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Test Report

Prepared for: Icom Inc

EUT Name: IP Advanced Radio System
Model: IP504H

FCC ID: AFJ293100
IC: 202D-293100

To

FCC Part 22H, 24E, 27C, 90R, 90S
And
ISED RSS-Gen, RSS-130, RSS-132, RSS-133, RSS-139, RSS-140, RSS-199

Date of Issue: 09/13/2022

On the behalf of the applicant:

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Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	13 September 2022	Aaron S. Froehlich	Original Document
2.0	19 October 2022	Aaron S. Froehlich	RSS-199 added to cover page. Test Setup photos removed to be held confidential

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Compliance Testing, LLC, has been accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to the joint ISO-ILAC-IAF Communiqué dated January 2009).

The tests results contained within this test report all fall within our scope of accreditation.

Please refer to <http://www.compliancetesting.com/labscope.html> for current scope of accreditation.



FCC Site Reg. #349717

IC Site Reg. #2044A-2

Standard Test Conditions Engineering Practices

Except as noted herein, the following conditions and procedures were observed during the testing:

In accordance with ANSI C63.10-2013 and unless otherwise indicated in the specific measurement results, the ambient temperature of the actual EUT was maintained within the range of 10° to 40°C (50° to 104°F) unless the particular equipment requirements specified testing over a different temperature range. Also, unless otherwise indicated, the humidity levels were in the range of 10% to 90% relative humidity.

Measurement results, unless otherwise noted, are worst-case measurements.

Environmental Conditions		
Temperature (°C)	Humidity (%)	Pressure (mbar)
27.0	48.9	970.8

EUT Description

Product Marketing Name (PMN)	IP Advanced Radio system
Model:	IP504H
Hardware Version Identification Number (HVIN)	293100-01
Serial Number (SN)	AP Conducted: 3740U005D Radiated: NSN (Test Mode Prototype)
Supported Bands:	LTE FDD Band 2 LTE FDD Band 4 LTE FDD Band 5 LTE FDD Band 12 LTE FDD Band 13 LTE FDD Band 14 LTE FDD Band 25 LTE FDD Band 26 LTE TDD Band 41 LTE FDD Band 66 LTE FDD Band 71
Modulation(s)	QPSK, 16-QAM Type: External Passive Antenna Part Number: TH81J-RPMA (M) Pk Gain (dBi): Band 2: 1.87 Band 4: 3.12 Band 5: 0.91 Band 12: 0.95 Band 13: 2.23 Band 14: 2.18 Band 25: 1.87 Band 26: 1.40 Band 41: 3.20 Band 66: 3.12 Band 71: -0.48
Antenna	

General Description of EUT and its intended use:

The DUT is a battery powered handheld transceiver for audio transmission. The DUT cannot transmit while in its charging dock. Evaluation of the compliance of the charging dock is beyond the scope of this report.

EUT operation during test:

The DUT was operated at maximum RF output and 100% RBs for all tests in this report.

During EIRP measurements a production unit was paired with a CMW 500 call box to control the LTE transmission.

During Radiated measurements a test mode sample was utilized that allowed control of the BT transmissions from a support laptop connected to a secondary PCB via USB 2.0. The CMW 500 was again used to control the LTE transmission, this time using a radiated connection.

LTE Bands Not Tested

LTE Band 2 was exempted from testing as its spectrum is completely covered by Band 25
 LTE Band 4 was exempted from testing as its spectrum is completely covered by Band 66
 LTE Band 5 was exempted from testing as its spectrum is completely covered by Band 26

Simultaneous Transmission

Each of the LTE Bands had the channel with the highest EIRP tested for unwanted spurious emissions, while simultaneously transmitting with the worst-case BT modes identified i.a.w. ANSI C63.10 Clause 5.6.2.2. Additionally, the DUT was tested while oriented in 3 orthogonal axis. The worst-case results in each spectrum have been reported for all LTE Bands. EIRP measurements were not made under simultaneous transmission conditions.

Support Equipment

Qty	Description	Manufacturer	Model	S/N
1	Laptop	Dell	Latitude E6440	52YJQ32
1	Call Box	Rohde & Schwarz	CMW500	171198 / i00636

Support Cables:

Qty	Description	Length (M)	Shielding Y/N	Shielded Hood Y/N	Termination
1	USB 2.0	2.1	Y	Y	Communication Board

Modifications:

none

15.203: Antenna Requirement:

- The antenna is permanently attached to the EUT
- Reverse Polarity SMA Connection The antenna uses a unique coupling
- The EUT must be professionally installed
- The antenna requirement does not apply

Test Summary

FCC Title 47 Specification	ISED Specification	Test Name	Pass, Fail, N/A	Comments
22.913(a)(5), 24.232(c), 27.50(b)(10), 27.50(c)(10), 27.50(d)(4), 90.635(b), 90.542(a)(7)	RSS-130 Sec 4.6.2, RSS-130 Sec 4.6.3, RSS-132 Sec 5.4, SRSP-510 Sec 5.1.2, RSS-139 Sec 6.5, RSS-140 Sec 4.3	Average Conducted Output and EIRP	Pass	
22.917(a), 24.238(a), 27.53(c)(2), 27.53(h)(1), 27.53(g), 90.210(c)(3)	RSS-130 Sec 4.7.1, RSS-132 Sec 5.5, RSS-133 Sec 6.5.1, RSS-139 Sec 6.6, RSS-140 Sec 4.4	Radiated Spurious Emissions	Pass	

Statements of conformity are reported as:

- Pass - the measured value is below the acceptance limit, *acceptance limit = test limit*.
- Fail - the measured value is above the acceptance limit, *acceptance limit = test limit*.

Data Included by Reference

Report STS2006194W01	Test Name	Pass, Fail, N/A	Comments
Section 4	Peak to Average Ratio	Pass	Pg 34
Section 5	Radiated Power and EIRP	Pass	Pg 37
Section 6	Occupied Bandwidth	Pass	Pg 56
Section 7	Conducted Band Edge	Pass	Pg 59
Section 8	Conducted Spurious Emission	Pass	Pg 61
Section 10	Frequency Stability	Pass	Pg 98

*Note: Data referenced from Shenzhen STS Test Services Co., Ltd. Report STS2006194W01 certified under FCC ID: 2AJYU-8PYA006

Normative References

References	Description
CFR47, Part 22, Subpart H	Cellular Radiotelephone Service
CFR47, Part 24, Subpart E	Broadband PCS
CFR47, Part 27, Subpart C	Miscellaneous Wireless Communications Service – Technical Standards
CFR47, Part 90, Subpart I	Private Land Mobile Radio Services - General Technical Standards
CFR47, Part 90, Subpart R	Regulations Governing the Licensing and Use of Frequencies in the 763-775 and 793-805 MHz Bands
CFR47, Part 90, Subpart S	Regulations Governing the Licensing and Use of Frequencies in the 806-824, 851-869, 896-901, and 935-940 MHz Bands
RSS-130, Issue 2	Equipment Operating the Frequency Bands 617-652 MHz, 63-698 MHz, 698-756 MHz and 777-787 MHz
RSS-132, Issue 3	Cellular Telephone Systems Operating in the Bands 824-849 MHz and 869-894 MHz
SRSP-510, Issue 5	Technical Requirements for Personal Communications Services (PCS) in the Bands 1850-1915 MHz and 1930-1995 MHz
RSS-133, Issue 6, Amendment 1	2 GHz Personal Communications Services – Spectrum management and telecommunications
RSS-139, Issue 3	Advanced Wireless Services (AWS) Equipment Operating in the Bands 1710-1780 MHz and 2110-2180 MHz – Spectrum management and telecommunications
RSS-140, Issue 1	Equipment Operating in the Public Safety Broadband Frequency Bands 758-768 MHz and 788-798 MHz – Spectrum management and telecommunications
ANSI C63.26-2015	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
ANSI C63.10-2013	American National standard for testing Unlicensed Wireless Devices
ANSI C63.4-2014	Method and Measurements of Radio-Noise Emissions from low-Voltage Electrical and Electronic Equipment in the range 9kHz to 40GHz.
KDB 971163 D01 v03r01	Measurement Guidance for Certification of Licensed Digital Transmitters
ISO/IEC 17025:2005	General requirements for the Competence of Testing and Calibrations Laboratories

Average Conducted Output Power and EIRP

Engineer: Aaron S. Froehlich

Test Date: 07/15/22-07/27/22

Test Procedure

The Average conducted output power has been measured according to ANSI C63.26 Clause 5.2.4.4.1. A greater than 98% Duty cycle was not achieved during the testing of Band 66 only. For that band triggering and gating techniques were used to ensure that measurements were made during the transmitter on-time. All other bands operated at 100% duty cycle when paired with the CMW 500. The worst case path loss within the measured spectrum was input as a reference level offset.

Limits

47 CFR 22.913(a)(5)

The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 watts.

Applicable to:

LTE Band 26 (Ch 16797-27033, 824.7-848.3 MHz)

47 CFR 24.232(c)

Mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.

Applicable to:

LTE Band 25 (Ch 26047-26682, 1850.7-1914.2 MHz)

47 CFR 27.50(b)(10)

Portable stations (hand-held devices) transmitting in the 746-757 MHz, 776-788 MHz, and 805-806 MHz bands are limited to 3 watts ERP.

Applicable to:

LTE Band 13 (Ch 23205-23255, 779.5-784.5 MHz)

47 CFR 27.50(c)(10)

Portable stations (hand-held devices) in the 600 MHz uplink band and the 698-746 MHz band, and fixed and mobile stations in the 600 MHz uplink band are limited to 3 watts ERP.

Applicable to:

LTE Band 12 (Ch 23017-23173, 699.7-715.3 MHz)

LTE Band 71 (Ch 133147-133447, 665.5-695.5 MHz)

47 CFR 27.50(d)(4)

Fixed, mobile, and portable (hand-held) stations operating in the 1710-1755 MHz band and mobile and portable stations operating in the 1695-1710 MHz and 1755-1780 MHz bands are limited to 1 watt EIRP.

Applicable to:

LTE Band 66 (Ch 131979-132665, 1710.7-1779.3 MHz)

47 CFR 27.50(h)(2)

Mobile stations are limited to 2.0 watts EIRP. All user stations are limited to 2.0 watts transmitter output power.

Applicable to:

LTE Bank 41 (Ch 39675-41565, 2498.5 – 2687.5 MHz)

47 CFR 90.635(b)

The maximum output power of the transmitter for mobile stations is 100 watts (20 dBw).

Applicable to:

LTE Band 26 (Ch 26697-26783, 814.7-823.3 MHz)

47 CFR 90.542(a)(7)

Portable stations (hand-held devices) transmitting in the 758-768 MHz band and the 788-798 MHz band are limited to 3 watts ERP.

Applicable to:

LTE Band 14 (Ch 23305-23355, 790.5-795.5 MHz)

RSS-130 Clause 4.6.2

The e.r.p. shall not exceed 3 watts for mobile equipment, fixed subscriber equipment and portable equipment.

Applicable to:

LTE Band 71 (Ch 133147-133447, 665.5-695.5 MHz)

RSS-130 Clause 4.6.3

The e.r.p. shall not exceed 3 watts for portable equipment and indoor fixed subscriber equipment.

Applicable to:

LTE Band 12 (Ch 23017-23173, 699.7-715.3 MHz)

LTE Band 13 (Ch 23205-23255, 779.5-784.5 MHz)

RSS-132 Clause 5.4

The equivalent isotropically radiated power (e.i.r.p.) for mobile equipment shall not exceed 11.5 watts.

Applicable to:

LTE Band 26 (Ch 16797-27033, 824.7 – 848.3 MHz)

RSS-133 / SRSP-510 Clause 5.1.2

Mobile stations and hand-held portables are limited to 2 watts maximum e.i.r.p.

Applicable to:

LTE Band 25 (Ch 26047-26682, 1850.7-1914.2 MHz)

RSS-139 Clause 6.5

The equivalent isotropically radiated power (e.i.r.p.) for mobile and portable transmitters shall not exceed one watt.

Applicable to:

LTE Band 26 (Ch 26047-26682, 1850.7-1914.2 MHz)

LTE Band 66 (Ch 131979-132665, 1710.7-1779.3 MHz)

RSS-140 Clause 4.3

The e.r.p. for portable equipment including handheld devices shall not exceed 3 W.

Applicable to:

LTE Band 14(Ch 23305-23355, 790.5-795.5 MHz)

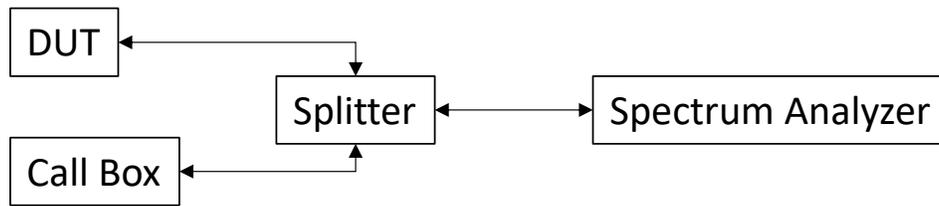
RSS-199 Clause 4.4

For mobile subscriber equipment, the e.i.r.p. shall not exceed 2 W.

Spectrum Analyzer Settings:

Span	2x to 3x the OBW
RBW	1% to 5% of the OBW
VBW	≥ 3 * RBW
Sweep	Auto
Detector	Power Averaging (RMS)
Trace Mode	Trace Averaging, Count ≥ 100
Integration	Via channel power measurement function

Test Setup



Test Data

Tabular Data

Where:

$$\text{ERP} = \text{Avg Power} + \text{Ant Gain} - 2.15$$

$$\text{EIRP} = \text{Avg Power} + \text{Ant Gain}$$

$$\text{Limit[dBm]} = 10 * \text{Log}_{10}(\text{Limit[W]}/0.001)$$

$$\text{Margin} = \text{Power}^1 - \text{Limit}$$

Note 1: EIRP, ERP, or Conducted Output depending on rule part limits

LTE Band 12 – Part 27C / RSS-130

Band #	Modulation Type	Ch #	Freq MHz	BW MHz	Avg Power dBm	Ant Gain dBi	ERP dBm	FCC Limit W	FCC Limit dBm	FCC Margin dB	ISED Limit W	ISED Limit dBm	ISED Margin dB
12	QPSK	23017	699.7	1.4	21.40	0.79	20.04	3.0	34.77	-14.7	3.0	34.77	-14.7
		23025	700.5	3	21.17	0.79	19.81	3.0	34.77	-15.0	3.0	34.77	-15.0
		23035	701.5	5	20.71	0.79	19.35	3.0	34.77	-15.4	3.0	34.77	-15.4
		23060	704	10	19.83	0.79	18.47	3.0	34.77	-16.3	3.0	34.77	-16.3
		23085	706.5	1.4	19.65	0.79	18.29	3.0	34.77	-16.5	3.0	34.77	-16.5
				3	19.69	0.79	18.33	3.0	34.77	-16.4	3.0	34.77	-16.4
				5	19.79	0.79	18.43	3.0	34.77	-16.3	3.0	34.77	-16.3
				10	20.06	0.79	18.70	3.0	34.77	-16.1	3.0	34.77	-16.1
		23173	715.3	1.4	19.91	0.79	18.55	3.0	34.77	-16.2	3.0	34.77	-16.2
	23165	714.5	3	19.74	0.79	18.38	3.0	34.77	-16.4	3.0	34.77	-16.4	
	23155	713.5	5	20.13	0.79	18.77	3.0	34.77	-16.0	3.0	34.77	-16.0	
	23130	711	10	20.47	0.79	19.11	3.0	34.77	-15.7	3.0	34.77	-15.7	
	16QAM	23017	699.7	1.4	20.70	0.79	19.34	3.0	34.77	-15.4	3.0	34.77	-15.4
		23025	700.5	3	20.32	0.79	18.96	3.0	34.77	-15.8	3.0	34.77	-15.8
		23035	701.5	5	19.87	0.79	18.51	3.0	34.77	-16.3	3.0	34.77	-16.3
		23085	706.5	1.4	18.63	0.79	17.27	3.0	34.77	-17.5	3.0	34.77	-17.5
				3	18.72	0.79	17.36	3.0	34.77	-17.4	3.0	34.77	-17.4
				5	18.89	0.79	17.53	3.0	34.77	-17.2	3.0	34.77	-17.2
23173		715.3	1.4	18.90	0.79	17.54	3.0	34.77	-17.2	3.0	34.77	-17.2	
23165		714.5	3	18.75	0.79	17.39	3.0	34.77	-17.4	3.0	34.77	-17.4	
23155		713.5	5	19.32	0.79	17.96	3.0	34.77	-16.8	3.0	34.77	-16.8	

LTE Band 13 – Part 27C / RSS-130

Band #	Modulation Type	Ch #	Freq MHz	BW MHz	Avg Power dBm	Ant Gain dBi	ERP dBm	FCC Limit W	FCC Limit dBm	FCC Margin dB	ISED Limit W	ISED Limit dBm	ISED Margin dB
13	QPSK	23205	779.5	5	22.07	1.56	21.48	3.0	34.77	-13.3	3.0	34.77	-13.3
		23230	782	5	22.19	1.56	21.60	3.0	34.77	-13.2	3.0	34.77	-13.2
				10	21.92	1.56	21.33	3.0	34.77	-13.4	3.0	34.77	-13.4
	23255	784.5	5	22.24	1.56	21.65	3.0	34.77	-13.1	3.0	34.77	-13.1	
	16QAM	23205	779.5	5	21.11	1.56	20.52	3.0	34.77	-14.3	3.0	34.77	-14.3
		23230	782	5	21.31	1.56	20.72	3.0	34.77	-14.1	3.0	34.77	-14.1
23255		784.5	5	21.25	1.56	20.66	3.0	34.77	-14.1	3.0	34.77	-14.1	

LTE Band 14 – Part 90R / RSS-140

Band #	Modulation Type	Ch #	Freq MHz	BW MHz	Avg Power dBm	Ant Gain dBi	ERP dBm	FCC Limit W	FCC Limit dBm	FCC Margin dB	ISED Limit W	ISED Limit dBm	ISED Margin dB
14	QPSK	23305	790.5	5	19.53	1.65	19.03	3.0	34.77	-15.7	95.0	49.78	-30.7
		23330	793	5	19.20	1.65	18.70	3.0	34.77	-16.1	95.0	49.78	-31.1
				10	21.50	1.65	21.00	3.0	34.77	-13.8	95.0	49.78	-28.8
	23355	795.5	5	19.42	1.65	18.92	3.0	34.77	-15.9	95.0	49.78	-30.9	
	16QAM	23305	790.5	5	18.48	1.65	17.98	3.0	34.77	-16.8	91.0	49.59	-31.6
		23330	793	5	18.32	1.65	17.82	3.0	34.77	-17.0	91.0	49.59	-31.8
23355		795.5	5	18.29	1.65	17.79	3.0	34.77	-17.0	91.0	49.59	-31.8	

LTE Band 25 – Part 24E / RSS-133

Band #	Modulation Type	Ch #	Freq MHz	BW MHz	Avg Power dBm	Ant Gain dBi	EIRP dBm	FCC Limit W	FCC Limit dBm	Grant Margin dB	ISED Limit W	ISED Limit dBm	TAC Margin dB
25	QPSK	26047	1850.7	1.4	21.76	2.73	24.49	2.0	33.01	-8.5	2.0	33.01	-8.5
		26055	1851.5	3	22.24	2.73	24.97	2.0	33.01	-8.0	2.0	33.01	-8.0
		26065	1852.5	5	21.91	2.73	24.64	2.0	33.01	-8.4	2.0	33.01	-8.4
		26090	1855	10	21.61	2.73	24.34	2.0	33.01	-8.7	2.0	33.01	-8.7
		26115	1857.5	15	21.70	2.73	24.43	2.0	33.01	-8.6	2.0	33.01	-8.6
		26140	1860	20	21.74	2.73	24.47	2.0	33.01	-8.5	2.0	33.01	-8.5
		26365	1882.5	1.4	20.93	2.73	23.66	2.0	33.01	-9.4	2.0	33.01	-9.4
				3	21.90	2.73	24.63	2.0	33.01	-8.4	2.0	33.01	-8.4
				5	21.69	2.73	24.42	2.0	33.01	-8.6	2.0	33.01	-8.6
				10	21.35	2.73	24.08	2.0	33.01	-8.9	2.0	33.01	-8.9
				15	20.79	2.73	23.52	2.0	33.01	-9.5	2.0	33.01	-9.5
				20	21.66	2.73	24.39	2.0	33.01	-8.6	2.0	33.01	-8.6
		26682	1914.2	1.4	18.83	2.73	21.56	2.0	33.01	-11.5	2.0	33.01	-11.5
		26674	1913.4	3	19.19	2.73	21.92	2.0	33.01	-11.1	2.0	33.01	-11.1
		26664	1912.4	5	19.59	2.73	22.32	2.0	33.01	-10.7	2.0	33.01	-10.7
		26639	1909.9	10	19.78	2.73	22.51	2.0	33.01	-10.5	2.0	33.01	-10.5
		26614	1907.4	15	20.11	2.73	22.84	2.0	33.01	-10.2	2.0	33.01	-10.2
		26589	1904.9	20	20.66	2.73	23.39	2.0	33.01	-9.6	2.0	33.01	-9.6
	16QAM	26047	1850.7	1.4	21.15	2.73	23.88	2.0	33.01	-9.1	2.0	33.01	-9.1
		26055	1851.5	3	21.10	2.73	23.83	2.0	33.01	-9.2	2.0	33.01	-9.2
		26065	1852.5	5	21.13	2.73	23.86	2.0	33.01	-9.2	2.0	33.01	-9.2
		26365	1882.5	1.4	20.03	2.73	22.76	2.0	33.01	-10.3	2.0	33.01	-10.3
				3	20.07	2.73	22.8	2.0	33.01	-10.2	2.0	33.01	-10.2
				5	20.81	2.73	23.54	2.0	33.01	-9.5	2.0	33.01	-9.5
26682		1914.2	1.4	18.47	2.73	21.2	2.0	33.01	-11.8	2.0	33.01	-11.8	
26674		1913.4	3	18.60	2.73	21.33	2.0	33.01	-11.7	2.0	33.01	-11.7	
26664	1912.4	5	19.04	2.73	21.77	2.0	33.01	-11.2	2.0	33.01	-11.2		

LTE Band 26 – Part 90S

Band #	Modulation Type	Ch #	Freq MHz	BW MHz	Avg Power dBm	Ant Gain dBi	ERP dBm	FCC Limit W	FCC Limit dBm	FCC Margin dB
26 [Part 90] 47 CFR 90.635(b)	QPSK	26697	814.7	1.4	21.80	1.93	21.58	100.0	50.00	-28.2
		26705	815.5	3	21.86	1.93	21.64	100.0	50.00	-28.1
		26715	816.5	5	21.80	1.93	21.58	100.0	50.00	-28.2
		26765	821.5	15	21.52	1.93	21.30	7.0	38.45	-17.2
		26740	819	1.4	21.67	1.93	21.45	100.0	50.00	-28.3
				3	21.80	1.93	21.58	100.0	50.00	-28.2
				5	21.66	1.93	21.44	100.0	50.00	-28.3
				10	21.58	1.93	21.36	100.0	50.00	-28.4
		26783	823.3	1.4	21.56	1.93	21.34	100.0	50.00	-28.4
	26775	822.5	3	21.68	1.93	21.46	100.0	50.00	-28.3	
	26765	821.5	5	21.61	1.93	21.39	100.0	50.00	-28.4	
	16QAM	26697	814.7	1.4	21.01	1.93	20.80	100.0	50.00	-29.0
		26705	815.5	3	20.80	1.93	20.58	100.0	50.00	-29.2
		26715	816.5	5	20.83	1.93	20.61	100.0	50.00	-29.2
		26740	819	1.4	20.77	1.93	20.56	100.0	50.00	-29.2
				3	20.56	1.93	20.34	100.0	50.00	-29.4
				5	20.72	1.93	20.50	100.0	50.00	-29.3
		26783	823.3	1.4	20.75	1.93	20.53	100.0	50.00	-29.3
26775		822.5	3	20.88	1.93	20.66	100.0	50.00	-29.1	
26765		821.5	5	20.75	1.93	20.53	100.0	50.00	-29.3	

Note: Ch 26765 at 15 MHz nominal bandwidth falls between Rule parts 90S and 22H. The more restrictive part 22 limit has been applied i.a.w. KDB 971168 D02 Clause VIII

LTE Band 26 – Part 22H / RSS-132

Band #	Modulation Type	Ch #	Freq MHz	BW MHz	Avg Power dBm	Ant Gain dBi	ERP dBm	FCC Limit W	FCC Limit dBm	FCC Margin dB	ISED Limit W	ISED Limit dBm	ISED Margin dB
26	QPSK	26797	824.7	1.4	21.40	1.93	21.18	7.0	38.45	-17.3	11.5	40.61	-19.4
		26805	825.5	3	21.59	1.93	21.37	7.0	38.45	-17.1	11.5	40.61	-19.2
		26815	826.5	5	21.60	1.93	21.38	7.0	38.45	-17.1	11.5	40.61	-19.2
		26840	829	10	21.54	1.93	21.32	7.0	38.45	-17.1	11.5	40.61	-19.3
		26865	831.5	15	21.72	1.93	21.50	7.0	38.45	-17.0	11.5	40.61	-19.1
		26915	836.5	1.4	22.35	1.93	22.13	7.0	38.45	-16.3	11.5	40.61	-18.5
				3	22.39	1.93	22.17	7.0	38.45	-16.3	11.5	40.61	-18.4
				5	22.18	1.93	21.96	7.0	38.45	-16.5	11.5	40.61	-18.6
				10	21.98	1.93	21.76	7.0	38.45	-16.7	11.5	40.61	-18.8
				15	22.11	1.93	21.89	7.0	38.45	-16.6	11.5	40.61	-18.7
		27033	848.3	1.4	22.54	1.93	22.32	7.0	38.45	-16.1	11.5	40.61	-18.3
		27025	847.5	3	22.57	1.93	22.35	7.0	38.45	-16.1	11.5	40.61	-18.3
		27015	846.5	5	22.61	1.93	22.39	7.0	38.45	-16.1	11.5	40.61	-18.2
		26990	844	10	22.40	1.93	22.18	7.0	38.45	-16.3	11.5	40.61	-18.4
		26965	841.5	15	22.42	1.93	22.20	7.0	38.45	-16.3	11.5	40.61	-18.4
	16QAM	26797	824.7	1.4	20.79	1.93	20.57	7.0	38.45	-17.9	11.5	40.61	-20.0
		26805	825.5	3	20.66	1.93	20.44	7.0	38.45	-18.0	11.5	40.61	-20.2
		26815	826.5	5	20.63	1.93	20.41	7.0	38.45	-18.0	11.5	40.61	-20.2
		26915	836.5	1.4	21.58	1.93	21.36	7.0	38.45	-17.1	11.5	40.61	-19.2
				3	21.70	1.93	21.48	7.0	38.45	-17.0	11.5	40.61	-19.1
				5	21.31	1.93	21.09	7.0	38.45	-17.4	11.5	40.61	-19.5
27033		848.3	1.4	21.76	1.93	21.54	7.0	38.45	-16.9	11.5	40.61	-19.1	
27025	847.5	3	21.64	1.93	21.42	7.0	38.45	-17.0	11.5	40.61	-19.2		
27015	846.5	5	21.72	1.93	21.50	7.0	38.45	-17.0	11.5	40.61	-19.1		

LTE Band 41 – Part 27 / RSS-199

Band #	Modulation Type	Ch #	Freq MHz	BW MHz	Avg Power dBm	Ant Gain dBi	EIRP dBm	FCC Limit W	FCC Limit dBm	FCC Margin dB	ISED Limit W	ISED Limit dBm	ISED Margin dB
41	QPSK	39675	2498.5	5	13.63	3.2	16.83	2.0	33.01	-16.2	2.0	33.01	-16.2
		39700	2501	10	17.05	3.2	20.25	2.0	33.01	-12.8	2.0	33.01	-12.8
		39725	2503.5	15	16.90	3.2	20.1	2.0	33.01	-12.9	2.0	33.01	-12.9
		39750	2506	20	17.32	3.2	20.52	2.0	33.01	-12.5	2.0	33.01	-12.5
		40620	2593	5	15.79	3.2	18.99	2.0	33.01	-14.0	2.0	33.01	-14.0
				10	15.32	3.2	18.52	2.0	33.01	-14.5	2.0	33.01	-14.5
				15	15.38	3.2	18.58	2.0	33.01	-14.4	2.0	33.01	-14.4
				20	14.97	3.2	18.17	2.0	33.01	-14.8	2.0	33.01	-14.8
		41565	2687.5	5	16.75	3.2	19.95	2.0	33.01	-13.1	2.0	33.01	-13.1
		41540	2685	10	16.41	3.2	19.61	2.0	33.01	-13.4	2.0	33.01	-13.4
	41515	2682.5	15	16.47	3.2	19.67	2.0	33.01	-13.3	2.0	33.01	-13.3	
	41490	2680	20	16.15	3.2	19.35	2.0	33.01	-13.7	2.0	33.01	-13.7	
	16QAM	39675	2498.5	5	16.51	3.2	19.71	2.0	33.01	-13.3	2.0	33.01	-13.3
		40620	2593	5	15.29	3.2	18.49	2.0	33.01	-14.5	2.0	33.01	-14.5
41565		2687.5	5	15.67	3.2	18.87	2.0	33.01	-14.1	2.0	33.01	-14.1	

LTE Band 66 – Part 27C / RSS-139

Band #	Modulation Type	Ch #	Freq MHz	BW MHz	Avg Power dBm	Ant Gain dBi	ERP dBm	FCC Limit W	FCC Limit dBm	FCC Margin dB	ISED Limit W	ISED Limit dBm	ISED Margin dB
66 [Part 27 / RSS-139] 47 CFR 27.50(d)(4) RSS-139 C 6.5	QPSK	131979	1710.7	1.4	22.87	2.8	25.67	1.0	30.00	-4.3	1.0	30.00	-4.3
		131987	1711.5	3	22.77	2.8	25.57	1.0	30.00	-4.4	1.0	30.00	-4.4
		131997	1712.5	5	22.60	2.8	25.4	1.0	30.00	-4.6	1.0	30.00	-4.6
		132022	1715	10	21.83	2.8	24.63	1.0	30.00	-5.4	1.0	30.00	-5.4
		132047	1717.5	15	21.57	2.8	24.37	1.0	30.00	-5.6	1.0	30.00	-5.6
		132072	1720	20	21.25	2.8	24.05	1.0	30.00	-6.0	1.0	30.00	-6.0
		132322	1745	1.4	23.19	2.8	25.99	1.0	30.00	-4.0	1.0	30.00	-4.0
				3	23.26	2.8	26.06	1.0	30.00	-3.9	1.0	30.00	-3.9
				5	23.28	2.8	26.08	1.0	30.00	-3.9	1.0	30.00	-3.9
				10	22.85	2.8	25.65	1.0	30.00	-4.4	1.0	30.00	-4.4
				15	22.57	2.8	25.37	1.0	30.00	-4.6	1.0	30.00	-4.6
				20	22.73	2.8	25.53	1.0	30.00	-4.5	1.0	30.00	-4.5
		132665	1779.3	1.4	22.41	2.8	25.21	1.0	30.00	-4.8	1.0	30.00	-4.8
		132657	1778.5	3	22.18	2.8	24.98	1.0	30.00	-5.0	1.0	30.00	-5.0
		132647	1777.5	5	22.46	2.8	25.26	1.0	30.00	-4.7	1.0	30.00	-4.7
		132622	1775	10	21.79	2.8	24.59	1.0	30.00	-5.4	1.0	30.00	-5.4
		132597	1772.5	15	21.44	2.8	24.24	1.0	30.00	-5.8	1.0	30.00	-5.8
		132572	1770	20	21.00	2.8	23.8	1.0	30.00	-6.2	1.0	30.00	-6.2
	16QAM	131979	1710.7	1.4	22.05	2.8	24.85	1.0	30.00	-5.2	1.0	30.00	-5.2
		131987	1711.5	3	22.09	2.8	24.89	1.0	30.00	-5.1	1.0	30.00	-5.1
		131997	1712.5	5	21.85	2.8	24.65	1.0	30.00	-5.4	1.0	30.00	-5.4
		132322	1745	1.4	22.61	2.8	25.41	1.0	30.00	-4.6	1.0	30.00	-4.6
				3	22.57	2.8	25.37	1.0	30.00	-4.6	1.0	30.00	-4.6
				5	22.56	2.8	25.36	1.0	30.00	-4.6	1.0	30.00	-4.6
132665		1779.3	1.4	21.10	2.8	23.9	1.0	30.00	-6.1	1.0	30.00	-6.1	
132657		1778.5	3	21.52	2.8	24.32	1.0	30.00	-5.7	1.0	30.00	-5.7	
132647		1777.5	5	21.87	2.8	24.67	1.0	30.00	-5.3	1.0	30.00	-5.3	

LTE Band 71 – Part 27C / RSS-130

Band #	Modulation Type	Ch #	Freq MHz	BW MHz	Avg Power dBm	Ant Gain dBi	ERP dBm	FCC Limit W	FCC Limit dBm	FCC Margin dB	ISED Limit W	ISED Limit dBm	ISED Margin dB
71 [Part 27 / RSS-130 C 4.6.2] 47 CFR 27.50(c)(10)	QPSK	133147	665.5	5	17.62	0.76	16.23	3.0	34.77	-18.5	3.0	34.77	-18.5
		133172	668	10	19.92	0.76	18.53	3.0	34.77	-16.2	3.0	34.77	-16.2
		133197	670.5	15	20.43	0.76	19.04	3.0	34.77	-15.7	3.0	34.77	-15.7
		133222	673	20	20.53	0.76	19.14	3.0	34.77	-15.6	3.0	34.77	-15.6
		133297	680.5	5	18.13	0.76	16.74	3.0	34.77	-18.0	3.0	34.77	-18.0
				10	20.43	0.76	19.04	3.0	34.77	-15.7	3.0	34.77	-15.7
				15	20.66	0.76	19.27	3.0	34.77	-15.5	3.0	34.77	-15.5
				20	20.59	0.76	19.20	3.0	34.77	-15.6	3.0	34.77	-15.6
		133447	695.5	5	17.54	0.76	16.15	3.0	34.77	-18.6	3.0	34.77	-18.6
		133422	693	10	19.94	0.76	18.55	3.0	34.77	-16.2	3.0	34.77	-16.2
		133397	690.5	15	20.25	0.76	18.86	3.0	34.77	-15.9	3.0	34.77	-15.9
		133372	688	20	20.38	0.76	18.99	3.0	34.77	-15.8	3.0	34.77	-15.8
		16QAM	133147	665.5	5	16.61	0.76	15.22	3.0	34.77	-19.6	3.0	34.77
	133297		680.5	5	17.21	0.76	15.82	3.0	34.77	-19.0	3.0	34.77	-19.0
	133447		695.5	5	16.60	0.76	15.21	3.0	34.77	-19.6	3.0	34.77	-19.6

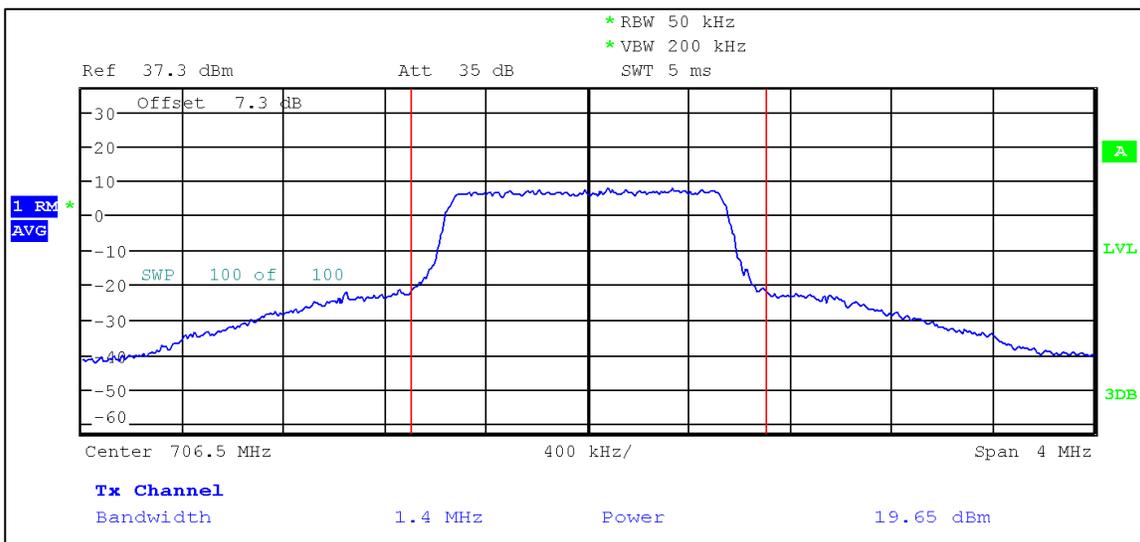
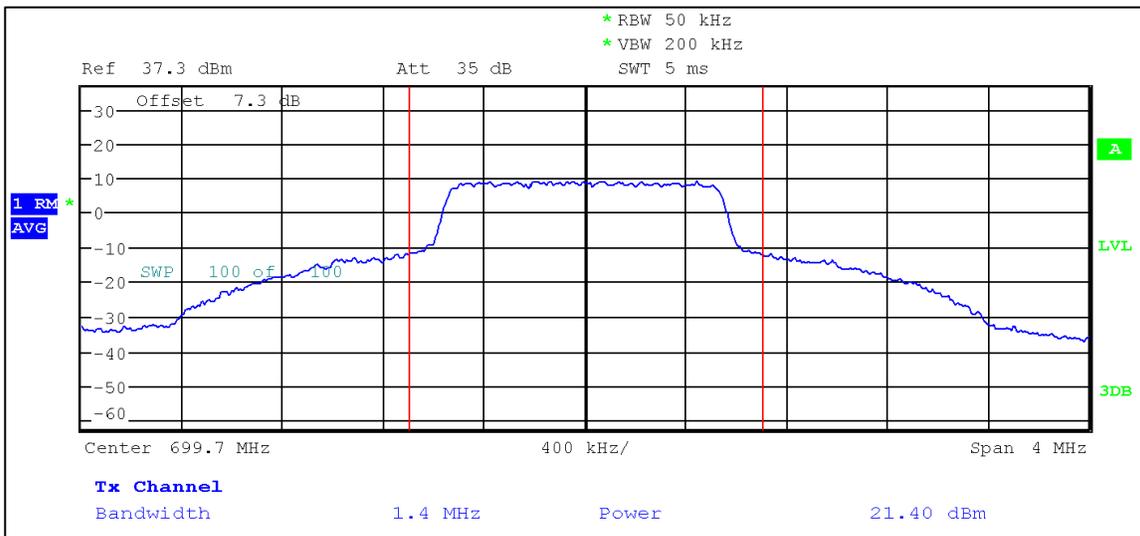
Plots

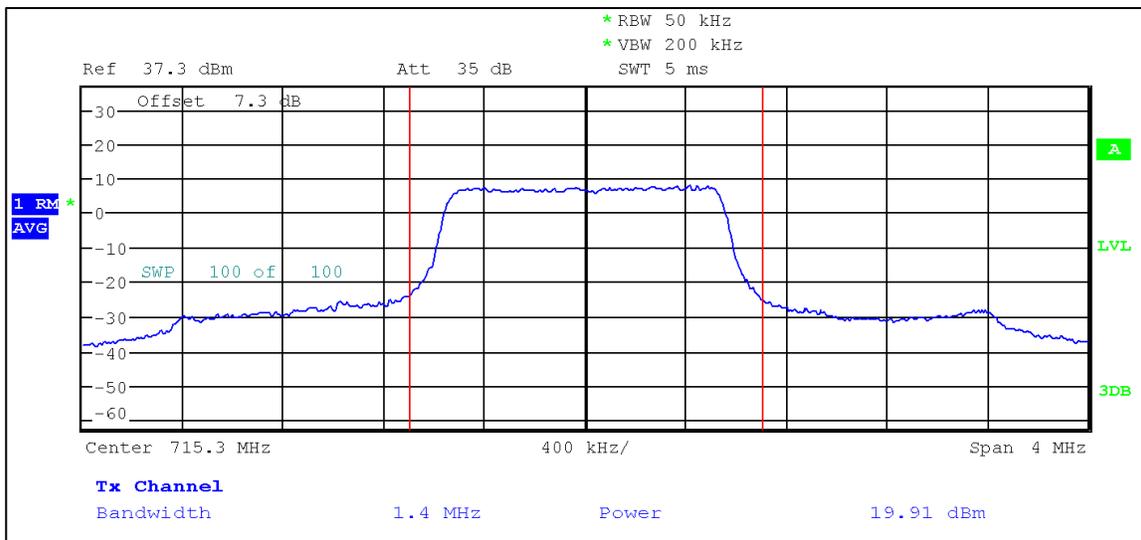
Representative plots have been included below. For full test data reference Annex A

LTE Band 12

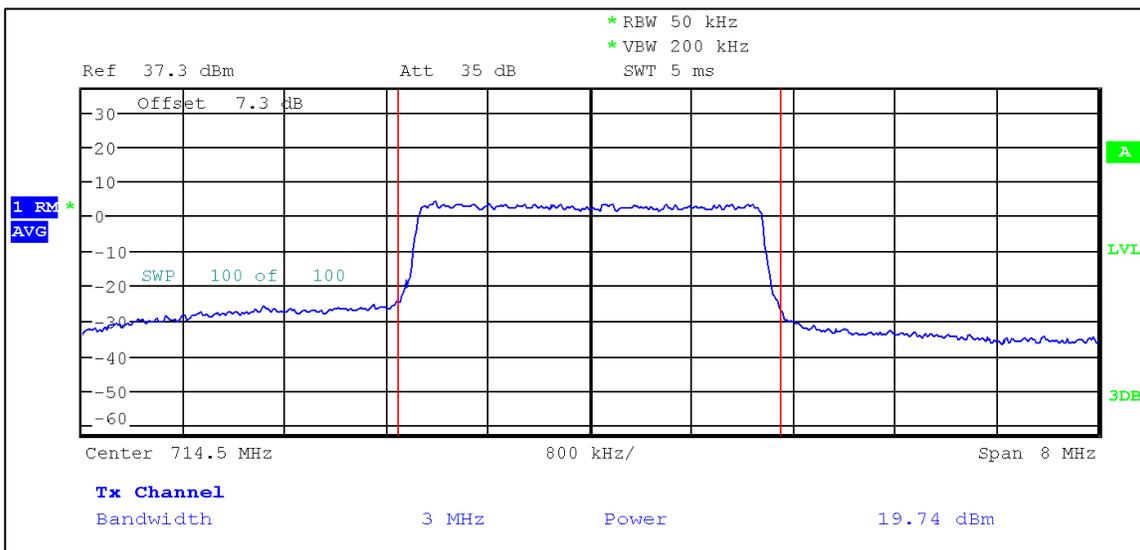
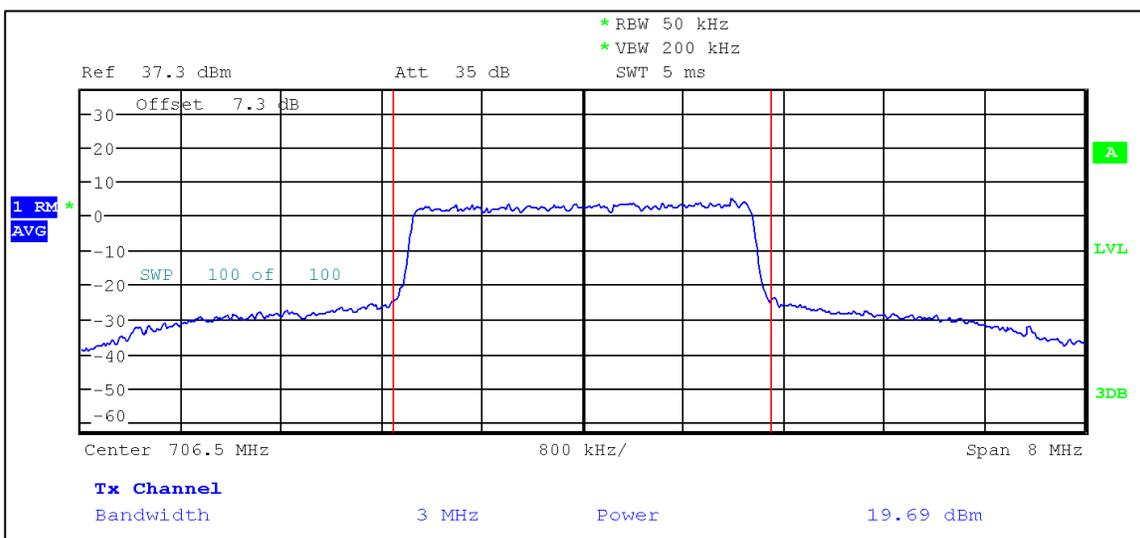
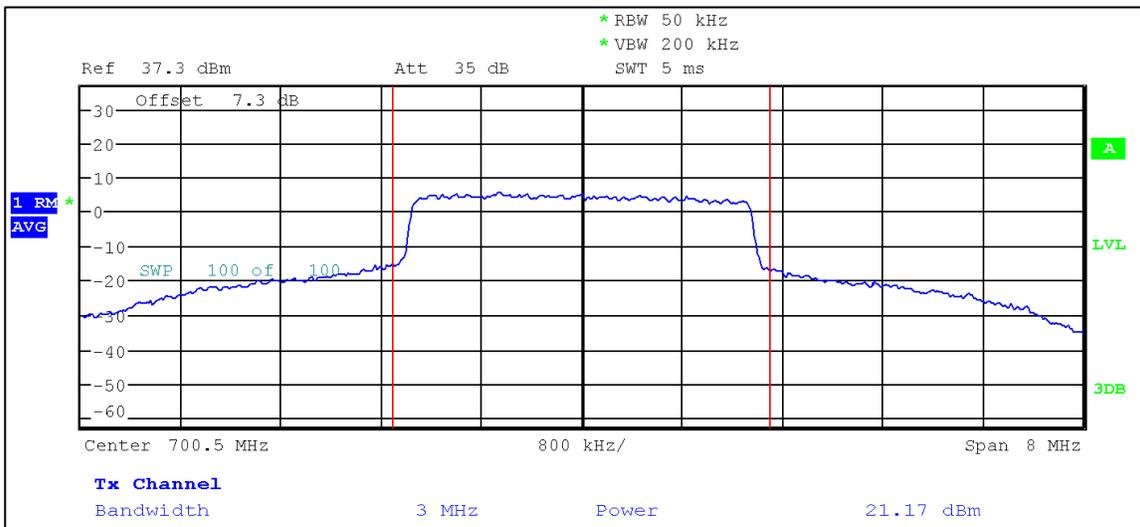
QPSK

1.4 MHz Nominal Bandwidth

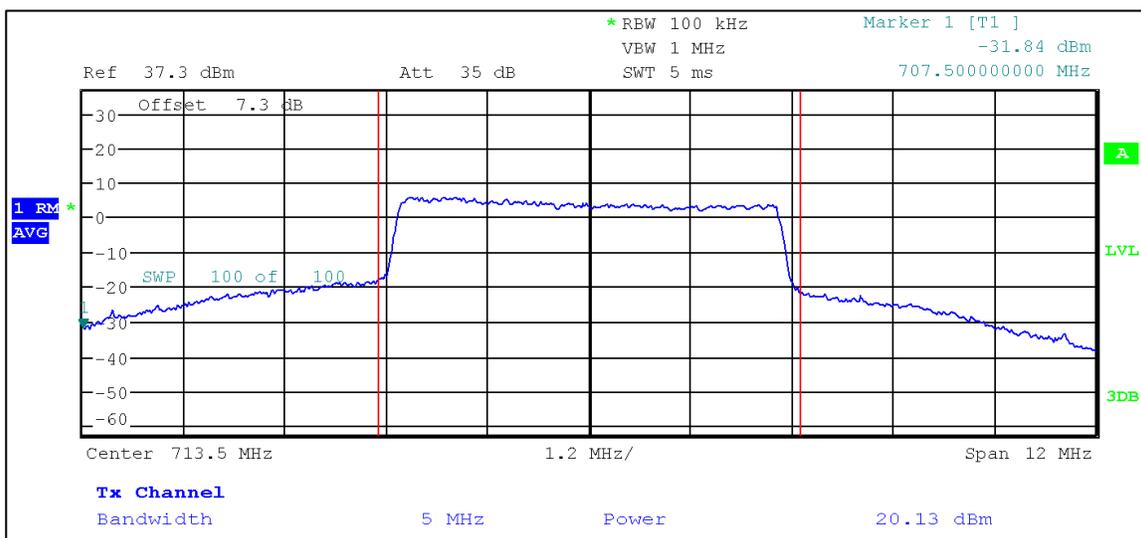
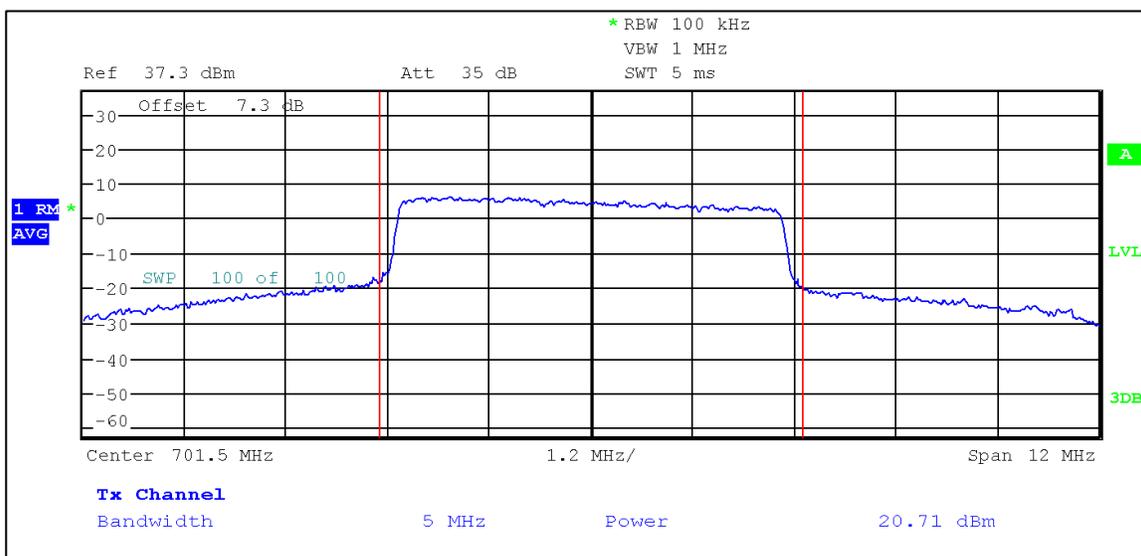
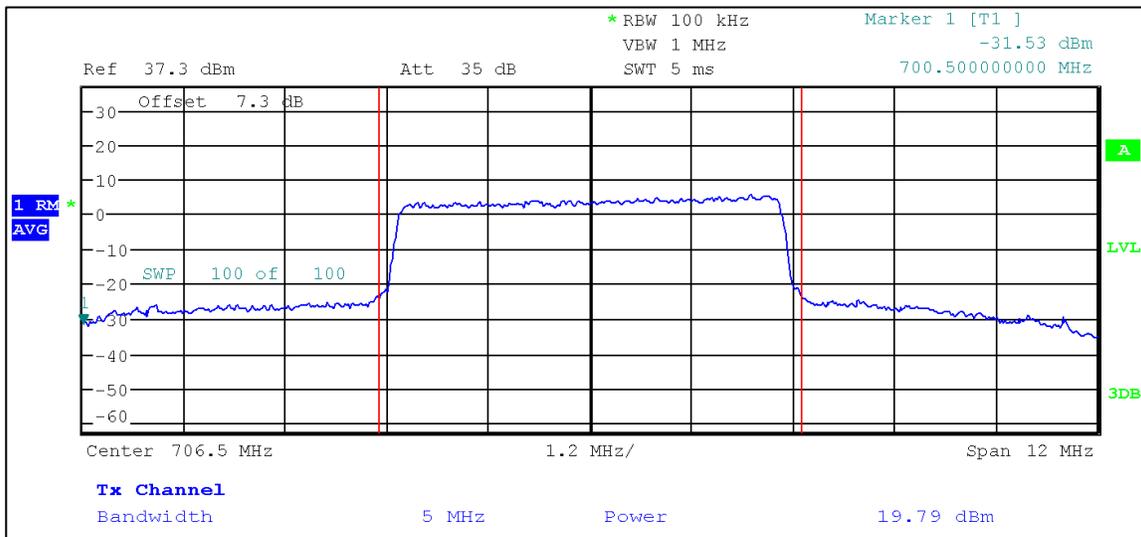




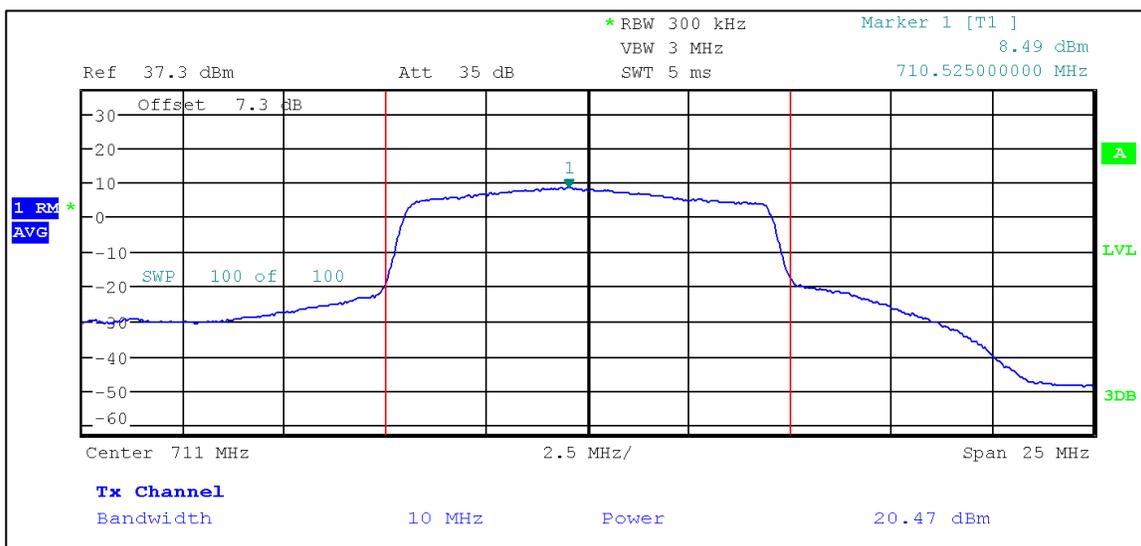
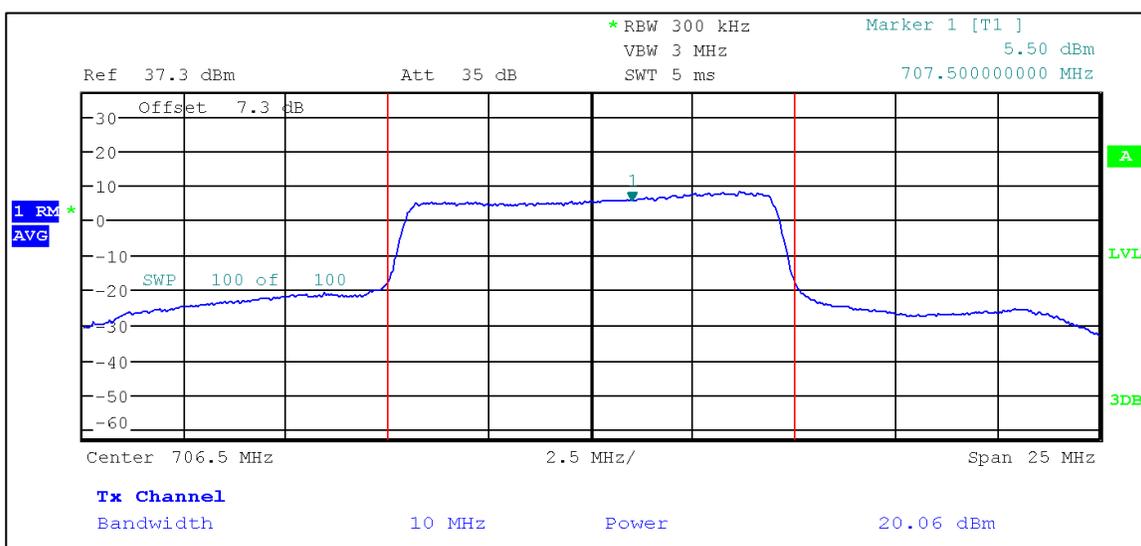
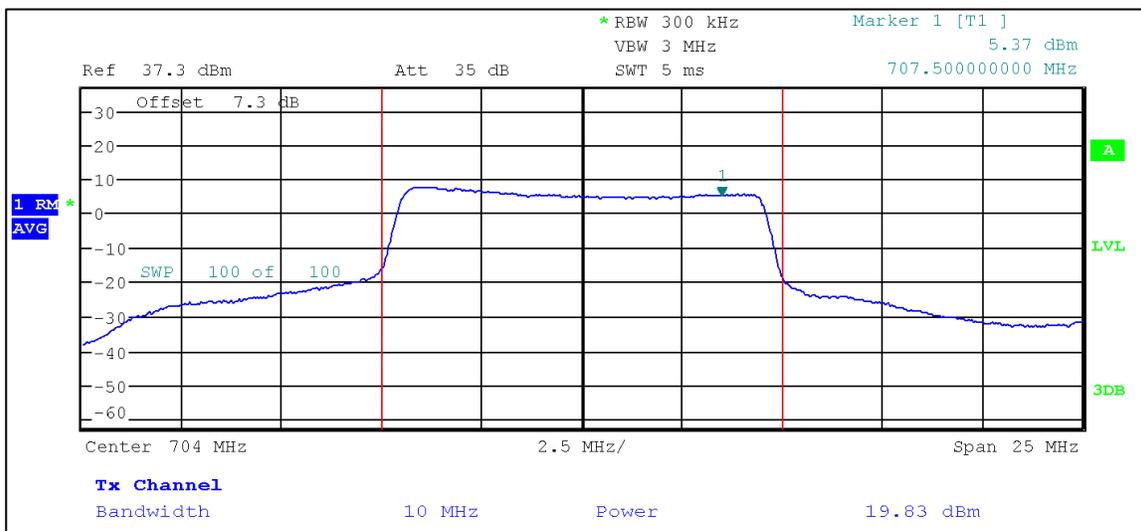
3 MHz Nominal Bandwidth



5 MHz Nominal Bandwidth

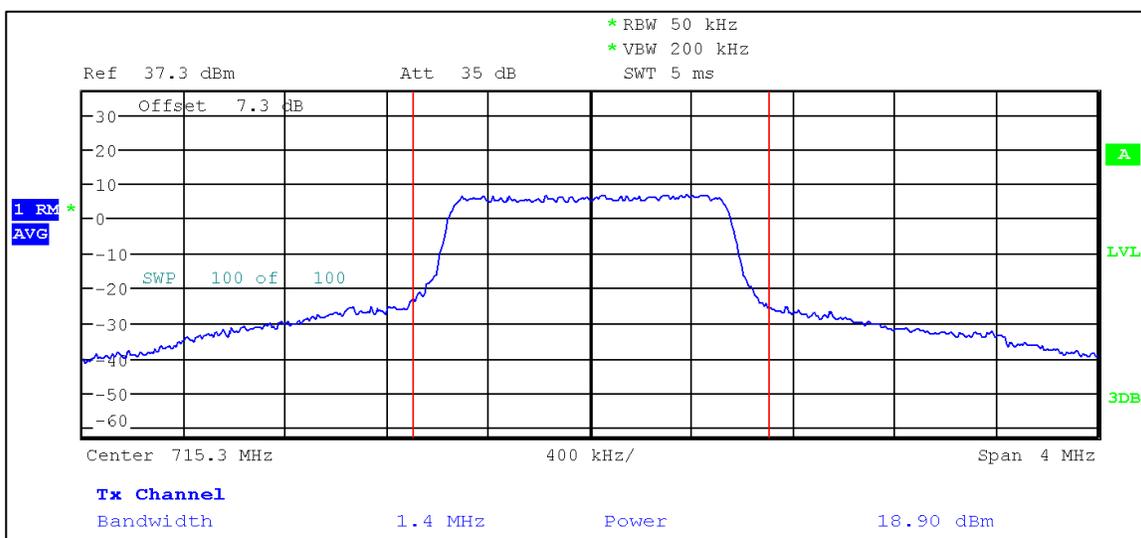
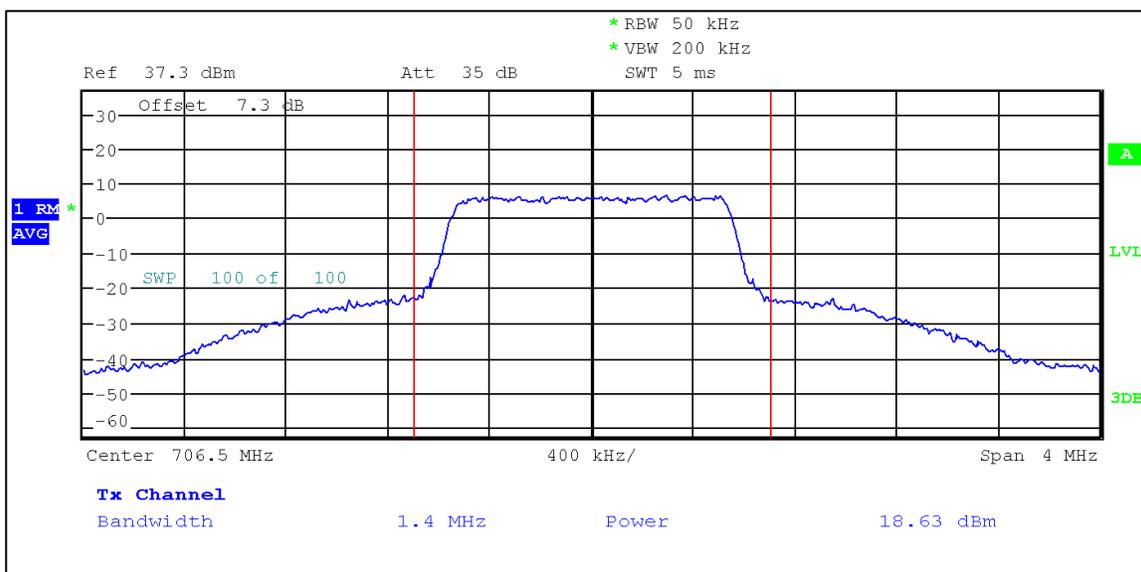
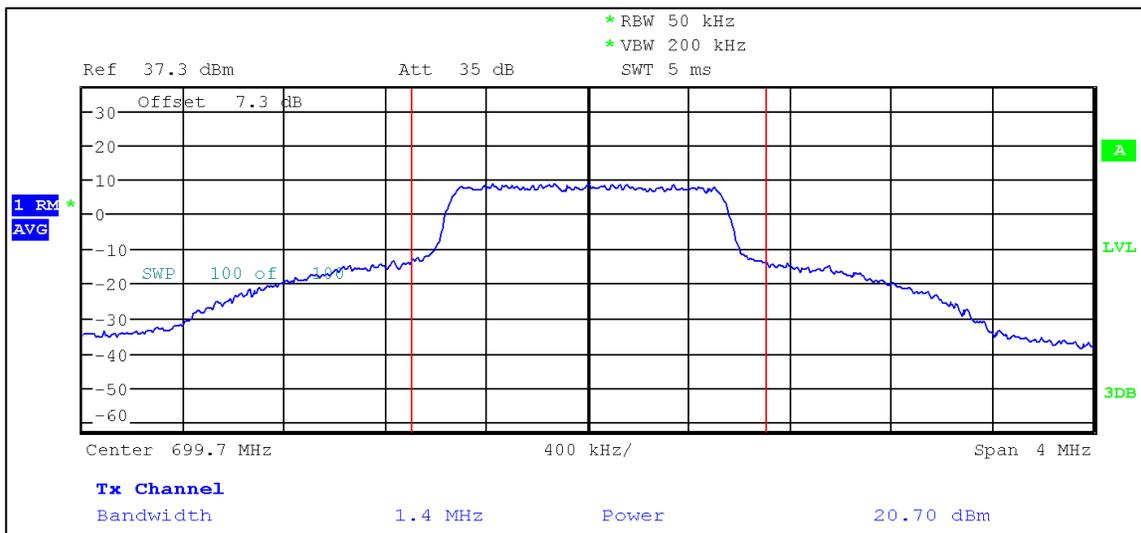


10 MHz Nominal Bandwidth

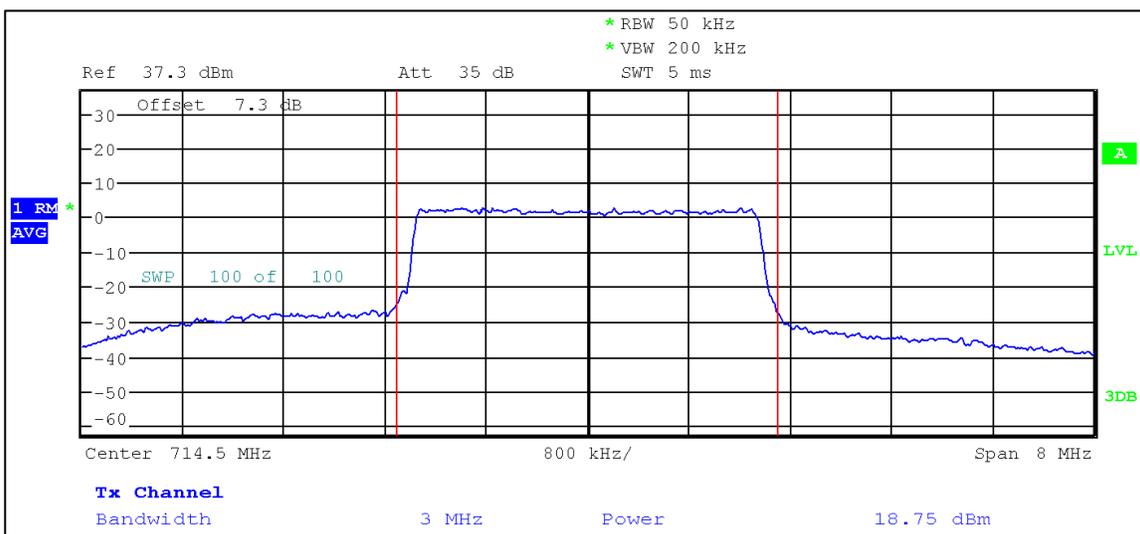
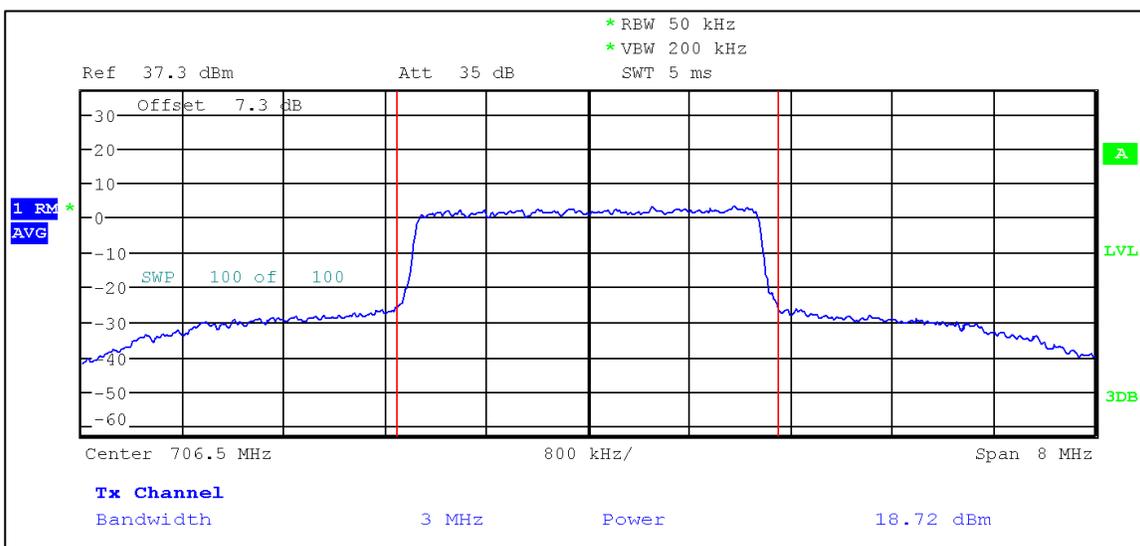
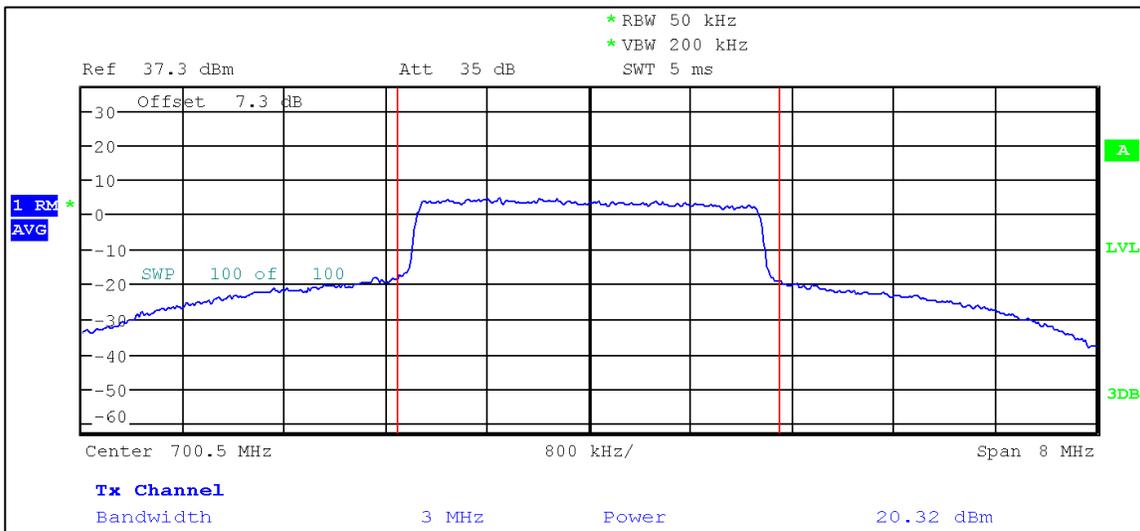


16QAM

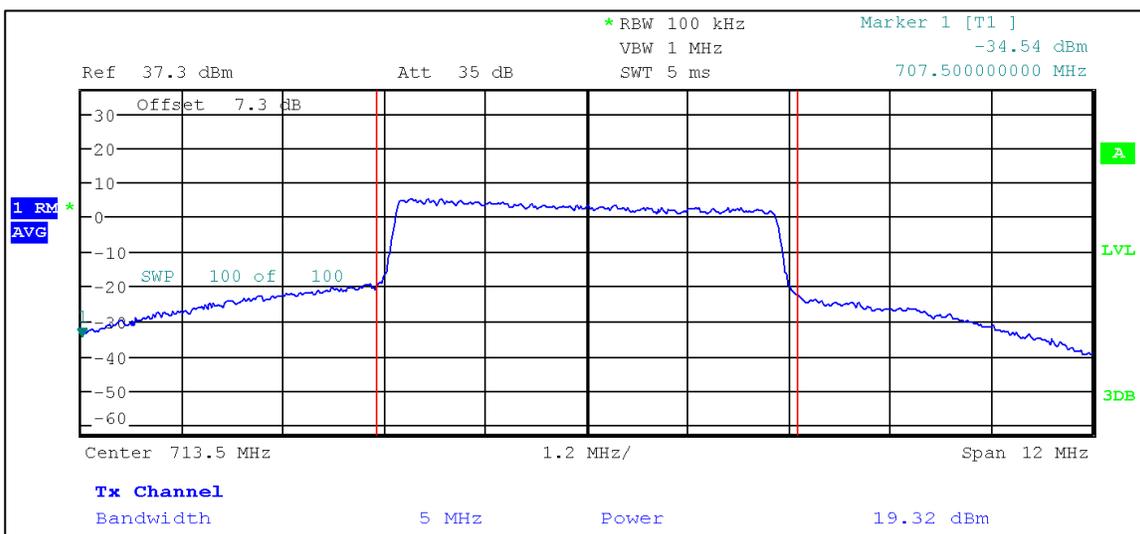
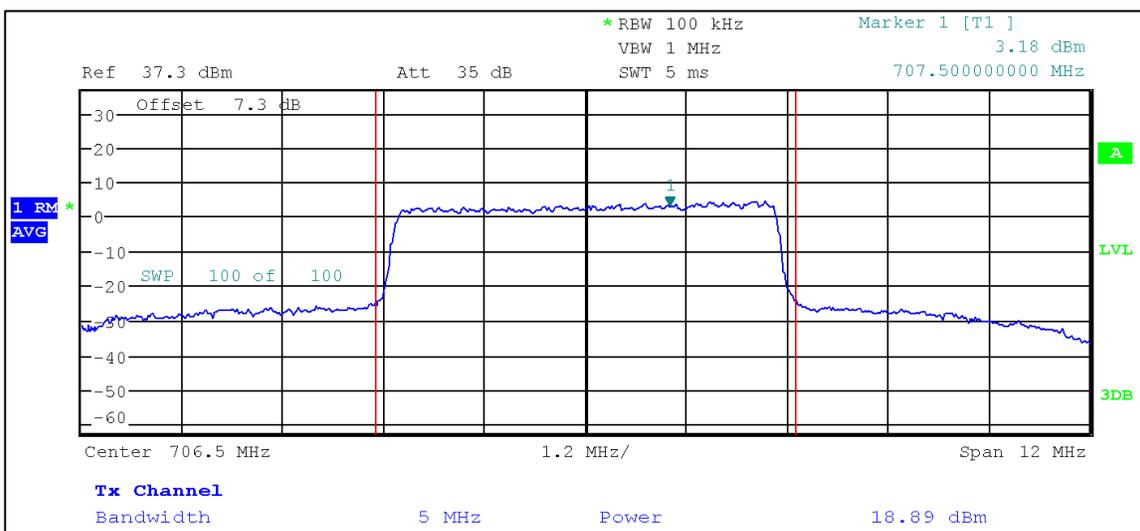
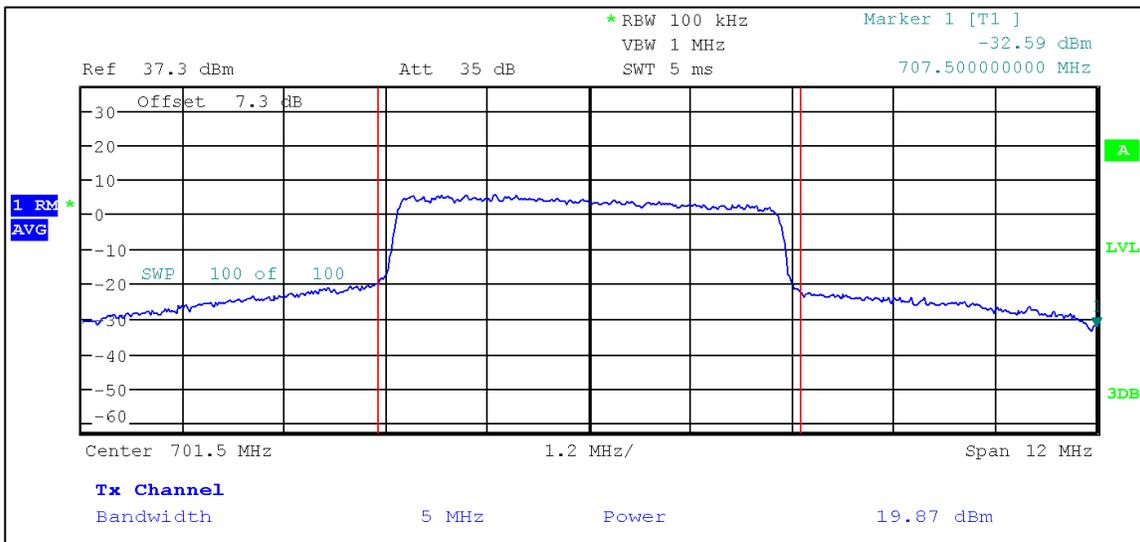
1.4 MHz Nominal Bandwidth



3 MHz Nominal Bandwidth



5 MHz Nominal Bandwidth



Radiated Spurious Emissions

Engineer: Aaron S. Froehlich

Test Date: 9/2/2022

Test Procedure: 30-1000 MHz

The EUT was setup in a semi-anechoic test chamber set 3m from the receiving antenna. The EUT was set to transmit on the lowest, middle and highest frequency of operation, as well as frequency hopping, at the maximum power level. The EUT was tested, in 3 orthogonal axis, by rotating it 360° with the receive antenna in both the vertical and horizontal orientation while raised from 1 to 4 meters to ensure the TX signal levels were maximized. A spectrum analyzer was used to verify that the EUT met the requirements for Radiated Spurious Emissions.

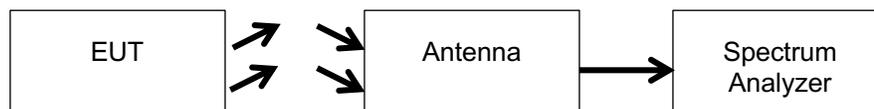
All emissions from 30 MHz to 1 GHz were examined.

RBW = 100 KHz

VBW = 300 KHz

Detector – Quasi Peak

Test Setup



Test Procedure: ≥ 1 GHz

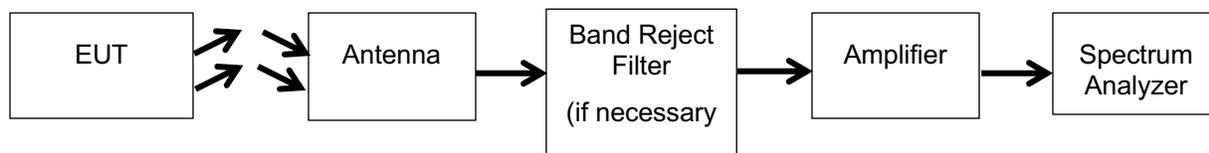
The EUT was setup in a semi-anechoic test chamber set 3m from the receiving antenna. The EUT was set to transmit on the lowest, middle and highest frequency of operation at the maximum power level. The EUT was tested, in 3 orthogonal axis, by rotating it 360° with the receive antenna in both the vertical and horizontal orientation while raised from 1 to 4 meters to ensure the TX signal levels were maximized. A spectrum analyzer was used to verify that the EUT met the requirements for Radiated Spurious Emissions.

RBW = 1 MHz

VBW = 3 MHz

Detector – Peak

Test Setup



Limits

The emissions limit is referenced to different rule parts, depending on the operating band, but in all cases is specified to be $43 + 10 \cdot \log_{10}(P)$ below the fundamental output power. In all cases $P(\text{watt}) - [43 + 10 \cdot \log_{10}(P_{\text{watt}})] = -13 \text{ dBm}$. The DUT was tested simultaneously for compliance of the Bluetooth transmitter to the limits of 47 CFR 15.209. The limits of 15.209 are more stringent than the LTE limits and all of the LTE spurious emissions were compliant with the 15.209 limit and are therefore compliant with the -13 dBm limit of the Rule parts listed below.

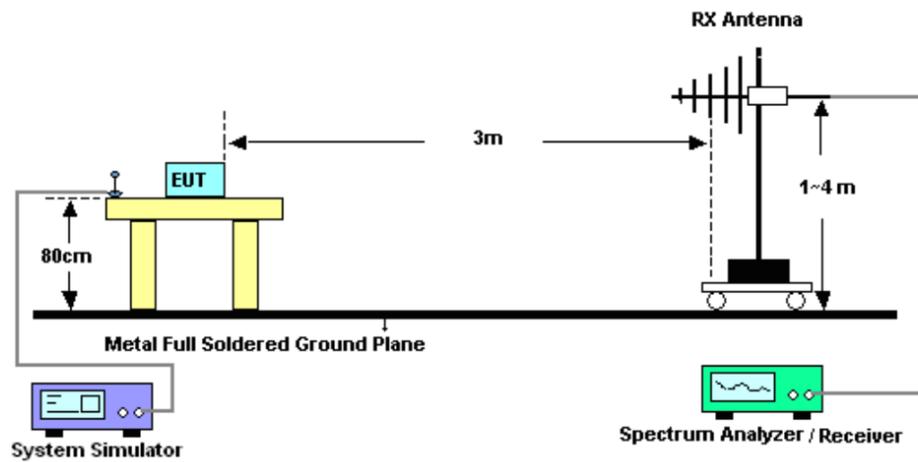
FCC Referenced Rule Parts: 47 CFR 22.917(a), 47 CFR 24.238(a), 47 CFR 27.53(c)(2), 47 CFR 27.53(h)(1), 47 CFR 27.53(g), 47 CFR 90.210(c)(3)

ISED Referenced Rule Parts: RSS-130 Clause 4.7.1, RSS-132 Clause 5.5, RSS-133 Clause 6.5.1, RSS-139 Clause 6.6, RSS-140 Clause 4.4

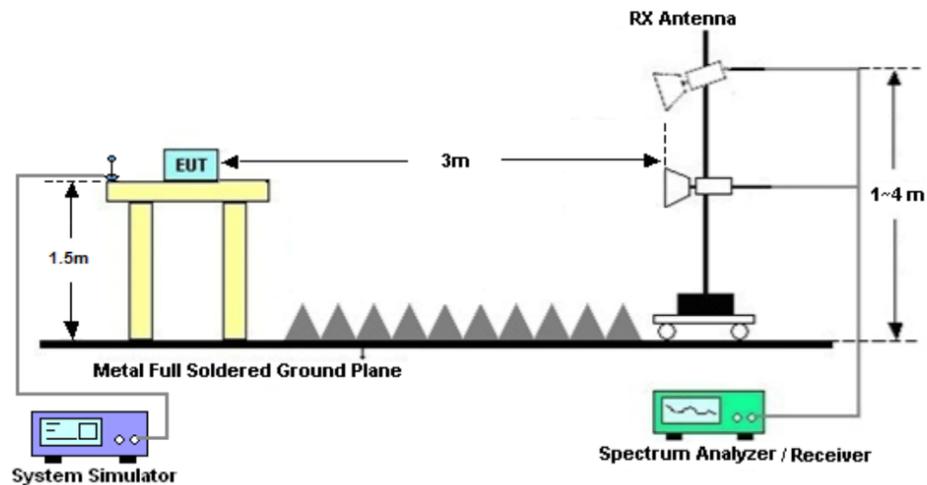
See Annex A for full test data

Chamber Setup Diagrams

For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



Test Data

Worst Case Emission:

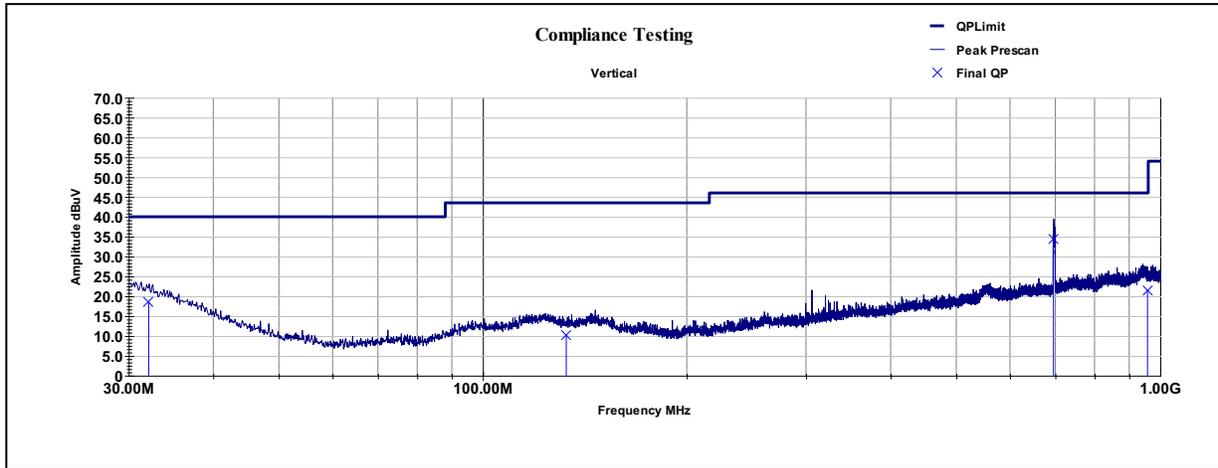
Frequency	Azimuth	Height	Raw Pk	Raw Avg	Correction	Final Avg	Avg Limit	Avg Margin
MHz	deg	cm	dBuV	dBuV	dB	dBuV/m	dBuV/m	dB
1928.033	146.00	395.00	25.46	6.06	32.62	38.68	53.98	-15.30

Final = Raw + Correction

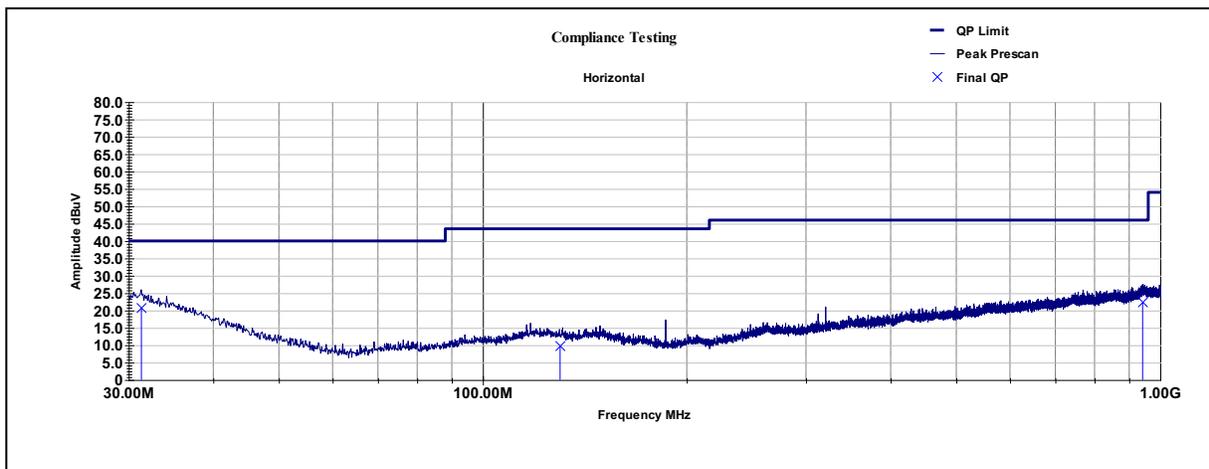
Margin = Final – Limit

30-1000 MHz

Band 66 5M Ch 132322



Frequency	Azimuth	Height	Raw QP	Correction	Final QP	Limit	QP Margin
MHz	deg	cm	dBuV	dB	dBuV/m	dBuV/m	dB
32.116	106	100	40.47	-21.95	18.51	40.0	-21.5
132.798	78	379	35.48	-25.27	10.21	43.5	-33.3
695.751	305	100	49.36	-14.96	34.40	46.0	-11.6
957.586	20	100	31.96	-10.44	21.52	46.0	-24.5
Final = Raw + Path Loss							
Margin = Final - Limit							

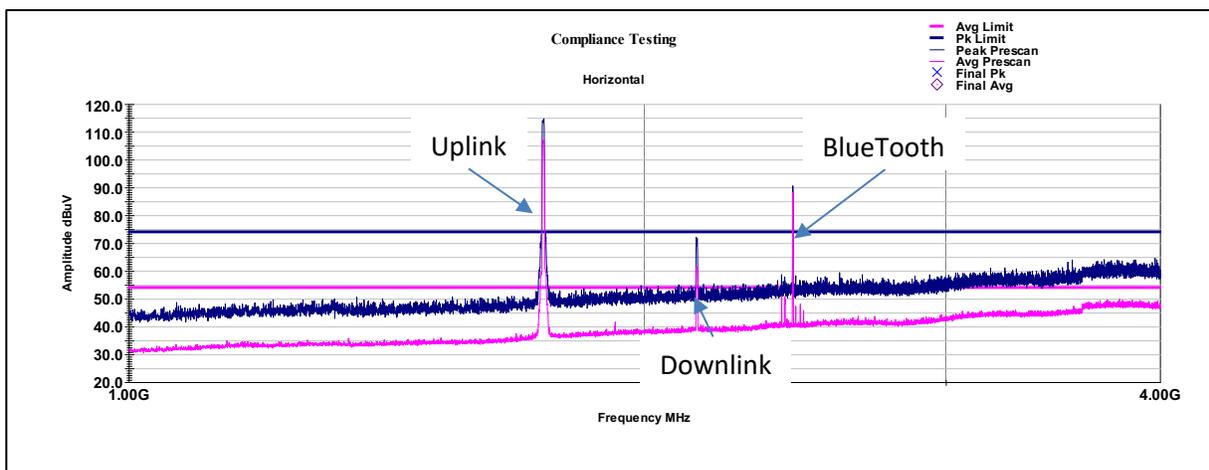
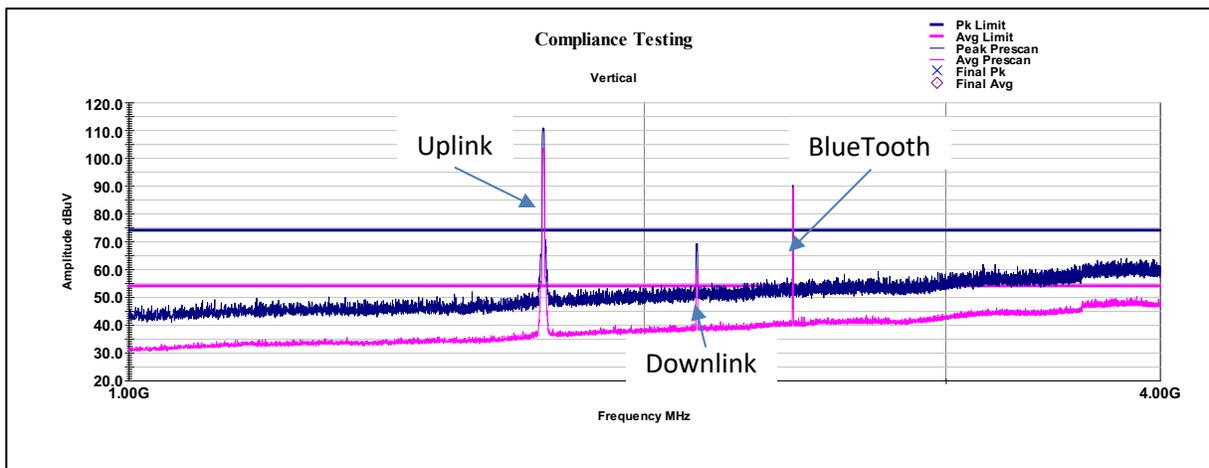


Frequency	Azimuth	Height	Raw QP	Correction	Final QP	Limit	QP Margin
MHz	deg	cm	dBuV	dB	dBuV/m	dBuV/m	dB
31.325	110	325	40.46	-19.89	20.57	40.0	-19.4
130.012	114	309	35.89	-26.18	9.71	43.5	-33.8
942.030	232	386	32.83	-10.59	22.24	46.0	-23.8
Final = Raw + Path Loss							
Margin = Final - Limit							

1-4 GHz

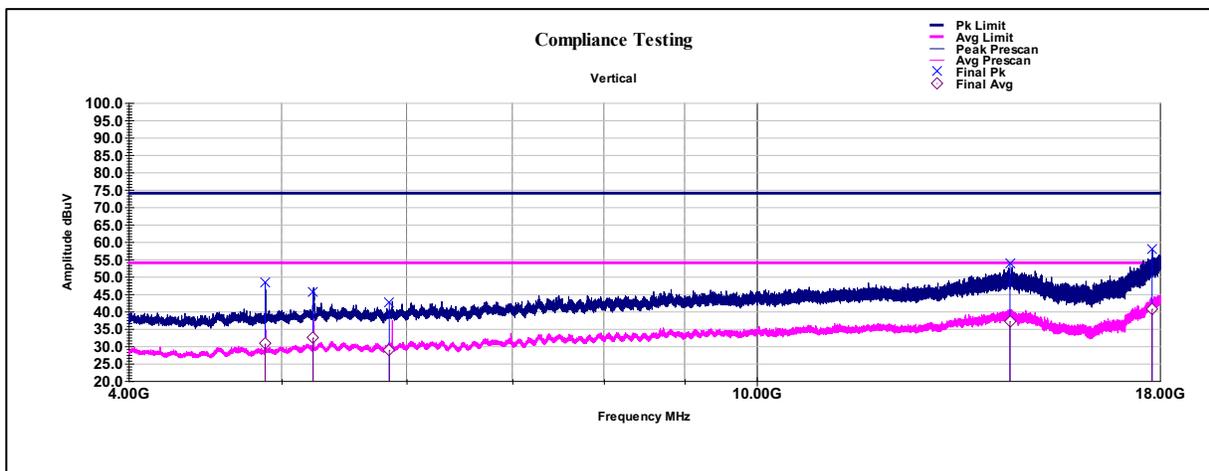
Band 66 5M BW Ch 132322

In the 1-4 GHz Region the fundamental transmissions have been identified, but are beyond the scope of this test.

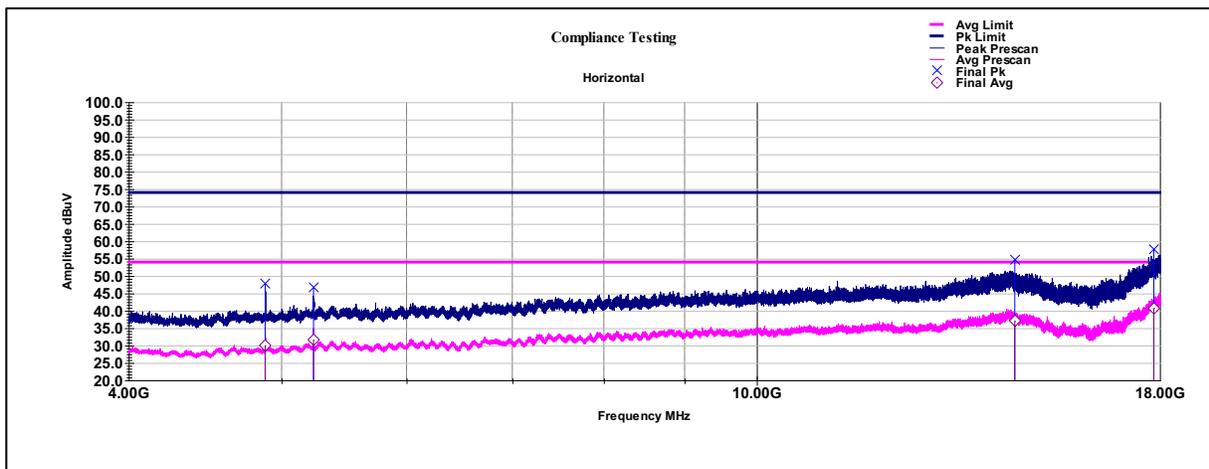


4-18 GHz

Band 66 5M BW Ch 132322



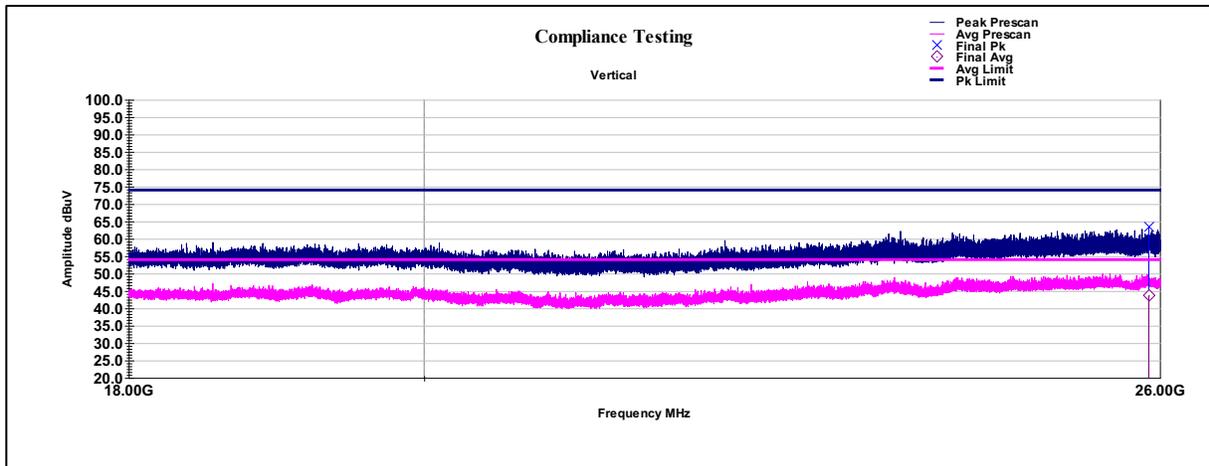
Frequency	Azimuth	Height	Raw Pk	Raw Avg	Correction	Final Pk	Pk Limit	Pk Margin	Final Avg	Avg Limit	Avg Margin
MHz	deg	cm	dBuV	dBuV	dB	dBuV/m	dBuV/m	dB	dBuV/m	dBuV/m	dB
4881.983	350.00	175.00	53.74	35.96	-5.26	48.48	74.00	-25.52	30.70	53.98	-23.28
5234.959	15.00	293.00	49.76	36.45	-4.01	45.75	74.00	-28.25	32.44	53.98	-21.54
5850.585	346.00	325.00	45.72	31.98	-3.06	42.66	74.00	-31.34	28.92	53.98	-25.06
14464.386	321.00	325.00	39.41	22.64	14.49	53.91	74.00	-20.09	37.14	53.98	-16.84
17796.28	83.00	147.00	37.67	20.54	20.19	57.86	74.00	-16.14	40.73	53.98	-13.25
Final = Raw + Path Loss											
Margin = Final - Limit											



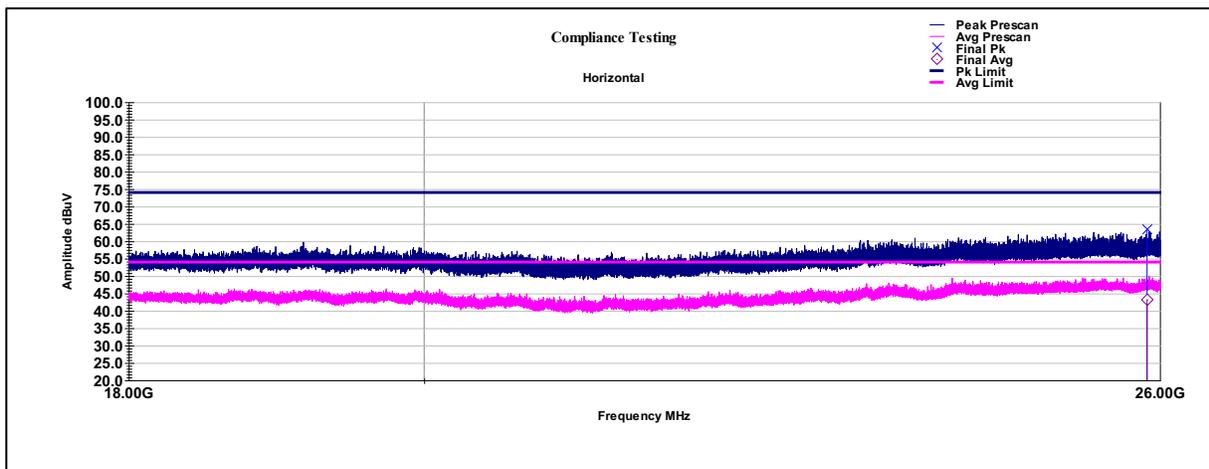
Frequency	Azimuth	Height	Raw Pk	Raw Avg	Correction	Final Pk	Pk Limit	Pk Margin	Final Avg	Avg Limit	Avg Margin
MHz	deg	cm	dBuV	dBuV	dB	dBuV/m	dBuV/m	dB	dBuV/m	dBuV/m	dB
4881.973	0.00	400.00	52.99	35.33	-5.26	47.72	74.00	-26.28	30.07	53.98	-23.91
5238.518	195.00	400.00	50.61	35.66	-4.00	46.61	74.00	-27.39	31.66	53.98	-22.32
14566.338	38.00	400.00	40.06	22.51	14.57	54.63	74.00	-19.37	37.08	53.98	-16.90
17843.19	107.00	295.00	37.36	20.44	20.36	57.72	74.00	-16.28	40.81	53.98	-13.17
Final = Raw + Path Loss											
Margin = Final - Limit											

18-26 GHz

No emissions detected regardless of axis, modulation, channel, or simultaneous transmit conditions.



Frequency	Azimuth	Height	Raw Pk	Raw Avg	Correction	Final Pk	Pk Limit	Pk Margin	Final Avg	Avg Limit	Avg Margin
MHz	deg	cm	dBuV	dBuV	dB	dBuV/m	dBuV/m	dB	dBuV/m	dBuV/m	dB
25897.253	187.00	105.00	39.72	19.97	23.69	63.41	74.00	-10.59	43.67	53.98	-10.32
Final = Raw + Path Loss											
Margin = Final - Limit											



Frequency	Azimuth	Height	Raw Pk	Raw Avg	Correction	Final Pk	Pk Limit	Pk Margin	Final Avg	Avg Limit	Avg Margin
MHz	deg	cm	dBuV	dBuV	dB	dBuV/m	dBuV/m	dB	dBuV/m	dBuV/m	dB
25881.039	18.00	172.00	39.70	19.55	23.67	63.37	74.00	-10.63	43.22	53.98	-10.76
Final = Raw + Path Loss											
Margin = Final - Limit											

Test Equipment Utilized

Description	Manufacturer	Model #	CT Asset #	Last Cal Date	Cal Due Date
Preamplifier	Eravant	SBB-0115034018-2F2F-E3	i00646	Verified on: 8/10/22	
Bi-Log antenna	Chase	CBL6111C	i00349	2/27/22	2/27/24
Humidity / Temp Meter	Omega	IBTHX-W-5	i00631	11/3/21	11/3/22
3 Meter Semi-Anechoic Chamber	Panashield	3 Meter Semi-Anechoic Chamber	i00428	7/17/20	7/17/23
Horn Antenna	EMCO	3115	i00103	2/23/21	2/23/23
Horn Antenna	EMCO	3116	i00085	2/22/21	2/22/23
EMI Analyzer	Rohde & Schwarz	FSU 26	i00501	5/10/22	5/10/23
EMI Receiver	Keysight	N9038A	i00552	2/24/22	2/24/23

In addition to the above listed equipment standard RF connectors and cables were utilized in the testing of the described equipment. Prior to testing these components were tested to verify proper operation.

Measurement Uncertainty

Measurement Uncertainty (U_{lab}) for Compliance Testing is listed in the table below.

Measurement	U_{lab}
Radio Frequency	$\pm 3.3 \times 10^{-8}$
RF Power, conducted	± 1.5 dB
RF Power Density, conducted	± 1.0 dB
Conducted Emissions	± 1.8 dB
Radiated Emissions	± 4.5 dB
Temperature	± 1.5 deg C
Humidity	± 4.3 %
DC voltage	± 0.20 VDC
AC Voltage	± 1.2 VAC

The reported expanded uncertainty $\pm U_{lab}$ (dB) has been estimated at a 95% confidence level ($k=2$)

U_{lab} is less than or equal to U_{ETSI} therefore

- Compliance is deemed to occur if no measured disturbance exceeds the disturbance limit
- Non-Compliance is deemed to occur if any measured disturbance exceeds the disturbance limit