.523
256QAM	56690	3695	8.9788	9.512

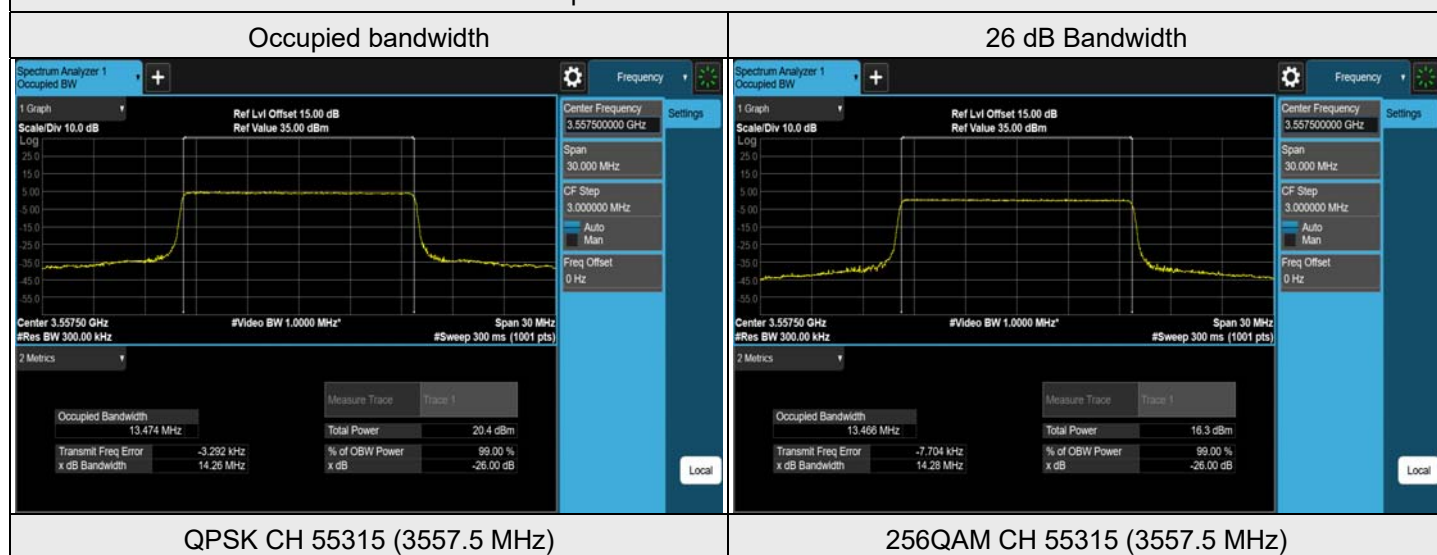
Spectrum Plot of Worst Value



LTE Band 48 - Ant 5, Channel Bandwidth: 15 MHz

Modulation	Channel	Frequency (MHz)	Occupied Bandwidth (MHz)	26 dB Bandwidth (MHz)
QPSK	55315	3557.5	13.4744	14.260
QPSK	55990	3625	13.4639	14.246
QPSK	56665	3692.5	13.4506	14.247
16QAM	55315	3557.5	13.4578	14.264
16QAM	55990	3625	13.4584	14.235
16QAM	56665	3692.5	13.4596	14.257
64QAM	55315	3557.5	13.4700	14.249
64QAM	55990	3625	13.4714	14.246
64QAM	56665	3692.5	13.4582	14.233
256QAM	55315	3557.5	13.4660	14.279
256QAM	55990	3625	13.4598	14.233
256QAM	56665	3692.5	13.4679	14.272

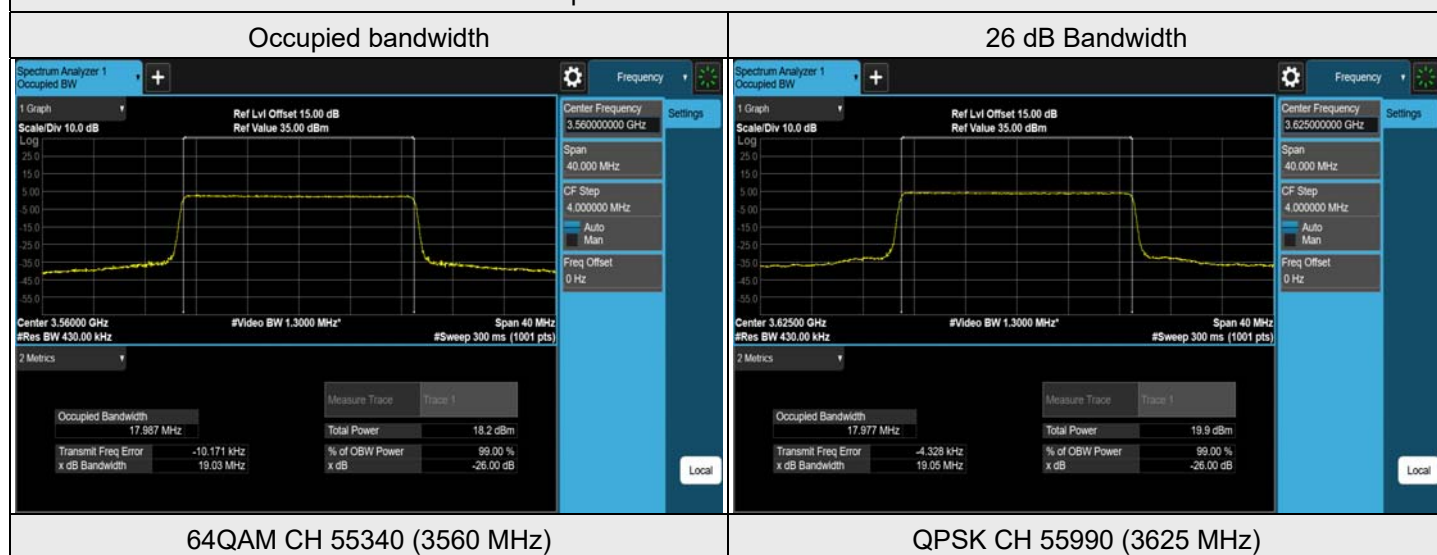
Spectrum Plot of Worst Value



LTE Band 48 - Ant 5, Channel Bandwidth: 20 MHz

Modulation	Channel	Frequency (MHz)	Occupied Bandwidth (MHz)	26 dB Bandwidth (MHz)
QPSK	55340	3560	17.9780	19.050
QPSK	55990	3625	17.9774	19.054
QPSK	56640	3690	17.9648	19.034
16QAM	55340	3560	17.9684	19.053
16QAM	55990	3625	17.9782	19.028
16QAM	56640	3690	17.9721	19.033
64QAM	55340	3560	17.9868	19.025
64QAM	55990	3625	17.9666	19.025
64QAM	56640	3690	17.9585	19.029
256QAM	55340	3560	17.9666	19.030
256QAM	55990	3625	17.9647	19.031
256QAM	56640	3690	17.9707	19.039

Spectrum Plot of Worst Value

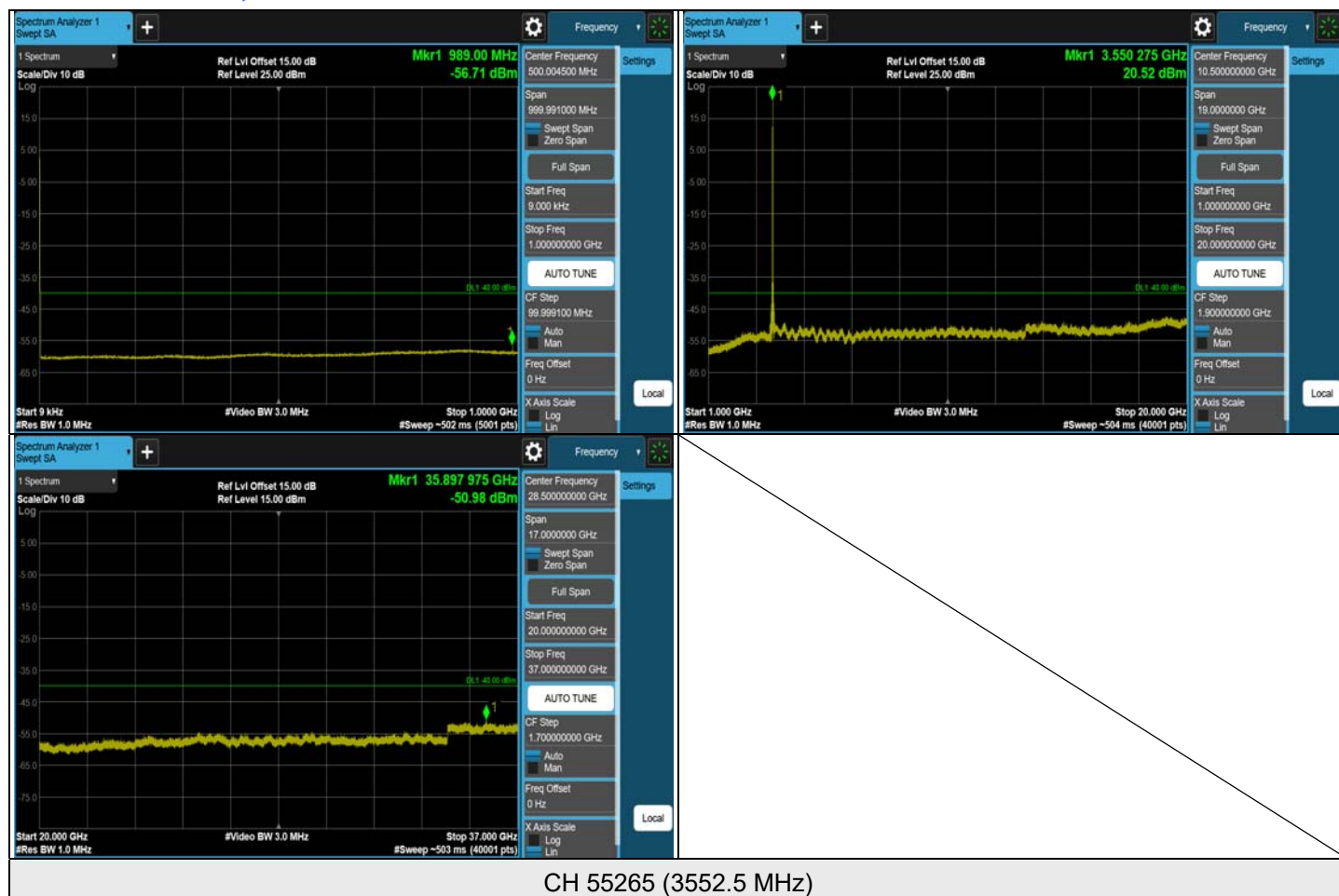


7.5 Conducted Spurious Emissions

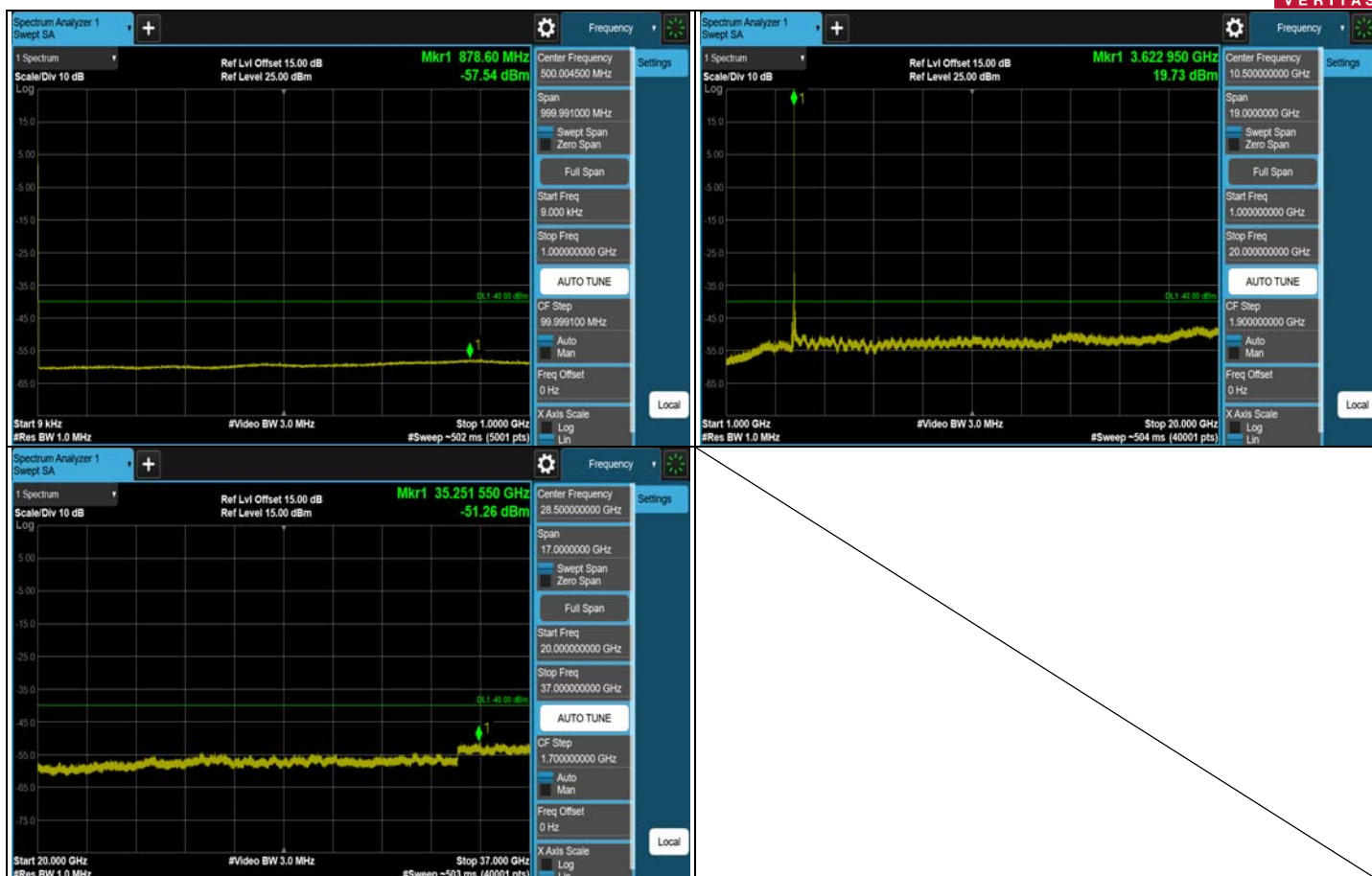
Input Power:	3.87 Vdc	Environmental Conditions:	22°C, 68% RH	Tested By:	Noah Chang
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7.5.1 LTE Band 48

LTE Band 48 - Ant 5, Channel Bandwidth: 5 MHz

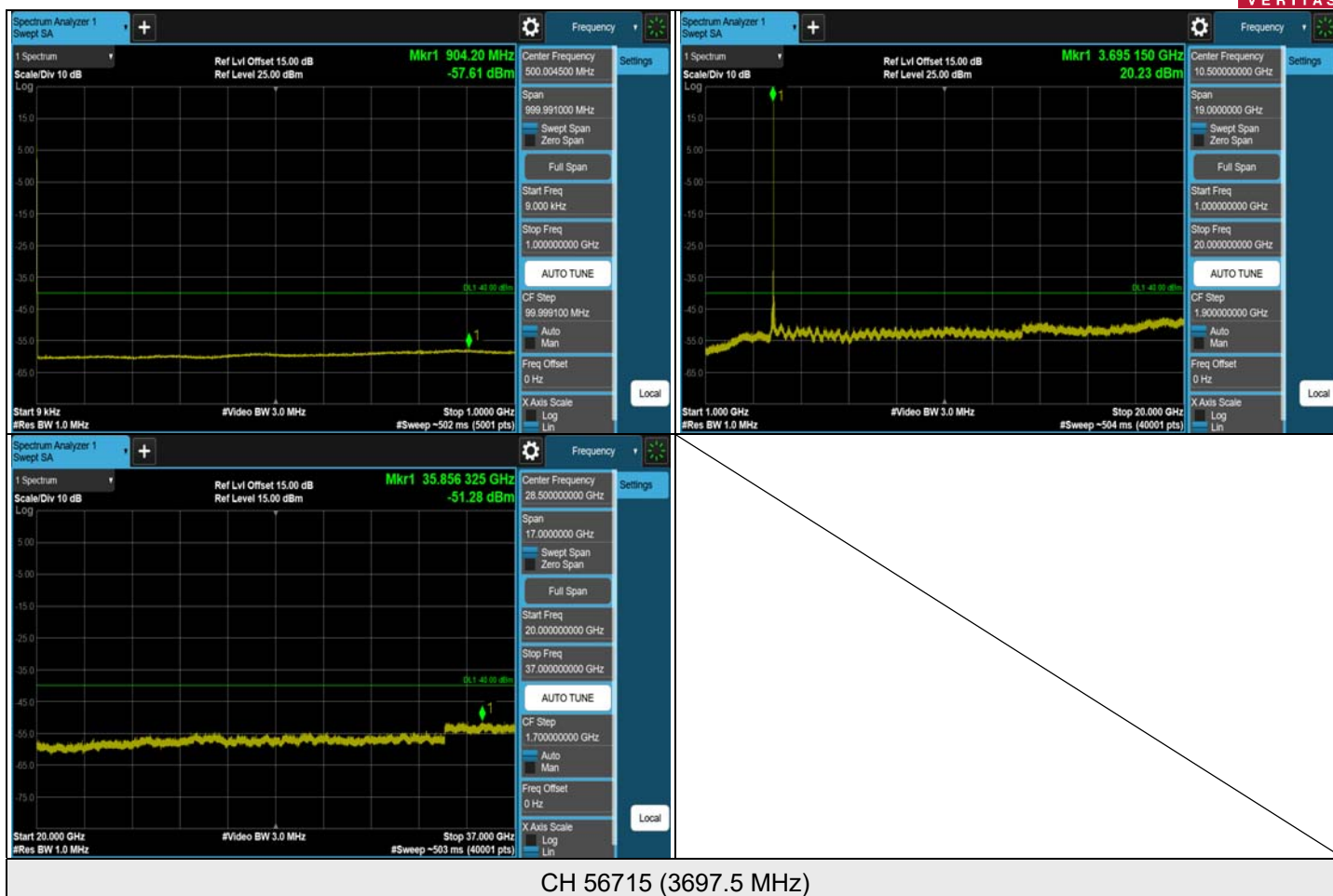


Note: The signal at 9 kHz is IF signal from spectrum analyzer.



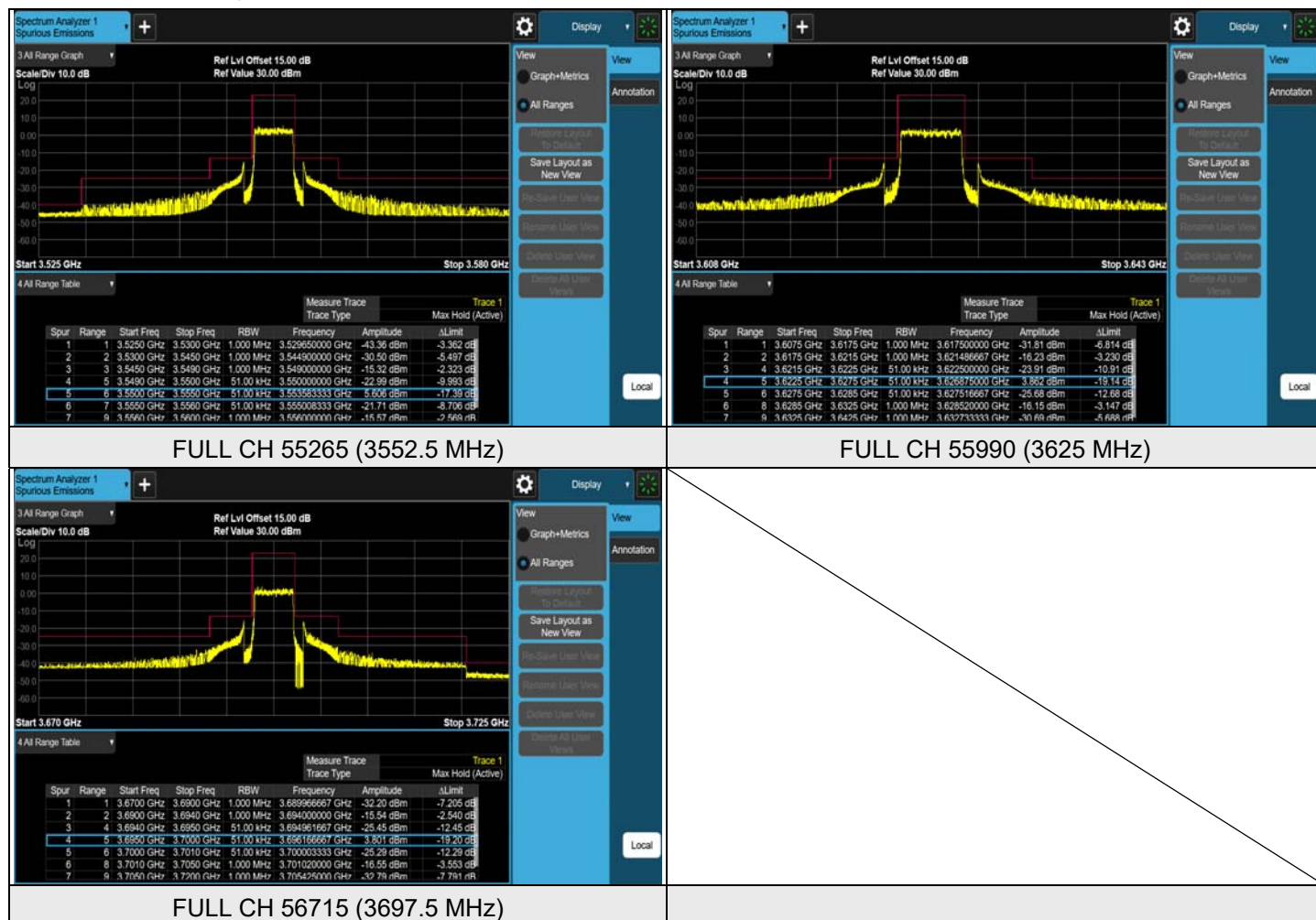
CH 55990 (3625 MHz)

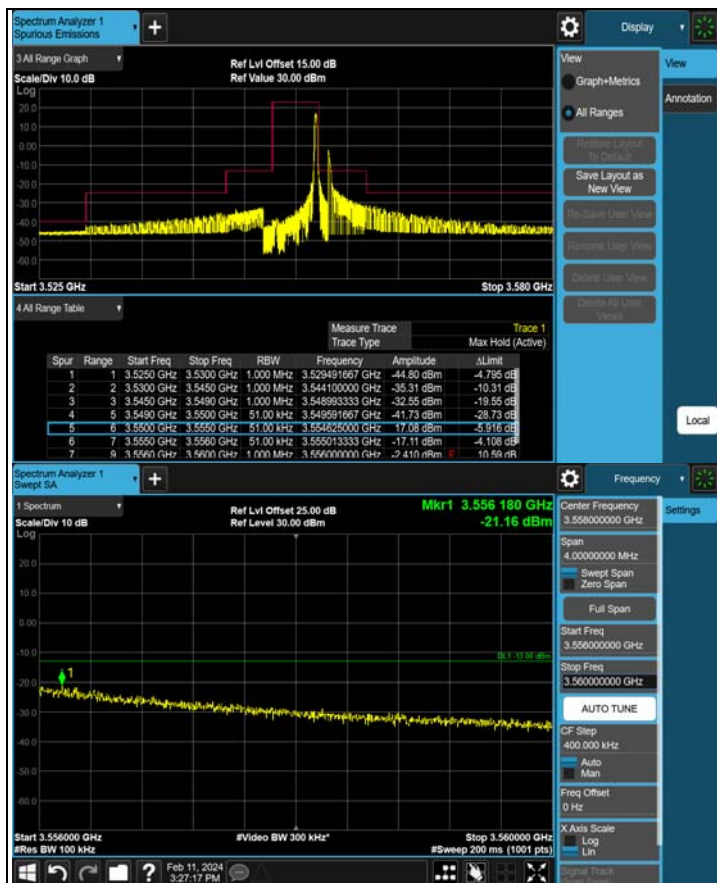
Note: The signal at 9 kHz is IF signal from spectrum analyzer.



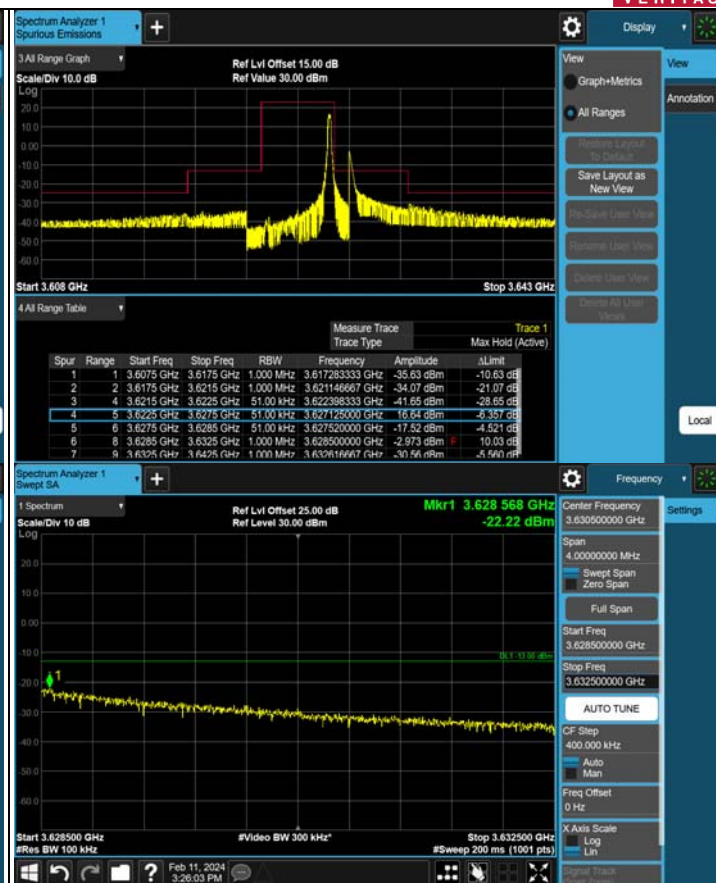
Note: The signal at 9 kHz is IF signal from spectrum analyzer.

LTE Band 48 - Ant 5, Channel Bandwidth: 5 MHz

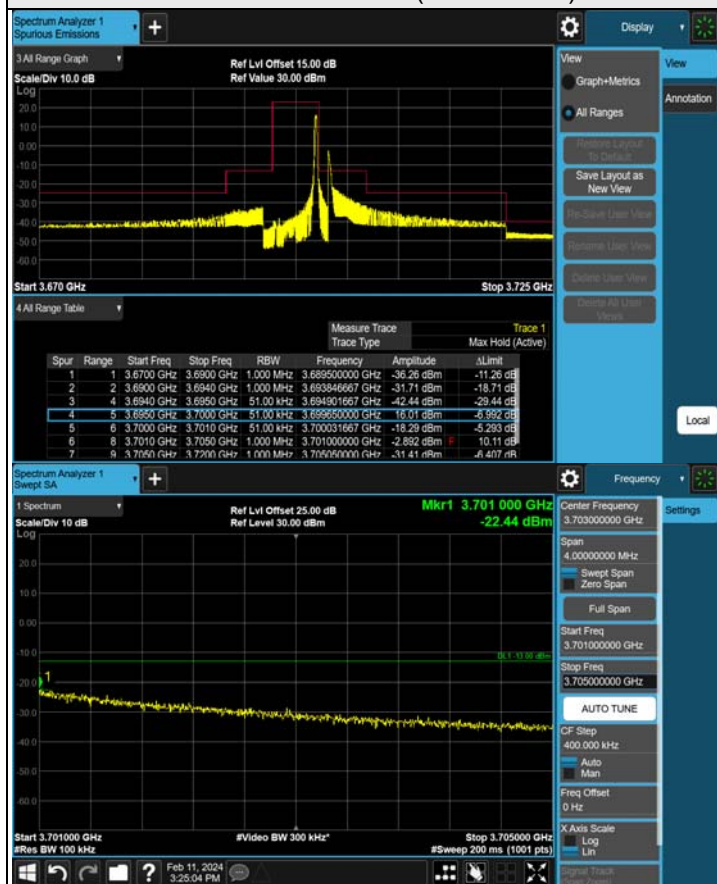




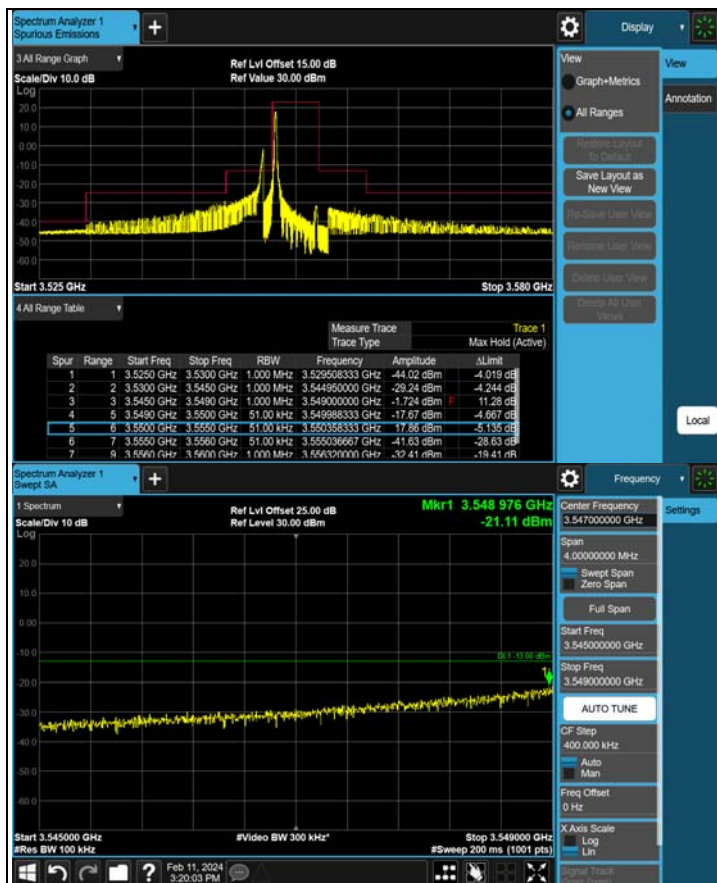
1RB#MAX CH 55265 (3552.5 MHz)



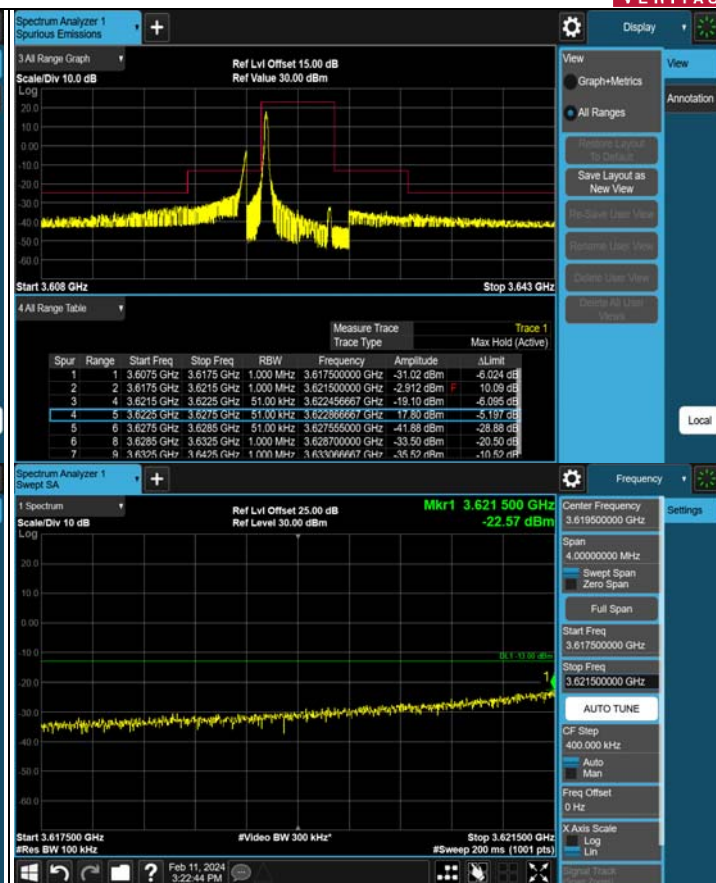
1RB#MAX CH 55990 (3625 MHz)



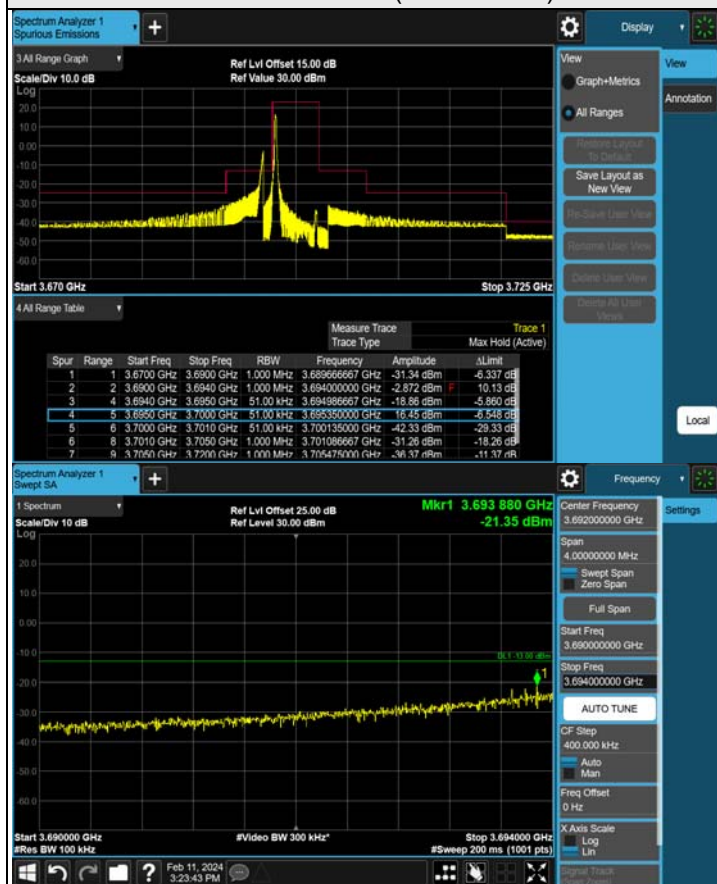
1RB#MAX CH 56715 (3697.5 MHz)



1RB#0 CH 55265 (3552.5 MHz)

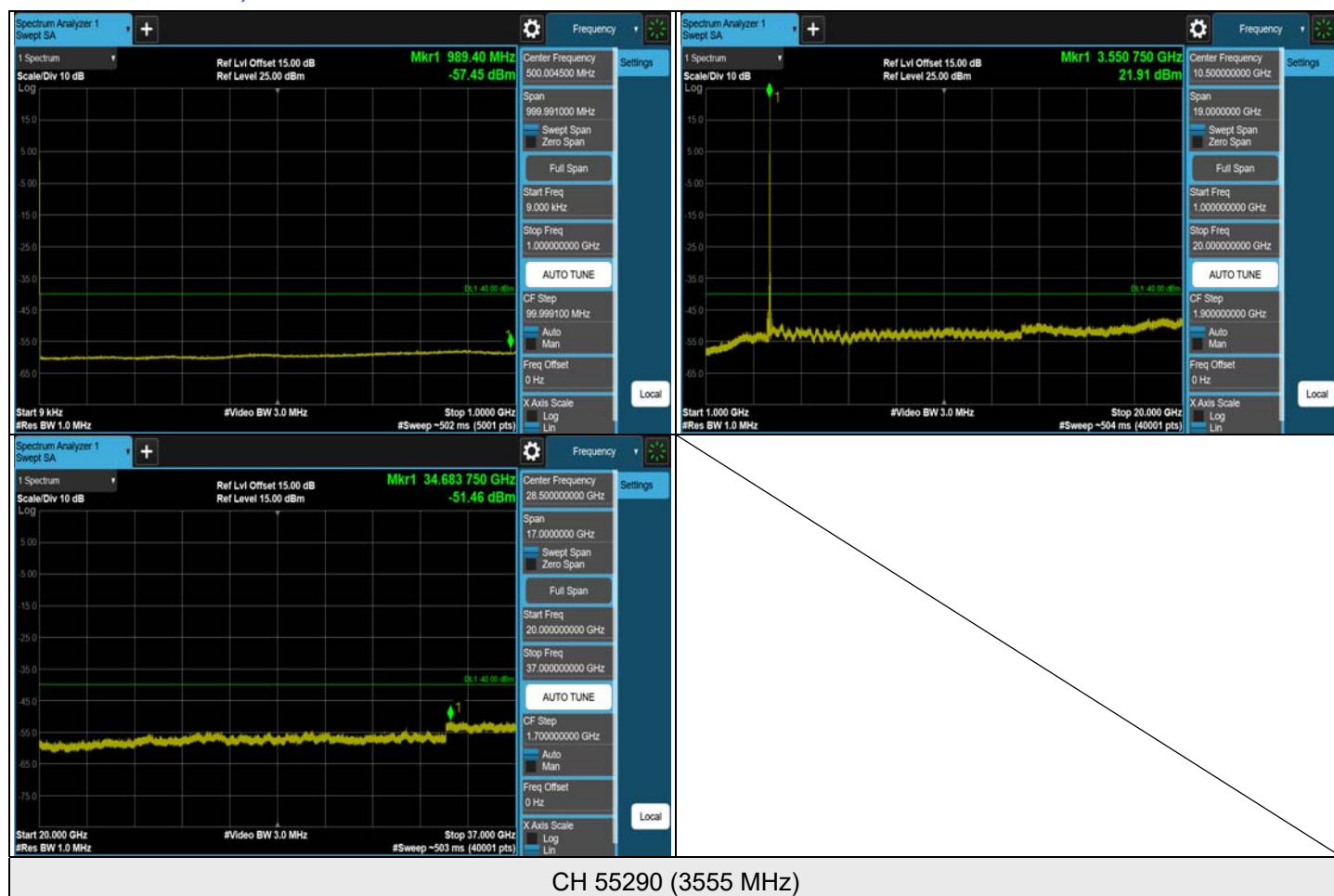


1RB#0 CH 55990 (3625 MHz)



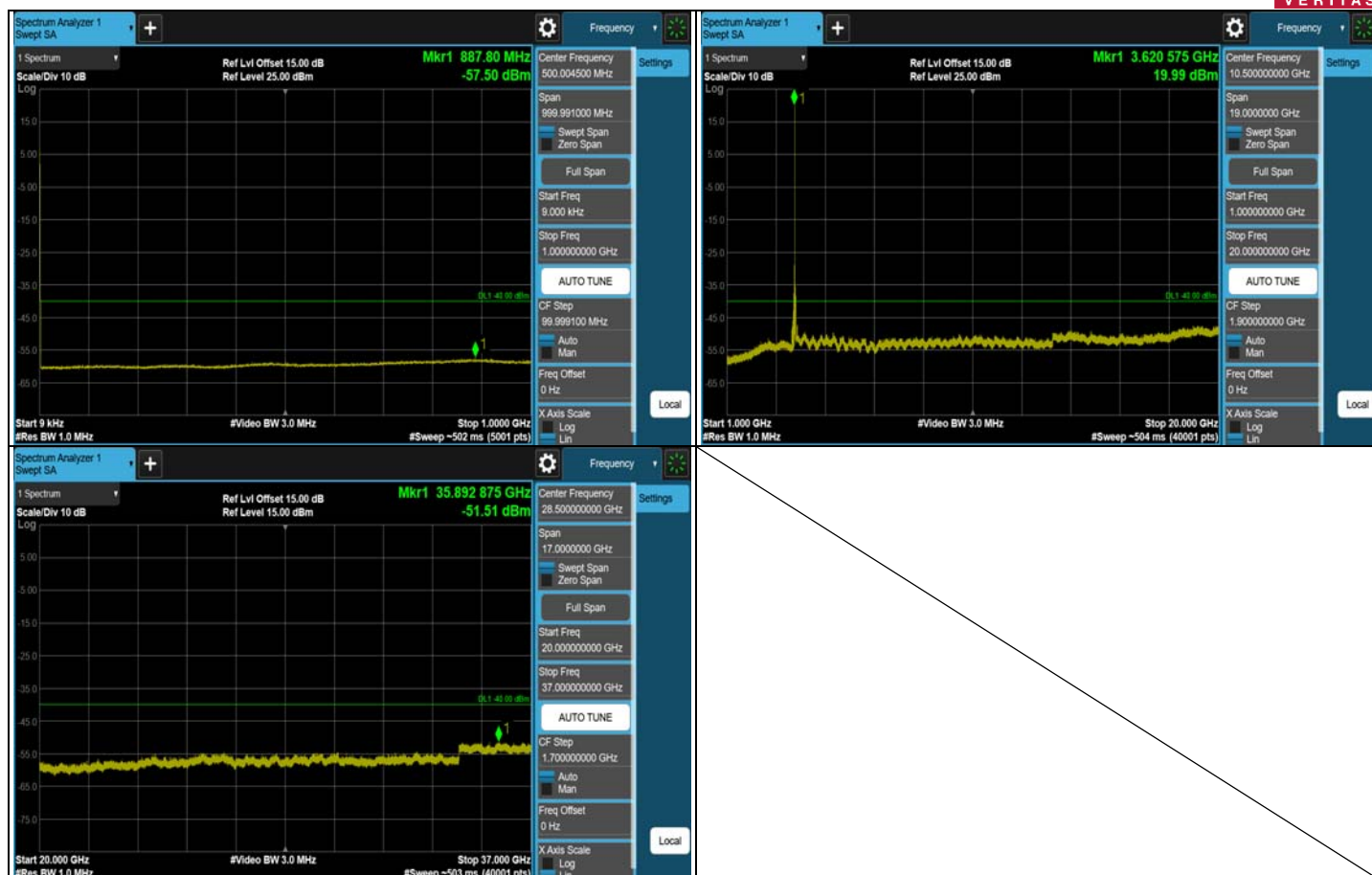
1RB#0 CH 56715 (3697.5 MHz)

LTE Band 48 - Ant 5, Channel Bandwidth: 10 MHz



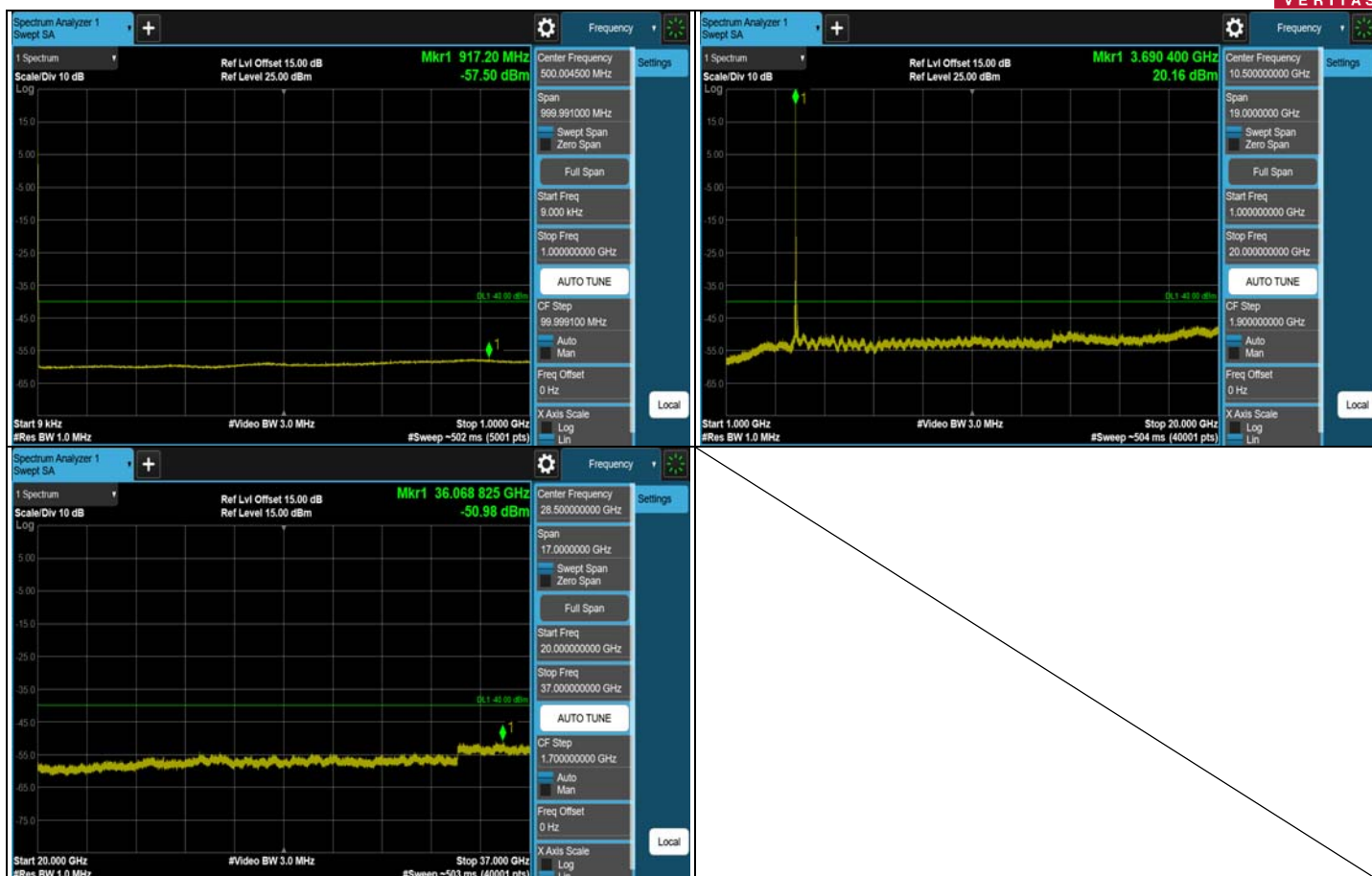
CH 55290 (3555 MHz)

Note: The signal at 9 kHz is IF signal from spectrum analyzer.



CH 55990 (3625 MHz)

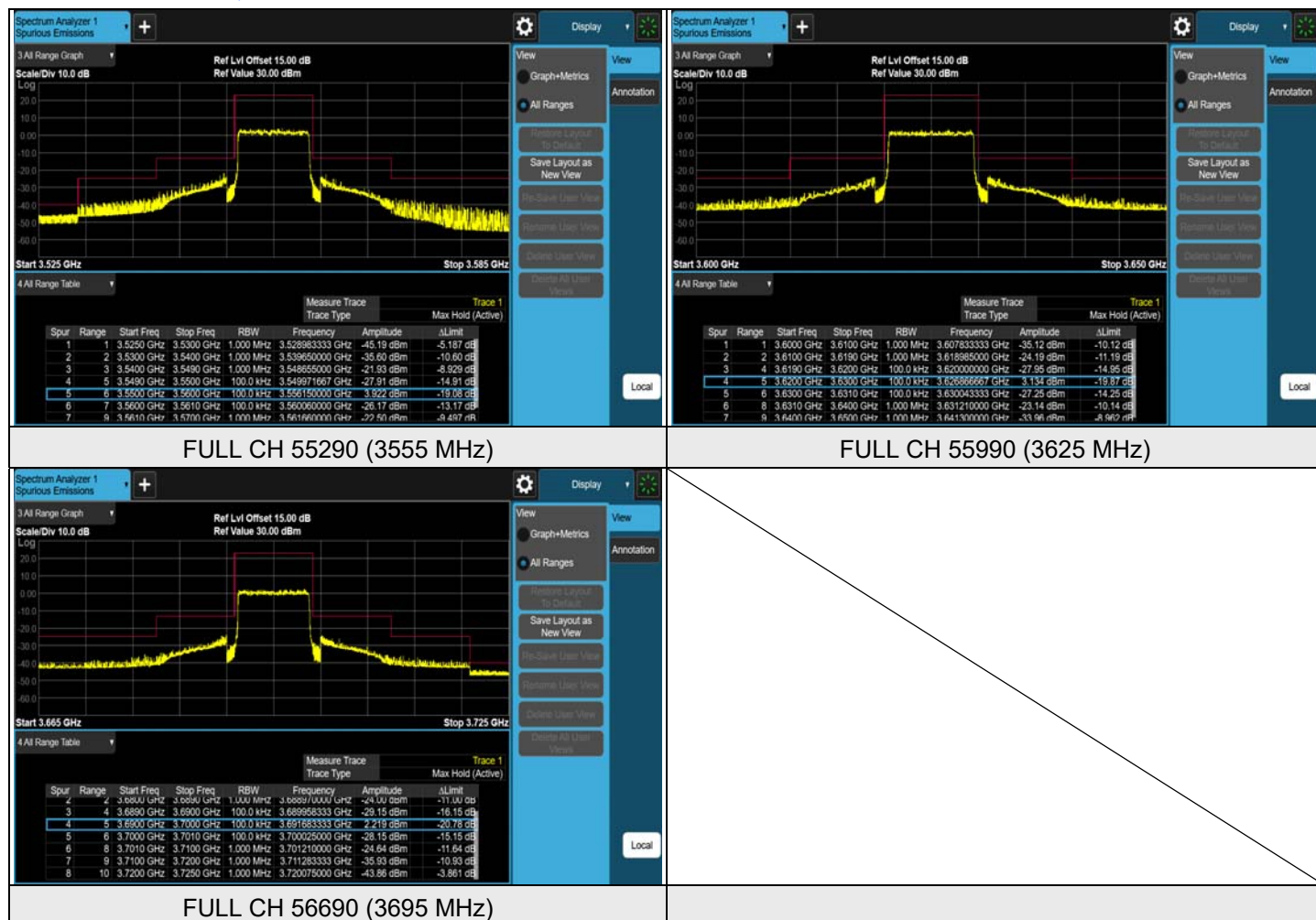
Note: The signal at 9 kHz is IF signal from spectrum analyzer.

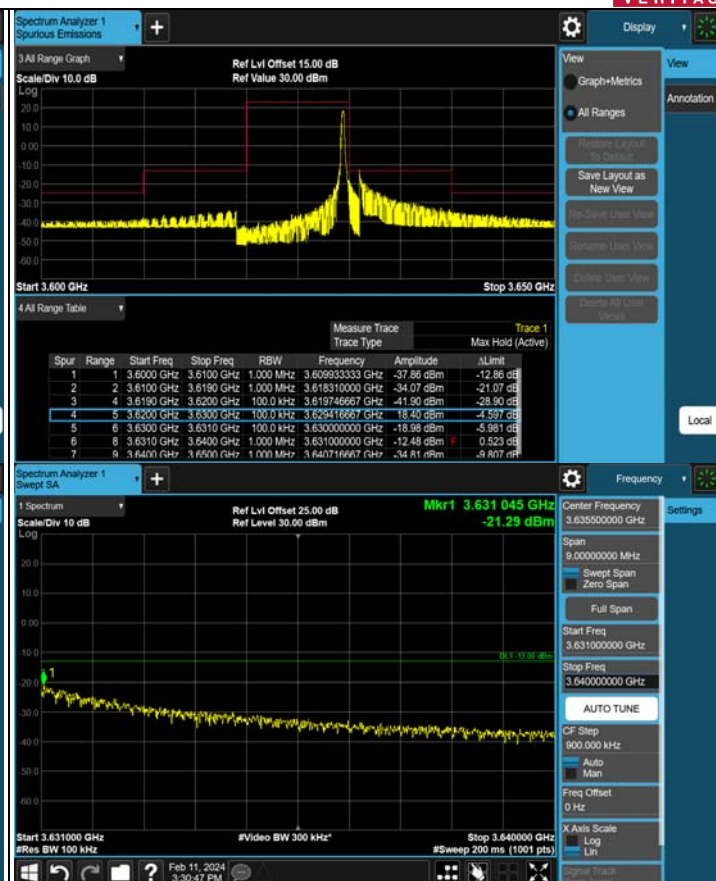
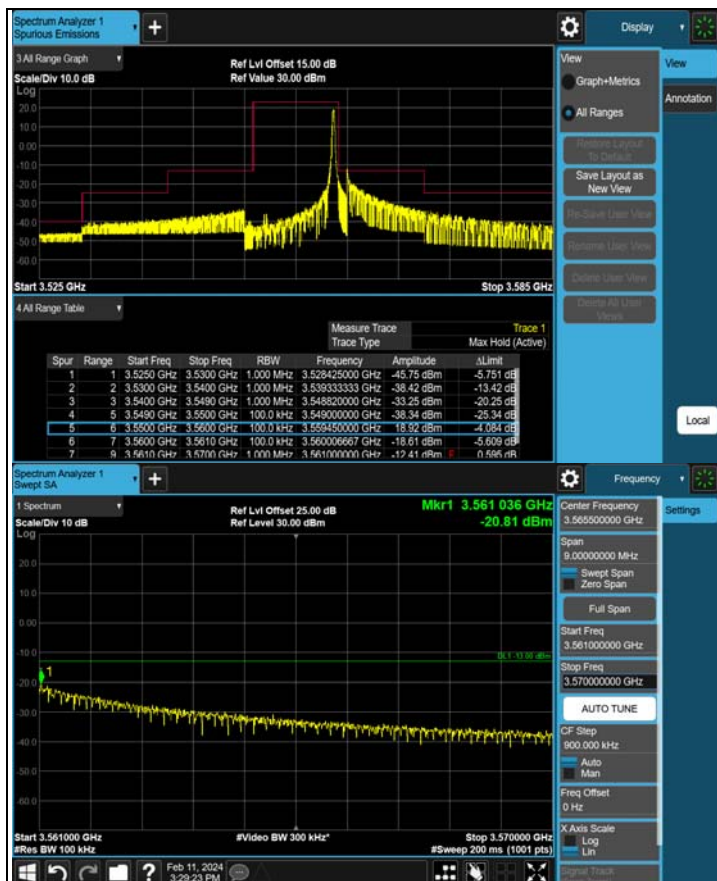


CH 56690 (3695 MHz)

Note: The signal at 9 kHz is IF signal from spectrum analyzer.

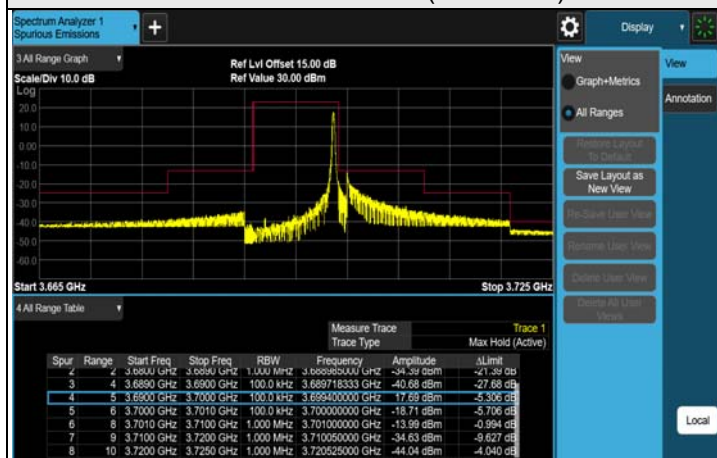
LTE Band 48 - Ant 5, Channel Bandwidth: 10 MHz



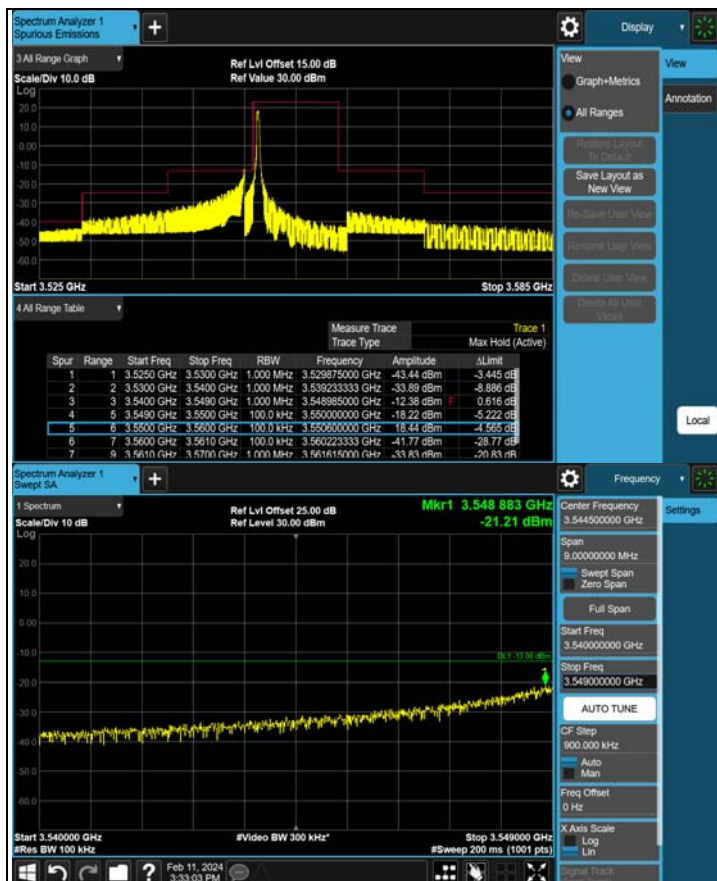


1RB#MAX CH 55290 (3555 MHz)

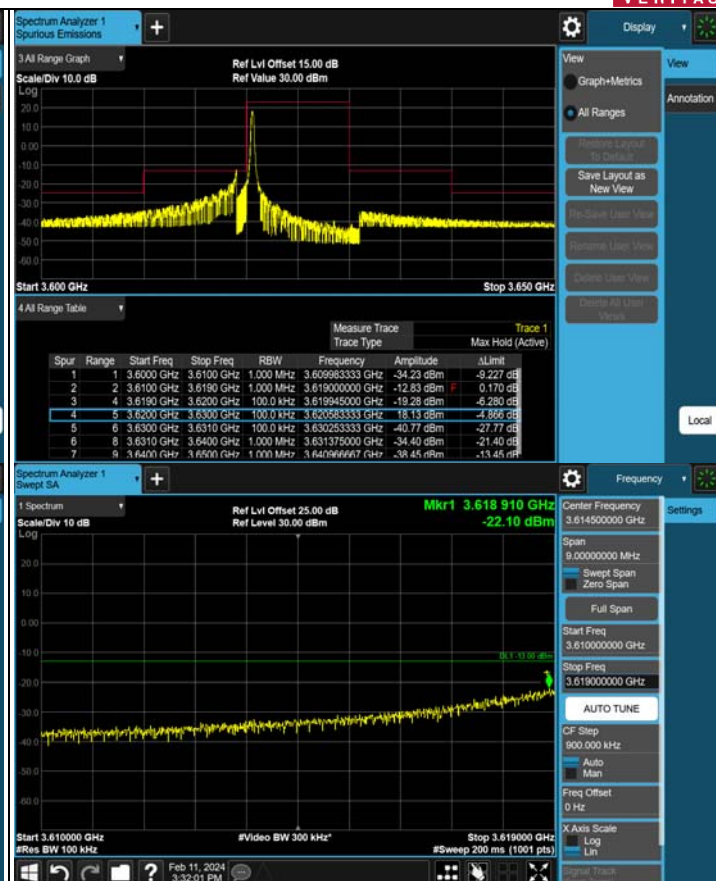
1RB#MAX CH 55990 (3625 MHz)



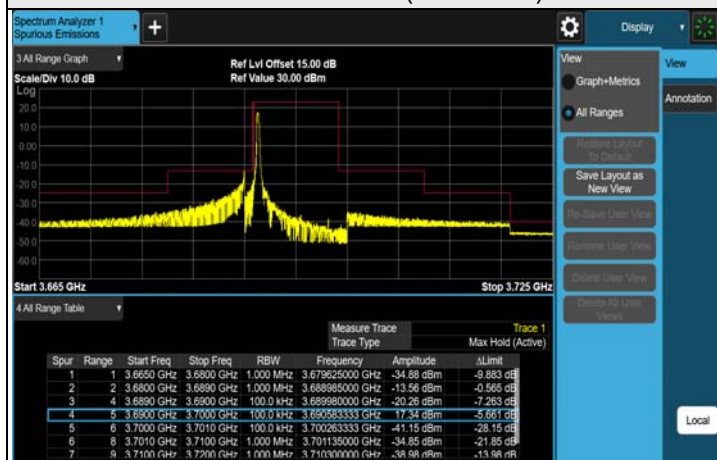
1RB#MAX CH 56690 (3695 MHz)



1RB#0 CH 55290 (3555 MHz)

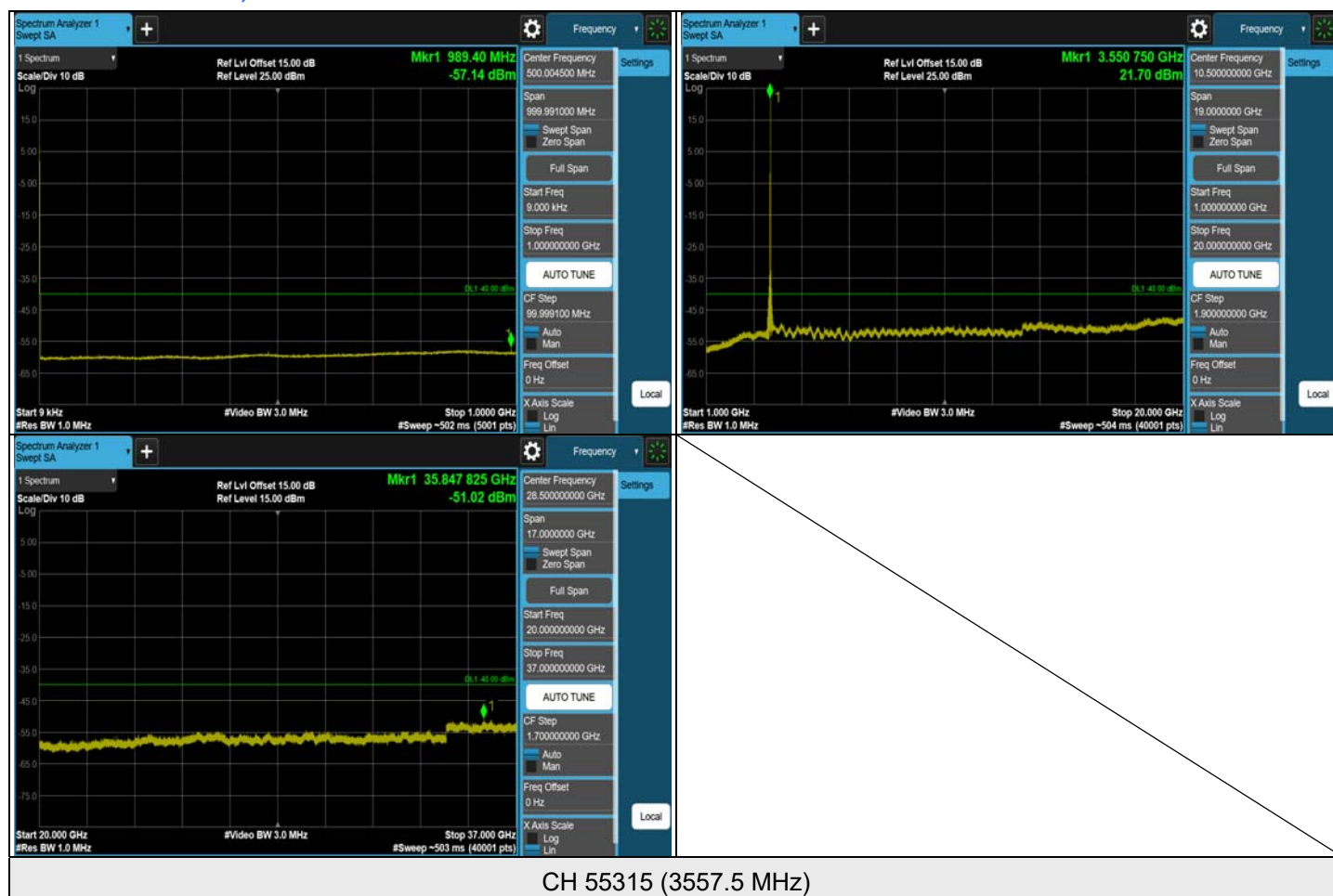


1RB#0 CH 55990 (3625 MHz)



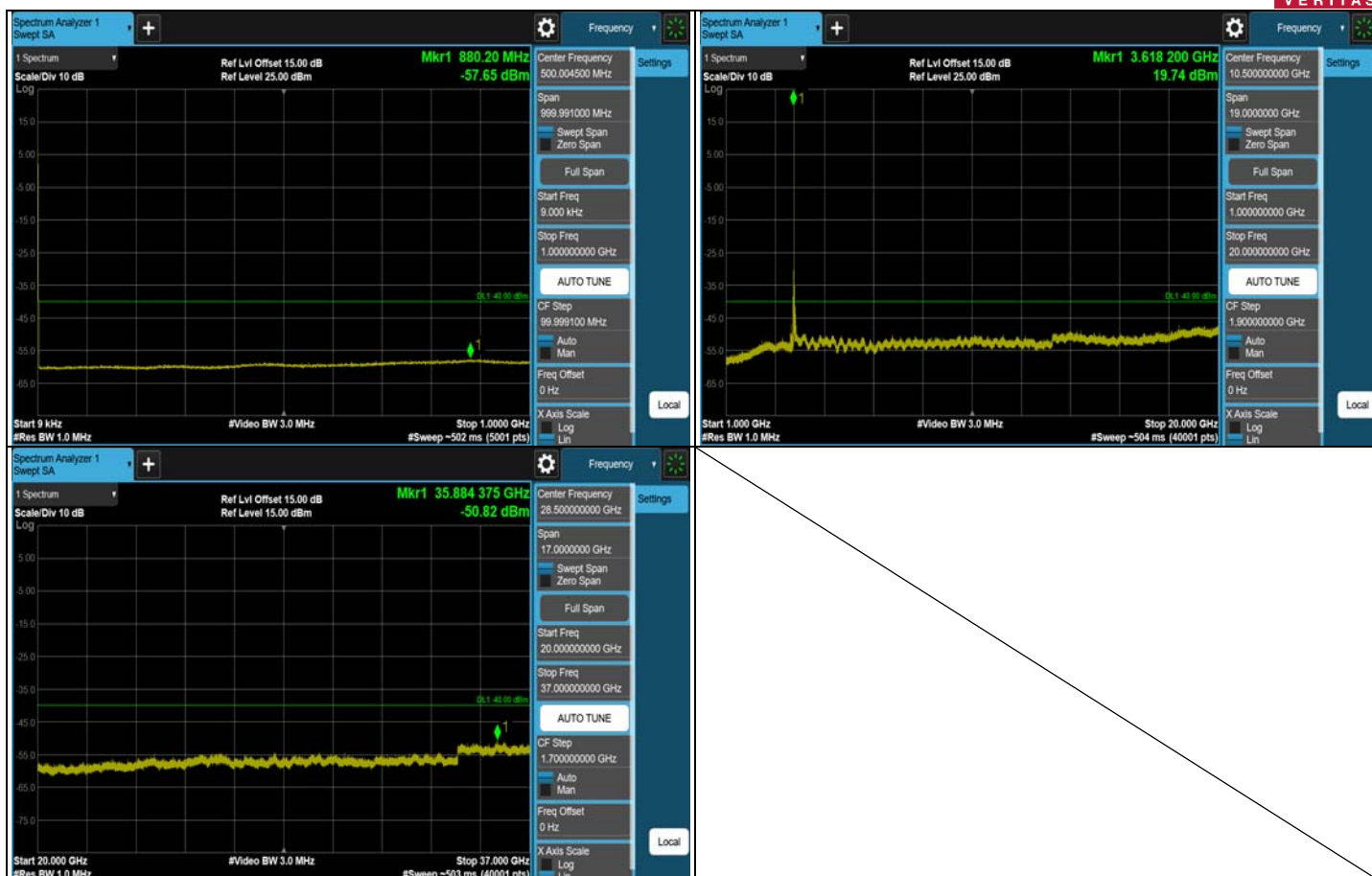
1RB#0 CH 56690 (3695 MHz)

LTE Band 48 - Ant 5, Channel Bandwidth: 15 MHz



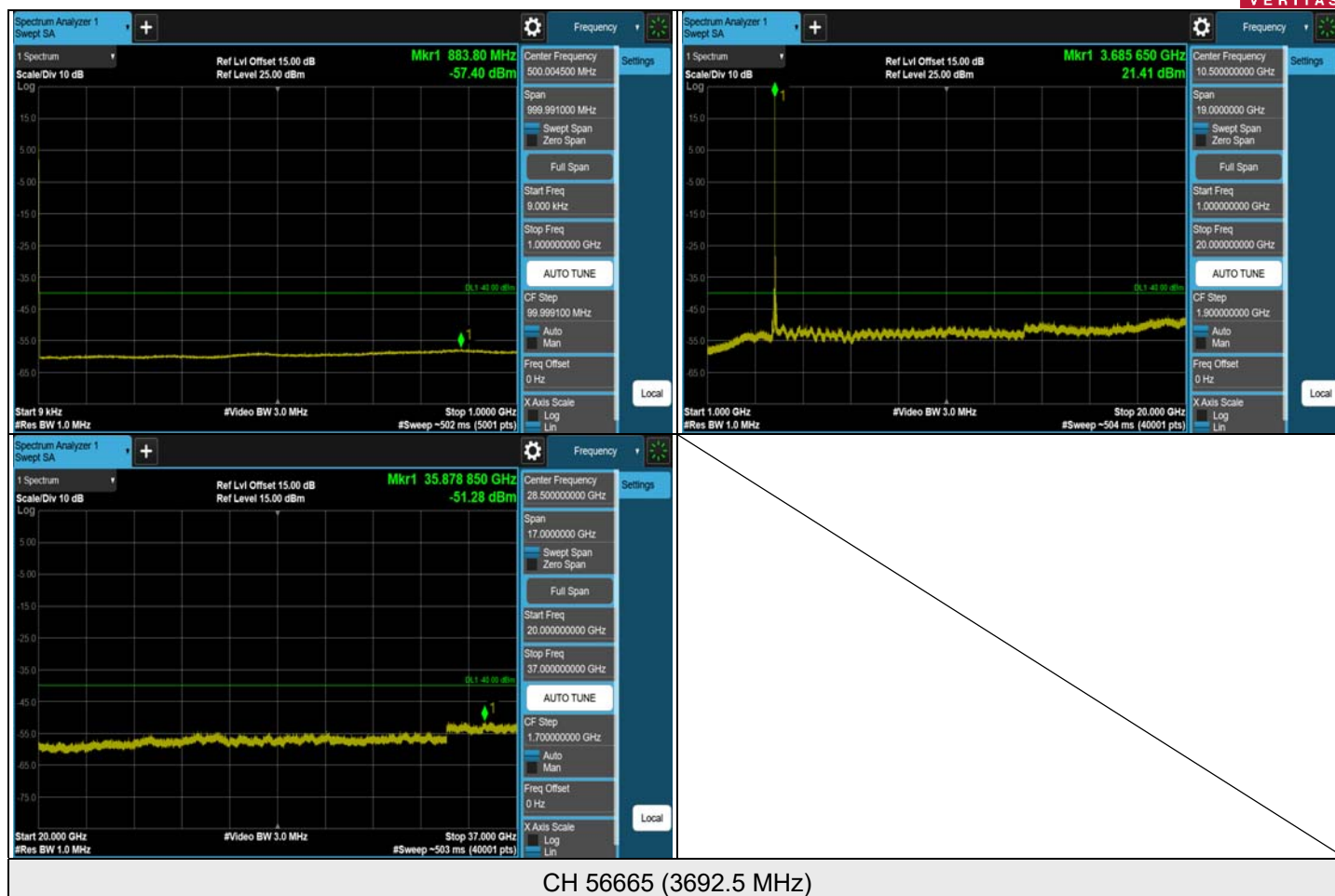
CH 55315 (3557.5 MHz)

Note: The signal at 9 kHz is IF signal from spectrum analyzer.



CH 55990 (3625 MHz)

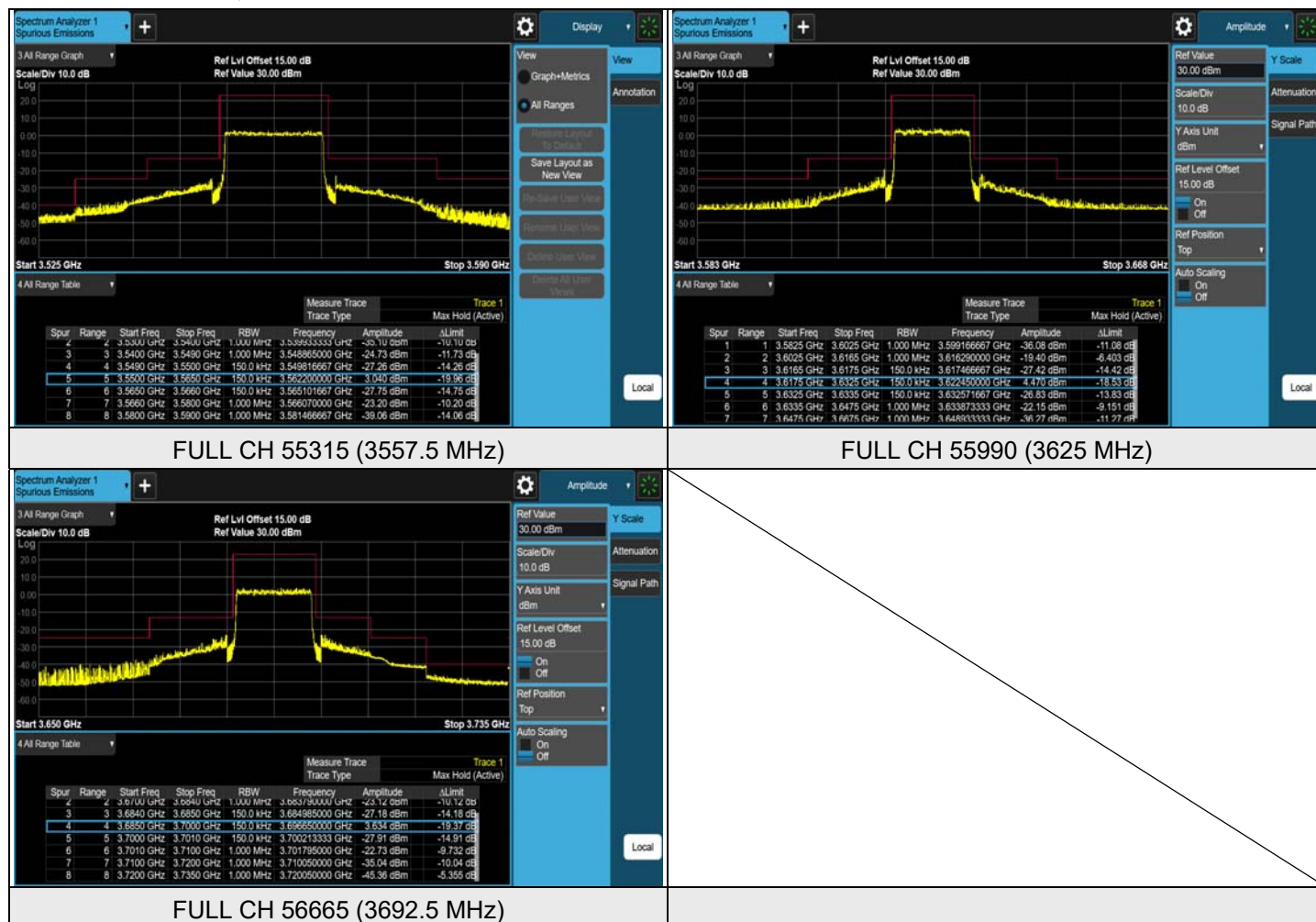
Note: The signal at 9 kHz is IF signal from spectrum analyzer.

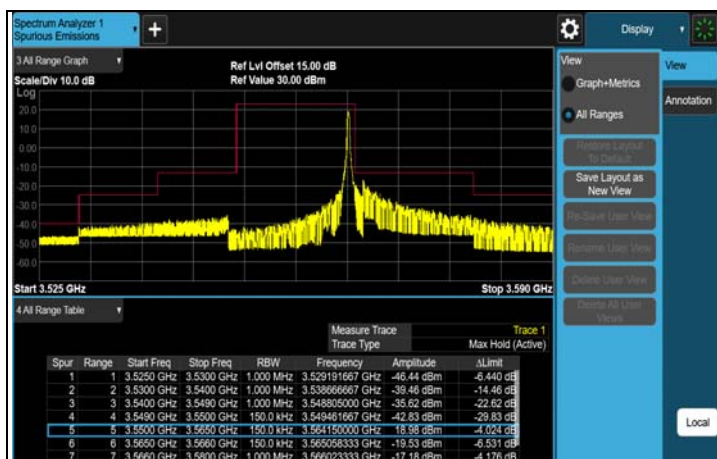


CH 56665 (3692.5 MHz)

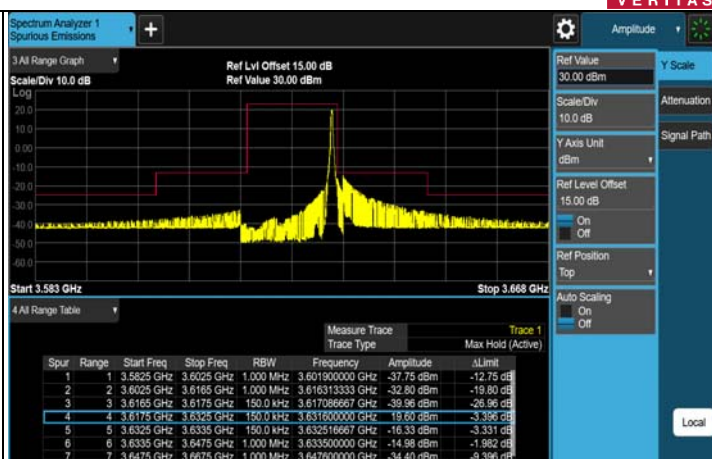
Note: The signal at 9 kHz is IF signal from spectrum analyzer.

LTE Band 48 - Ant 5, Channel Bandwidth: 15 MHz

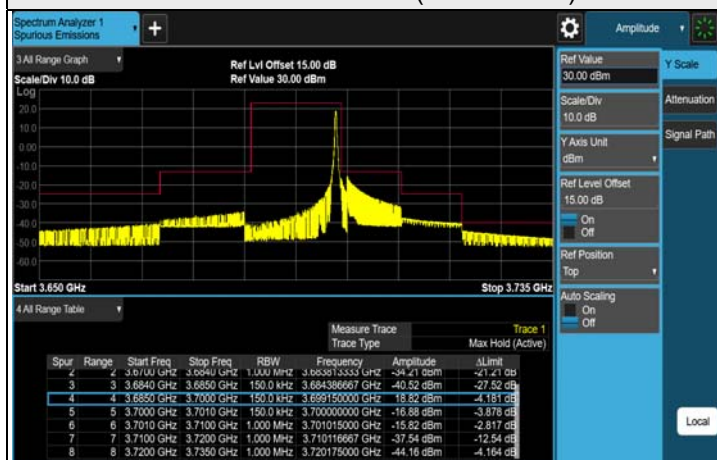




1RB#MAX CH 55315 (3557.5 MHz)



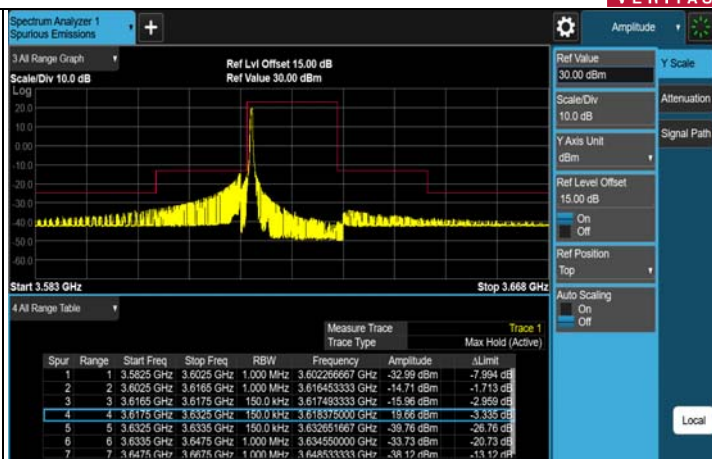
1RB#MAX CH 55990 (3625 MHz)



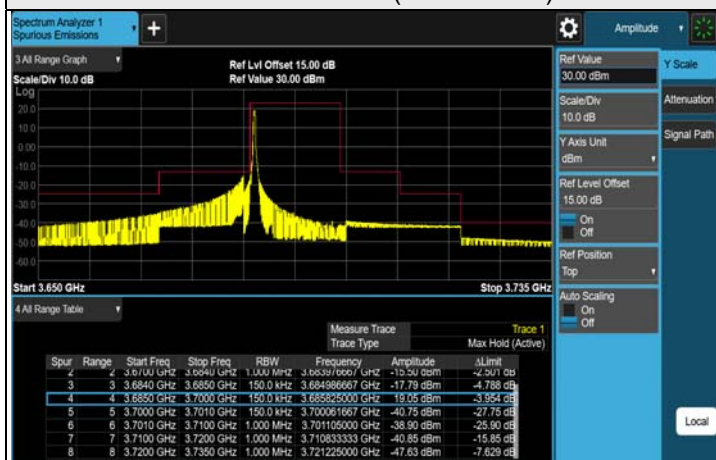
1RB#MAX CH 56665 (3692.5 MHz)



1RB#0 CH 55315 (3557.5 MHz)

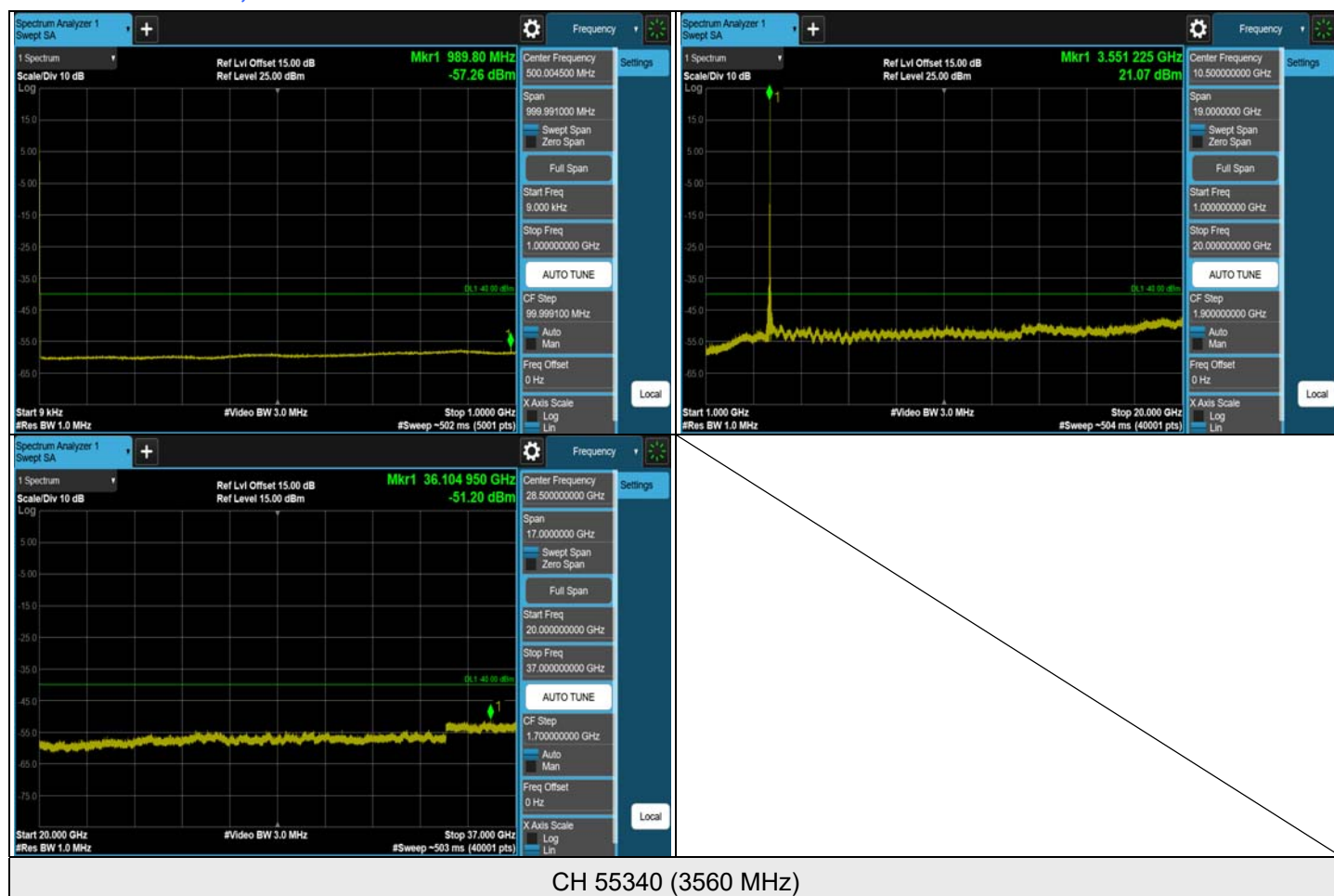


1RB#0 CH 55990 (3625 MHz)



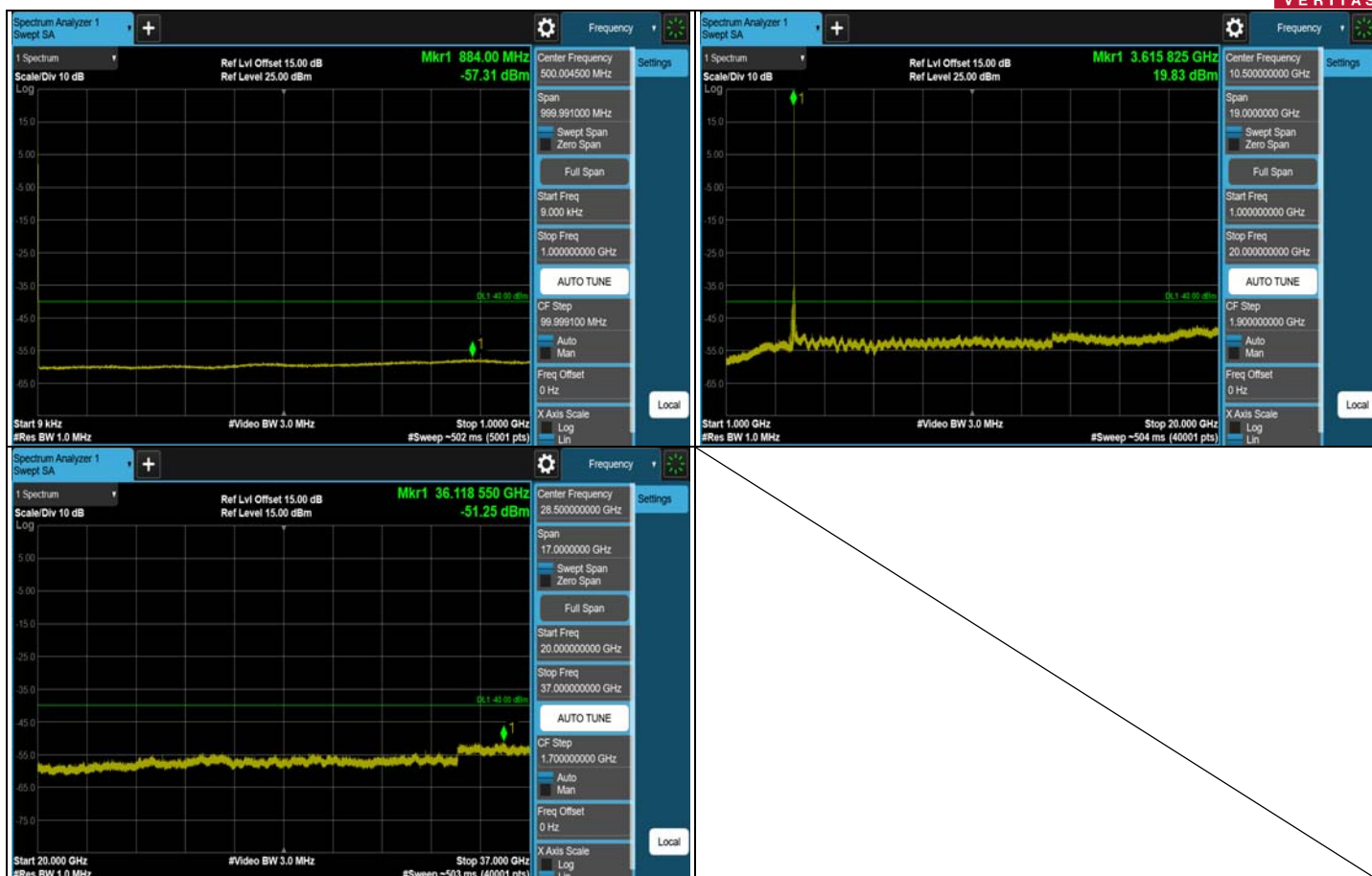
1RB#0 CH 56665 (3692.5 MHz)

LTE Band 48 - Ant 5, Channel Bandwidth: 20 MHz



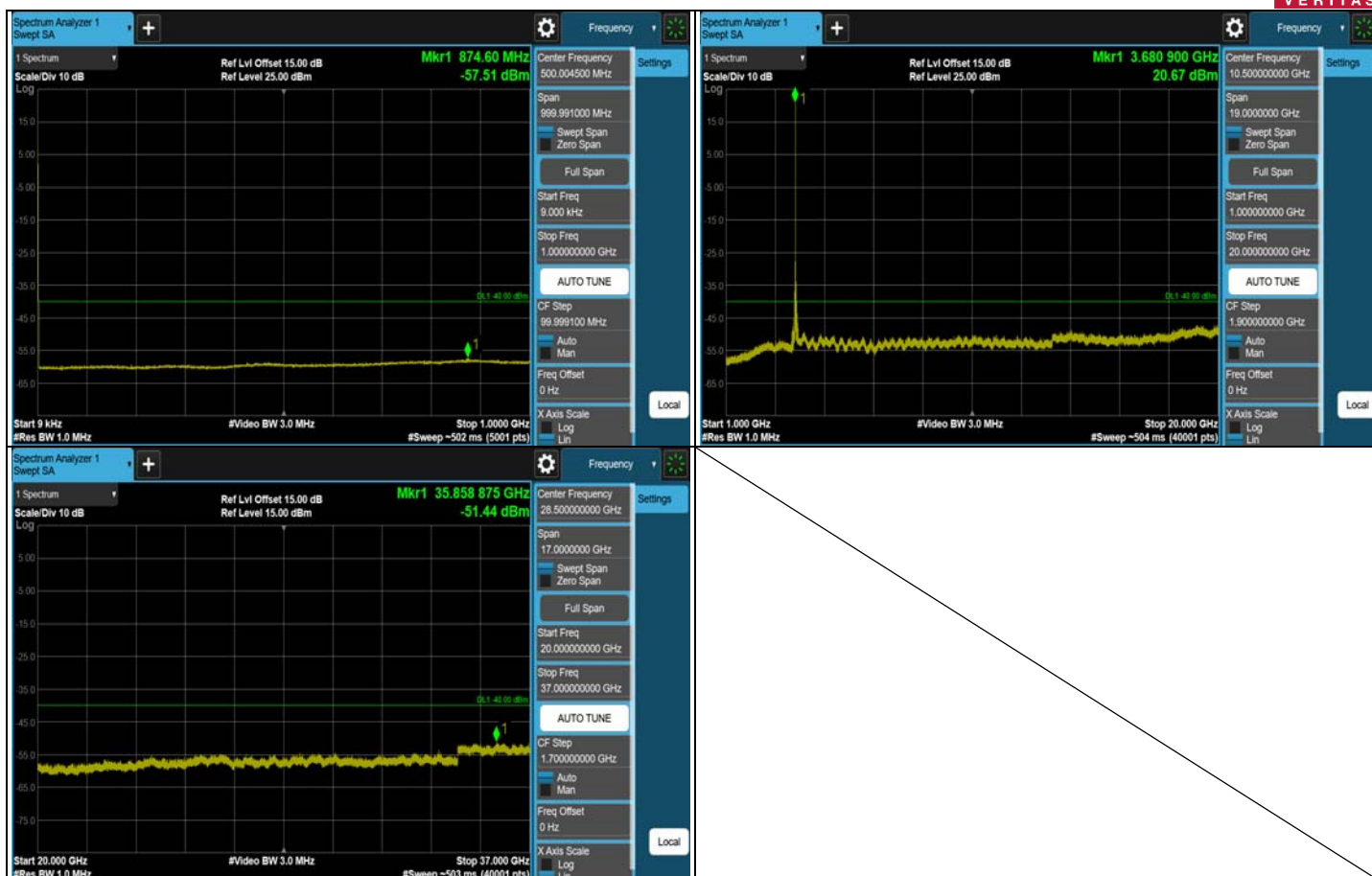
CH 55340 (3560 MHz)

Note: The signal at 9 kHz is IF signal from spectrum analyzer.



CH 55990 (3625 MHz)

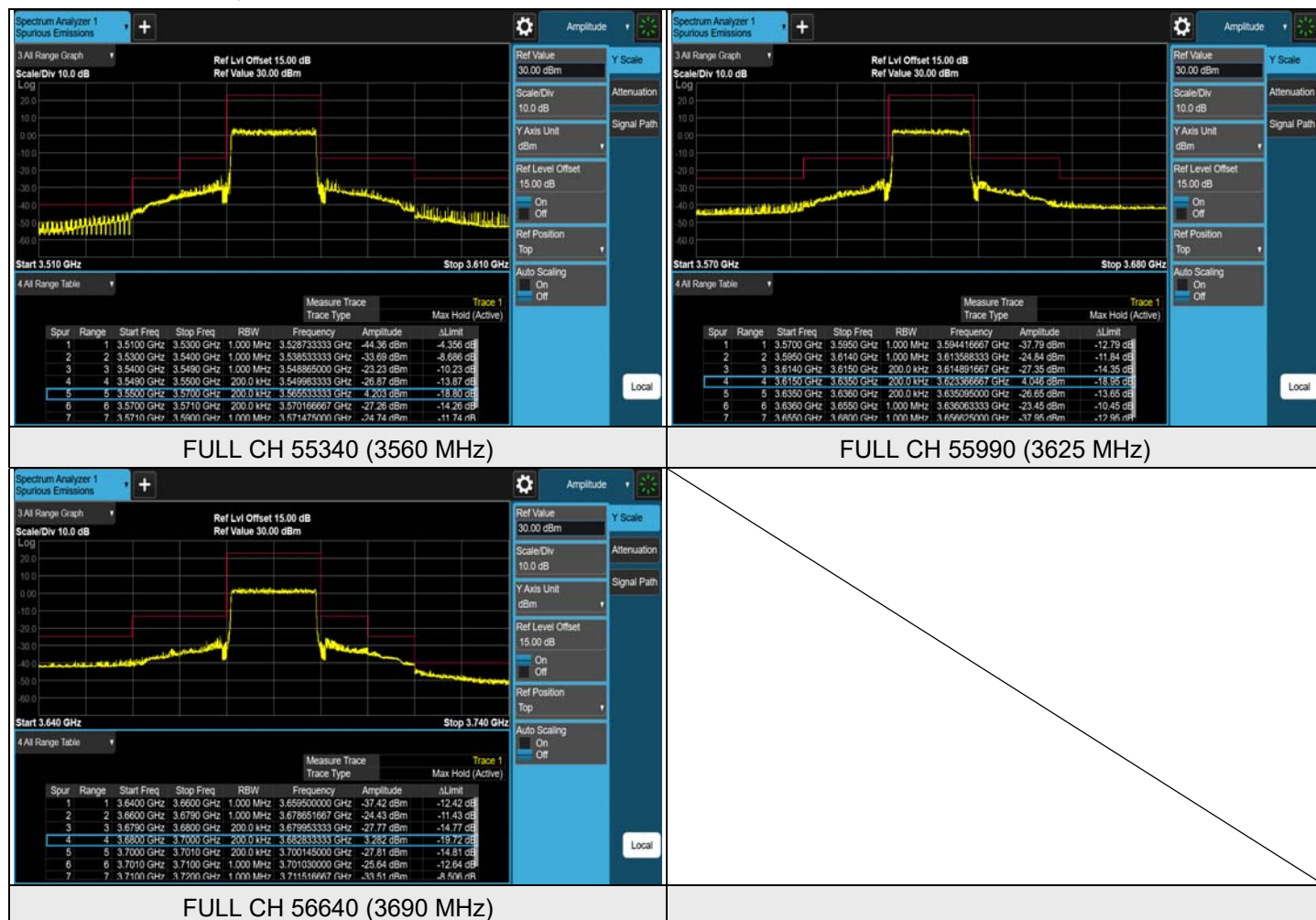
Note: The signal at 9 kHz is IF signal from spectrum analyzer.

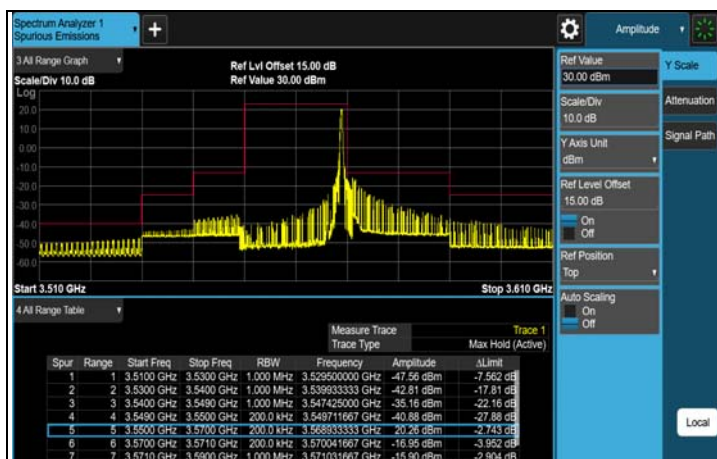


CH 56640 (3690 MHz)

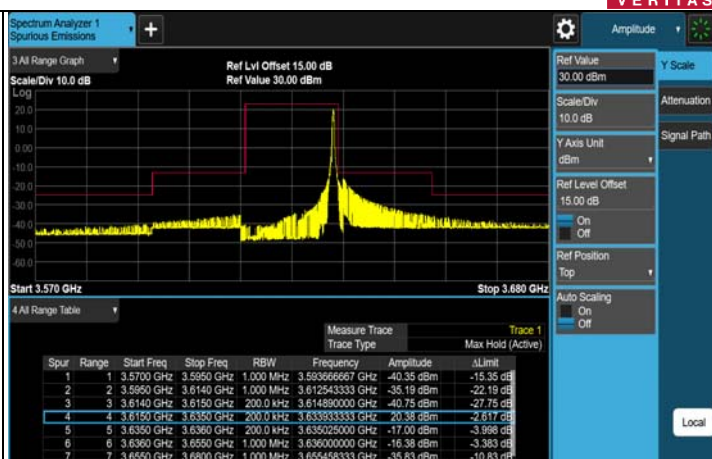
Note: The signal at 9 kHz is IF signal from spectrum analyzer.

LTE Band 48 - Ant 5, Channel Bandwidth: 20 MHz

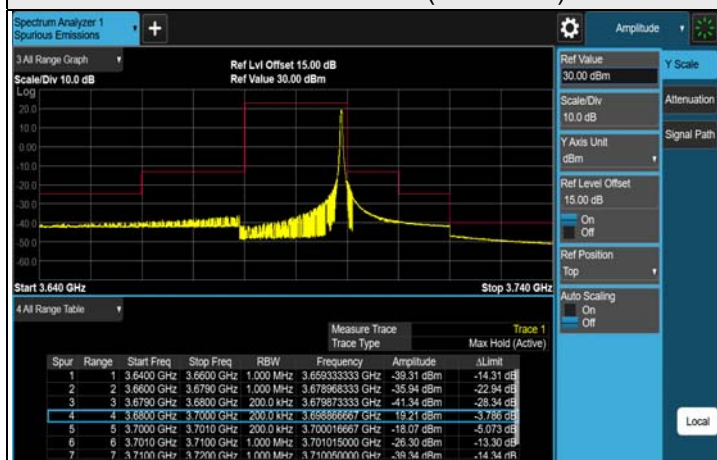




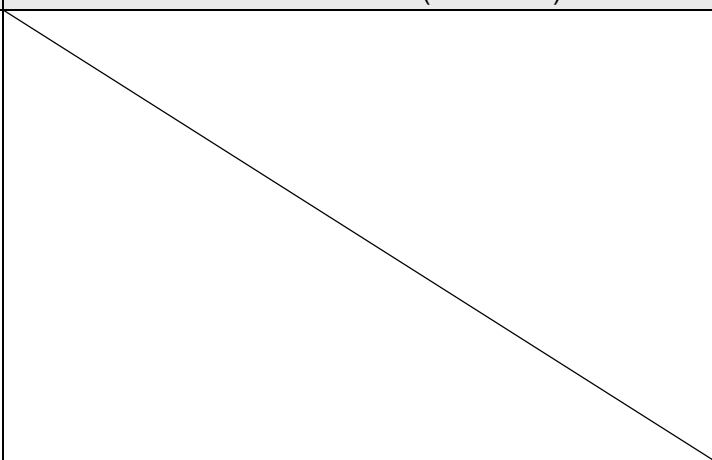
1RB#MAX CH 55340 (3560 MHz)

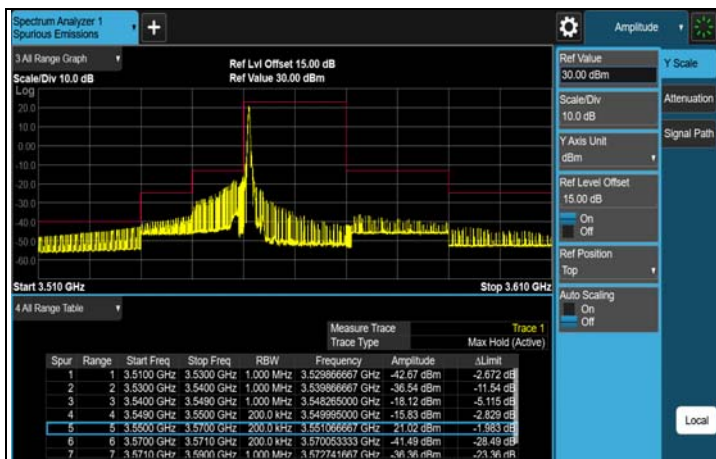


1RB#MAX CH 55990 (3625 MHz)

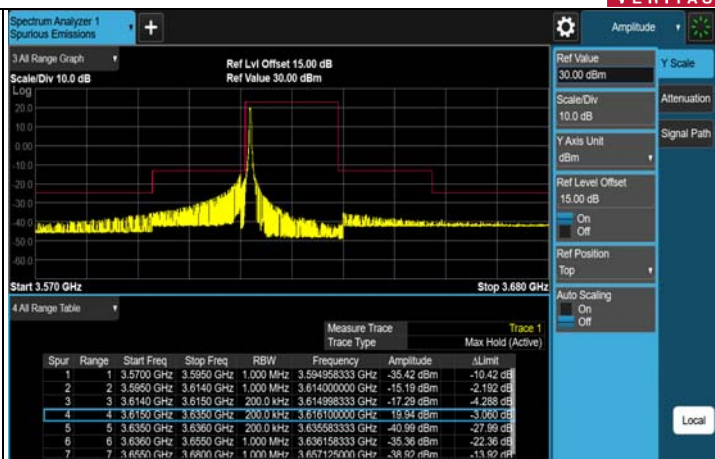


1RB#MAX CH 56640 (3690 MHz)

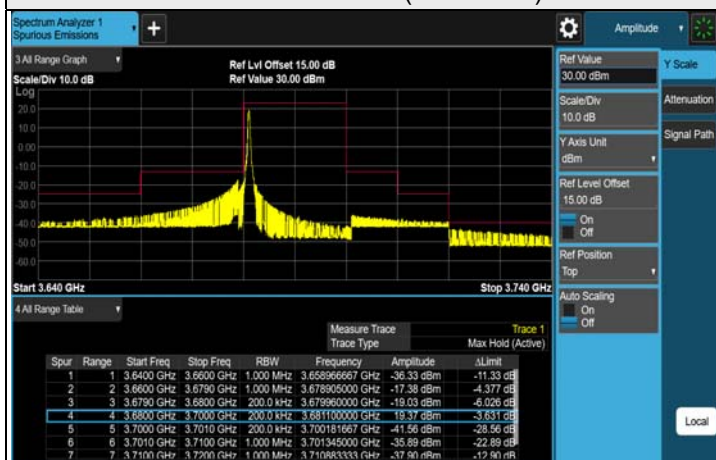




1RB#0 CH 55340 (3560 MHz)



1RB#0 CH 55990 (3625 MHz)



1RB#0 CH 56640 (3690 MHz)

7.6 Radiated Spurious Emissions below 1GHz

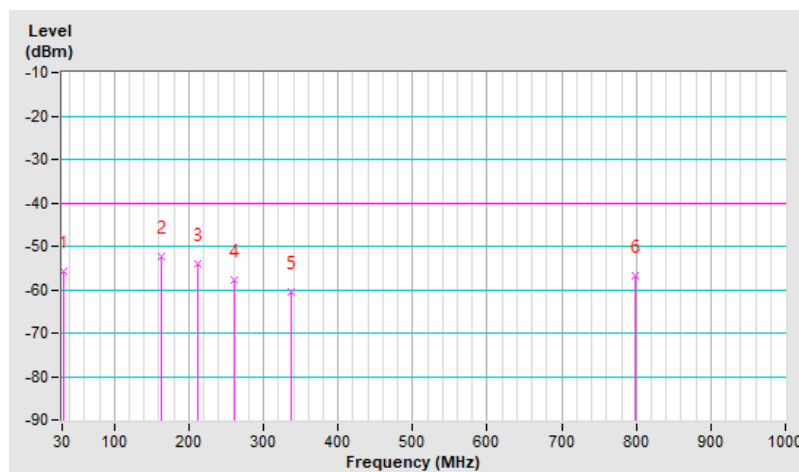
7.6.1 LTE Band 48

RF Mode	LTE Band 48 Channel Bandwidth: 20MHz	Channel	CH 56640 : 3690 MHz
Frequency Range	30 MHz ~ 1 GHz	Detector Function & Bandwidth	1 MHz/3 MHz (RMS)
Input Power	120 Vac, 60 Hz	Environmental Conditions	22 °C, 68 % RH
Tested By	Greg Lin		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	32.91	-55.71	-40.00	-15.71	1.00 H	18	53.86	-109.57
2	163.86	-52.35	-40.00	-12.35	1.25 H	260	55.86	-108.21
3	212.36	-54.21	-40.00	-14.21	1.50 H	103	57.69	-111.90
4	260.86	-57.64	-40.00	-17.64	1.00 H	90	51.68	-109.32
5	336.52	-60.58	-40.00	-20.58	1.50 H	317	46.19	-106.77
6	799.21	-56.89	-40.00	-16.89	1.25 H	268	40.90	-97.79

Remarks:

1. $EIRP(dBm) = Raw\ Value(dBuV) + Correction\ Factor(dB/m)$
2. $Correction\ Factor(dB/m) = Antenna\ Factor(dB/m) + Cable\ Factor(dB) - Pre-Amplifier\ Factor(dB) + 20\log(D) - 104.8$
3. $Margin\ value = EIRP - Limit\ value$
4. The other EIRP levels were very low against the limit of frequency range 30 MHz ~ 1 GHz.
5. The frequency range 9 kHz ~ 30 MHz: all emissions are more than 20 dB below the limit, therefore do not be recorded in this report.

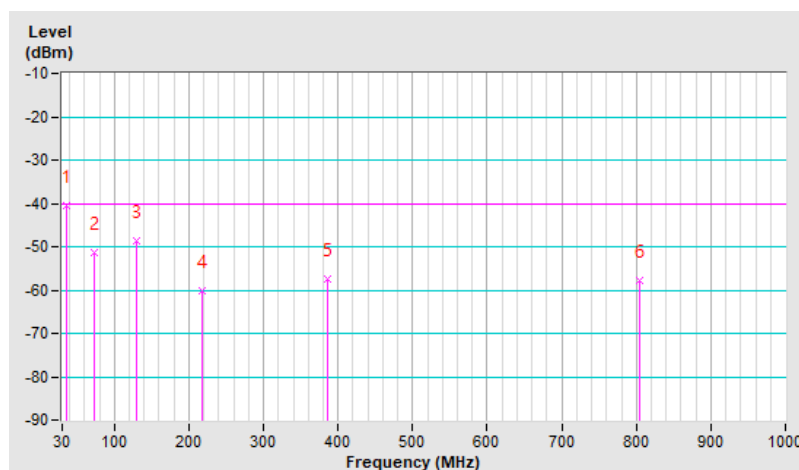


RF Mode	LTE Band 48 Channel Bandwidth: 20MHz	Channel	CH 56640 : 3690 MHz
Frequency Range	30 MHz ~ 1 GHz	Detector Function & Bandwidth	1 MHz/3 MHz (RMS)
Input Power	120 Vac, 60 Hz	Environmental Conditions	22 °C, 68 % RH
Tested By	Greg Lin		

Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	36.79	-40.66	-40.00	-0.66	1.25 V	108	68.35	-109.01
2	73.65	-51.37	-40.00	-11.37	1.00 V	246	60.29	-111.66
3	128.94	-48.71	-40.00	-8.71	1.50 V	130	61.06	-109.77
4	218.18	-60.11	-40.00	-20.11	2.00 V	120	51.73	-111.84
5	385.02	-57.32	-40.00	-17.32	1.00 V	193	48.34	-105.66
6	805.03	-57.83	-40.00	-17.83	1.25 V	128	39.85	-97.68

Remarks:

1. EIRP(dBm) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + 20log(D) – 104.8
3. Margin value = EIRP – Limit value
4. The other EIRP levels were very low against the limit of frequency range 30 MHz ~ 1 GHz.
5. The frequency range 9 kHz ~ 30 MHz: all emissions are more than 20 dB below the limit, therefore do not be recorded in this report.



7.7 Radiated Spurious Emissions above 1GHz

7.7.1 LTE Band 48

RF Mode	LTE Band 48 Channel Bandwidth: 5MHz	Channel	CH 55265 : 3552.5 MHz
Frequency Range	1 GHz ~ 40 GHz	Detector Function & Bandwidth	1 MHz/3 MHz (RMS)
Input Power	120 Vac, 60 Hz	Environmental Conditions	21 °C, 69 % RH
Tested By	Greg Lin		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	7105.00	-40.47	-40.00	-0.47	2.15 H	226	47.18	-87.65
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	7105.00	-41.77	-40.00	-1.77	1.96 V	209	45.88	-87.65

Remarks:

1. $EIRP(dBm) = Raw\ Value(dBuV) + Correction\ Factor(dB/m)$
2. $Correction\ Factor(dB/m) = Antenna\ Factor(dB/m) + Cable\ Factor(dB) - Pre-Amplifier\ Factor(dB) + 20\log(D) - 104.8$
3. $Margin\ value = EIRP - Limit\ value$
4. The other EIRP levels were very low against the limit.

RF Mode	LTE Band 48 Channel Bandwidth: 5MHz	Channel	CH 55990 : 3625 MHz
Frequency Range	1 GHz ~ 40 GHz	Detector Function & Bandwidth	1 MHz/3 MHz (RMS)
Input Power	120 Vac, 60 Hz	Environmental Conditions	21 °C, 69 % RH
Tested By	Greg Lin		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	7250.00	-40.54	-40.00	-0.54	2.16 H	228	47.19	-87.73
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	7250.00	-41.56	-40.00	-1.56	1.98 V	211	46.17	-87.73

Remarks:

1. $EIRP(dBm) = Raw\ Value(dBuV) + Correction\ Factor(dB/m)$
2. $Correction\ Factor(dB/m) = Antenna\ Factor(dB/m) + Cable\ Factor(dB) - Pre-Amplifier\ Factor(dB) + 20\log(D) - 104.8$
3. Margin value = EIRP – Limit value
4. The other EIRP levels were very low against the limit.

RF Mode	LTE Band 48 Channel Bandwidth: 5MHz	Channel	CH 56715 : 3697.5 MHz
Frequency Range	1 GHz ~ 40 GHz	Detector Function & Bandwidth	1 MHz/3 MHz (RMS)
Input Power	120 Vac, 60 Hz	Environmental Conditions	21 °C, 69 % RH
Tested By	Greg Lin		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	7395.00	-40.31	-40.00	-0.31	2.24 H	225	47.12	-87.43
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	7395.00	-41.49	-40.00	-1.49	1.95 V	211	45.94	-87.43

Remarks:

1. $EIRP(dBm) = Raw\ Value(dBuV) + Correction\ Factor(dB/m)$
2. $Correction\ Factor(dB/m) = Antenna\ Factor(dB/m) + Cable\ Factor(dB) - Pre-Amplifier\ Factor(dB) + 20\log(D) - 104.8$
3. Margin value = EIRP – Limit value
4. The other EIRP levels were very low against the limit.

RF Mode	LTE Band 48 Channel Bandwidth: 20MHz	Channel	CH 55340 : 3560 MHz
Frequency Range	1 GHz ~ 40 GHz	Detector Function & Bandwidth	1 MHz/3 MHz (RMS)
Input Power	120 Vac, 60 Hz	Environmental Conditions	21 °C, 69 % RH
Tested By	Greg Lin		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	7120.00	-40.61	-40.00	-0.61	2.23 H	227	47.07	-87.68
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	7120.00	-41.86	-40.00	-1.86	1.99 V	205	45.82	-87.68

Remarks:

1. $EIRP(dBm) = Raw\ Value(dBuV) + Correction\ Factor(dB/m)$
2. $Correction\ Factor(dB/m) = Antenna\ Factor(dB/m) + Cable\ Factor(dB) - Pre-Amplifier\ Factor(dB) + 20\log(D) - 104.8$
3. Margin value = EIRP – Limit value
4. The other EIRP levels were very low against the limit.

RF Mode	LTE Band 48 Channel Bandwidth: 20MHz	Channel	CH 55990 : 3625 MHz
Frequency Range	1 GHz ~ 40 GHz	Detector Function & Bandwidth	1 MHz/3 MHz (RMS)
Input Power	120 Vac, 60 Hz	Environmental Conditions	21 °C, 69 % RH
Tested By	Greg Lin		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	7250.00	-40.49	-40.00	-0.49	2.22 H	231	47.24	-87.73
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	7250.00	-41.52	-40.00	-1.52	1.97 V	209	46.21	-87.73

Remarks:

1. $EIRP(dBm) = Raw\ Value(dBuV) + Correction\ Factor(dB/m)$
2. $Correction\ Factor(dB/m) = Antenna\ Factor(dB/m) + Cable\ Factor(dB) - Pre-Amplifier\ Factor(dB) + 20\log(D) - 104.8$
3. Margin value = EIRP – Limit value
4. The other EIRP levels were very low against the limit.

RF Mode	LTE Band 48 Channel Bandwidth: 20MHz	Channel	CH 56640 : 3690 MHz
Frequency Range	1 GHz ~ 40 GHz	Detector Function & Bandwidth	1 MHz/3 MHz (RMS)
Input Power	120 Vac, 60 Hz	Environmental Conditions	21 °C, 69 % RH
Tested By	Greg Lin		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	7380.00	-40.24	-40.00	-0.24	2.18 H	229	47.23	-87.47
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	7380.00	-41.54	-40.00	-1.54	2.05 V	206	45.93	-87.47

Remarks:

1. $EIRP(dBm) = Raw\ Value(dBuV) + Correction\ Factor(dB/m)$
2. $Correction\ Factor(dB/m) = Antenna\ Factor(dB/m) + Cable\ Factor(dB) - Pre-Amplifier\ Factor(dB) + 20\log(D) - 104.8$
3. Margin value = EIRP – Limit value
4. The other EIRP levels were very low against the limit.

7.8 Frequency Stability

Environmental Conditions:	25°C, 60% RH	Tested By:	Noah Chang
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7.8.1 LTE Band 48

LTE Band 48, Channel Bandwidth: 5 MHz

Frequency Stability Versus Voltage				
Voltage (Vdc)	CH 55265 (3552.5 MHz)		CH 56715 (3697.5 MHz)	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.60	3552.499992	-0.0023	3697.499992	-0.0022
3.87	3552.499991	-0.0025	3697.499994	-0.0016
4.40	3552.499992	-0.0023	3697.499999	-0.0027

Note: The applicant defined the normal working voltage is from 3.60 to 4.40 Vdc.

Frequency Stability Versus Temperature				
Temperature (°C)	CH 55265 (3552.5 MHz)		CH 56715 (3697.5 MHz)	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	3552.50001	0.0028	3697.500008	0.0022
-20	3552.50001	0.0028	3697.500009	0.0024
-10	3552.500003	0.0008	3697.500007	0.0019
0	3552.500002	0.0006	3697.500006	0.0016
10	3552.500003	0.0008	3697.500005	0.0014
20	3552.499994	-0.0017	3697.499999	-0.0003
30	3552.500009	0.0025	3697.500008	0.0022
40	3552.500001	0.0003	3697.500006	0.0016
50	3552.499999	-0.0003	3697.5	0

LTE Band 48, Channel Bandwidth: 10 MHz

Frequency Stability Versus Voltage				
Voltage (Vdc)	CH 55290 (3555 MHz)		CH 56690 (3695 MHz)	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.60	3555	0	3695.000002	0.0005
3.87	3555.000004	0.0011	3695.000009	0.0024
4.40	3554.999998	-0.0006	3694.999997	-0.0008

Note: The applicant defined the normal working voltage is from 3.60 to 4.40 Vdc.

Frequency Stability Versus Temperature				
Temperature (°C)	CH 55290 (3555 MHz)		CH 56690 (3695 MHz)	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	3555.000002	0.0006	3695.000005	0.0014
-20	3555.000004	0.0011	3695.000002	0.0005
-10	3555.000001	0.0003	3695.000005	0.0014
0	3554.999996	-0.0011	3694.999998	-0.0005
10	3555.000001	0.0003	3695	0
20	3555.000001	0.0028	3695.000007	0.0019
30	3554.999993	-0.002	3694.999994	-0.0016
40	3555.000009	0.0025	3695.000001	0.0027
50	3555	0	3695.000003	0.0008

LTE Band 48, Channel Bandwidth: 15 MHz

Frequency Stability Versus Voltage				
Voltage (Vdc)	CH 55315 (3557.5 MHz)		CH 56665 (3692.5 MHz)	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.60	3557.500005	0.0014	3692.500001	0.0003
3.87	3557.499993	-0.002	3692.49999	-0.0027
4.40	3557.499991	-0.0025	3692.499991	-0.0024

Note: The applicant defined the normal working voltage is from 3.60 to 4.40 Vdc.

Frequency Stability Versus Temperature				
Temperature (°C)	CH 55315 (3557.5 MHz)		CH 56665 (3692.5 MHz)	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	3557.500006	0.0017	3692.500008	0.0022
-20	3557.499997	-0.0008	3692.499992	-0.0022
-10	3557.499991	-0.0025	3692.499991	-0.0024
0	3557.500001	0.0028	3692.500006	0.0016
10	3557.499997	-0.0008	3692.499998	-0.0005
20	3557.500009	0.0025	3692.500006	0.0016
30	3557.500009	0.0025	3692.500006	0.0016
40	3557.500006	0.0017	3692.500003	0.0008
50	3557.500008	0.0022	3692.500001	0.0027

LTE Band 48, Channel Bandwidth: 20 MHz

Frequency Stability Versus Voltage				
Voltage (Vdc)	CH 55340 (3560 MHz)		CH 56640 (3690 MHz)	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
3.60	3560.000009	0.0025	3690.000006	0.0016
3.87	3559.999991	-0.0025	3689.99999	-0.0027
4.40	3559.999997	-0.0008	3690	0

Note: The applicant defined the normal working voltage is from 3.60 to 4.40 Vdc.

Frequency Stability Versus Temperature				
Temperature (°C)	CH 55340 (3560 MHz)		CH 56640 (3690 MHz)	
	Frequency (MHz)	Frequency Error (ppm)	Frequency (MHz)	Frequency Error (ppm)
-30	3559.999994	-0.0017	3689.999996	-0.0011
-20	3560.000001	0.0003	3690.000001	0.0003
-10	3560.000004	0.0011	3689.999999	-0.0003
0	3559.999996	-0.0011	3689.999998	-0.0005
10	3560	0	3690.000002	0.0005
20	3559.999992	-0.0022	3689.999997	-0.0008
30	3560.000002	0.0006	3689.999999	-0.0003
40	3560.000003	0.0008	3690.000005	0.0014
50	3560.000008	0.0022	3690.000001	0.0027

8 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo)

9 Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited according to ISO/IEC 17025.

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The address and road map of all our labs can be found in our web site also.

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