Bluetooth Test Report

Test Report Number: WR479.002

Terminal device: FCC ID: QMNRM-18 Model: 6638 Type: RM-18 HW: B3.5 SW: L125b004
(Detailed information is listed in section 4).

Originator:	Darreyl Roberts
Function:	TCC - Dallas – EMC
Version/Status:	2.0 Approved
Location:	TCC Directories
Date:	March 23, 2005

Change History:

Version	*Date*	*Status*	*Handled By*	*Comments*
0.1	11 Jan 05	Draft	Darreyl Roberts	Initial Draft
0.2	11 Jan 05	Review	Darreyl Roberts	Testing Complete
1.0	17 Jan 05	Approved	Mark Severson	
1.1	23 Mar 05	Draft	Mark Severson	Re-Measure Power
1.2	23 Mar 05	Review	Mark Severson	
2.0	23 Mar 05	Approved	Nerina Walton	

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Date and signatures: **March 23, 2005**

For the contents:

Mark Severson
Technical Review

Nerina Walton
Manager Review

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1. GENERAL

1.1 Quality System

The quality system in place for TCC-Dallas conforms to ISO/IEC 17025 and has been audited to the standard by A2LA (American Association of Laboratory Accreditation). TCC - Dallas has also been audited using the ISO 9000 Quality System, as part of Nokia Mobile Phones, Inc., by ABS (American Bureau of Shipping) Quality Evaluations Inc.

TCC-Dallas is a recognized laboratory with the Federal Communications Commission in filing applications for Certification under Parts 15 and 18, Registration Number 100060, and Industry Canada, Registration Number IC 661.

1.2 Objective

All tests and measurement data shown was performed to determine whether the selected handset was in compliance as specified in FCC: CFR47 Parts 15.207 and 15.247.

1.3 Test Summary

Test Results: *The test result relates only to those tested devices mentioned in Section 4 of this test report.*

Test Performed	CFR 47	RSS-210	Section of Report	Complies / Does not comply / Not Tested
Carrier frequency separation	15.247 (a)(1)	6.2.2 (o), a1	7	Complies
Number of hopping frequencies	15.247 (a)(1)(iii)	6.2.2 (o), a3	8	Complies
Time of occupancy	15.247 (a)(1)(iii)	6.2.2 (o), a3	9	Complies
20dB bandwidth	15.247 (a)(1)	6.2.2 (o), a1	10	Complies
Peak output power	15.247 (b)(1)	6.2.2 (o), a3	11	Complies
Band-edge compliance of RF emissions	15.247 (c)	6.2.2 (o), e1	12	Complies
AC powerline conducted emissions	15.207	6.6	13	Complies
Radiated Emissions	15.247 (c)	6.2.2 (o), e1	14	Complies

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2. STANDARDS BASIS

Testing has been carried out in accordance with:

REF.	Code of the standard	Name of the standard
1	ANSI C63.4	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz.
2	FCC: CFR 47 Part 15	Code of Federal Regulations (CFR) Title 47, Part 15 – Radio Frequency Devices: Subpart B – Unintentional Radiators and Subpart C – Intentional Radiators
3	CISPR 22 / EN55022	Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement.
4	ICES-003	Digital Apparatus, Industry Canada
5	RSS-210	Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands)
6	RSS-212	Test Facilities and Test Methods for Radio Equipment, Industry Canada (Provisional)
7	RSP-100	Radio Equipment Certification Procedure

Note: Unless otherwise stated, (by reference to a version number and a publication date), the latest version of the above documents applies.

Deviations:

Not Applicable.

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3. LIST OF ABBREVIATIONS, ACRONYMS AND TERMS

3.1 Abbreviations

dB - decibel

dBm - decibels per milliwatt (absolute measurement)

dBµV - decibel per microvolt

dBµV/m - decibel of microvolt per meter

GHz - gigahertz or 1000000000 hertz

kHz - kilohertz or 1000 hertz

MHz - megahertz or 1000000 hertz

ms - millisecond or 0.001 second

µs - microsecond or 0.000001 second

3.2 Acronyms

BT - Bluetooth

EMC - Electromagnetic Compatibility

EMI - Electromagnetic Interference

EUT - Equipment under Test

PRBS - Pseudo Random Bit Sequence

RF - Radio Frequency

3.3 Terms

Base Station Simulator (BSS) - simulates all the necessary signals that a phone would experience while on a live network. There are many types of base station simulators catering for all current protocols, i.e., GSM, AMPS, TDMA, and CDMA.

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4. EQUIPMENT-UNDER-TEST (EUT)

The results in this report relate only to the items listed below:

4.1 Description of Tested Device(s):

Test Performed	Mode of Operation	Date of Receipt	Condition of Sample	Item	Identifying Information
FCC 15.247 FCC 15.207	BT On	01/11/05	Working	Handset	Model: 6638 Type: RM-18 SW: L125b004 HWID: B3.5 ESN: 044/00485807 ESN: 044/00485679 Code: 0518212LL10EZ
N/A	BT On	01/11/05	Working	Battery	Type: BL-6C Other: 3.7vdc
N/A	N/A	01/11/05	Working	Headset	Type: HDB-4
N/A	N/A	01/11/05	Working	Charger	Type: AC-1U 120v

Note: phones used for test were configured for FBUS functionality by installing zero Ohm jumpers on the PWB at the flash pins. This configuration was chosen to support FBUS functionality at the bottom connector instead of the USB.

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5. TEST EQUIPMENT LIST

The listing below indicates the test equipment utilized for the test (s). Calibration interval on all items listed can be obtained from the Engineering Services Group within NMP, Product Creation - Dallas. Where relevant, measuring equipment is subjected to in-service checks between testing. TCC - Dallas shall notify clients promptly, in writing, of identification of defective measuring equipment that casts doubt on the validity of results given in this report.

Section of Report	NMP#	Test Equipment	Mfr. #	Model #	Calibration Due Date	Calibration Interval
7, 8, 9, 10, 12, 13	026252	Base Station	Rhodes & Schwartz	CMU200	06/30/05	12 months
7, 8, 9, 10, 11, 12, 13	N/A	Power Splitter (must have 6 dB insertion loss)	Agilent	33120A	N/A	N/A
7, 8, 9, 10, 11, 12, 13	N/A	6dB Attenuator	Weinschel	Model 2	N/A	N/A
7, 8, 9, 10, 12, 13	03463	Spectrum Analyzer	Rhode & Schwarz	FSP	11/02/05	12 months
14	02664	EMI Receiver	Hewlett Packard	8546 / 85460A	2/23/05	12 months
14	02679	EMI Analyzer	Agilent	E7405A	3/13/05	12 months
14	00065	Horn Antenna	EMCO	3115	7/16/05	12 months
14	03961	Horn Antenna	EMCO	3116	5/26/05	12 months
14	01472	Biconilog Antenna	EMCO	3142	4/08/05	12 months
11	3459	Spectrum Analyzer	Rhode & Schwarz	FSP	1/31/06	12 months

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6. EUT TEST SETUPS

For each test the EUT was exercised to find out the worst case of operation modes and device configuration.

Two different test setups were used: one for conducted measurements, another for radiated measurements. One EUT was equipped with an external antenna connector for conductive measurements.

6.1 EUT test set-up A (conducted measurement)

This setup was used in conducted measurements. The Bluetooth simulator was used to control the following:

- set the EUT channel (0 – 79)

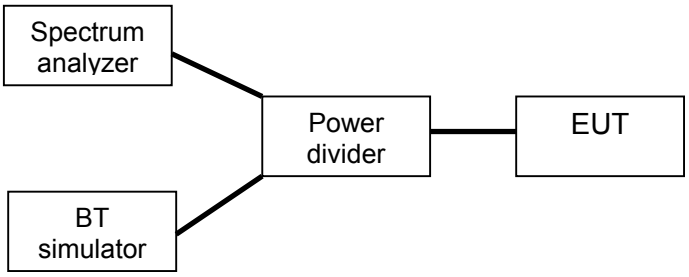
- set the number of EUT TX slots (1, 3, 5)

- set the EUT to TX, RX and TX/RX mode

- enable/disable frequency hopping

- select between several different test modulation patterns

In tests, where absolute level reporting were required, the results were corrected with all applicable factors as detailed in the result section of each measurement.



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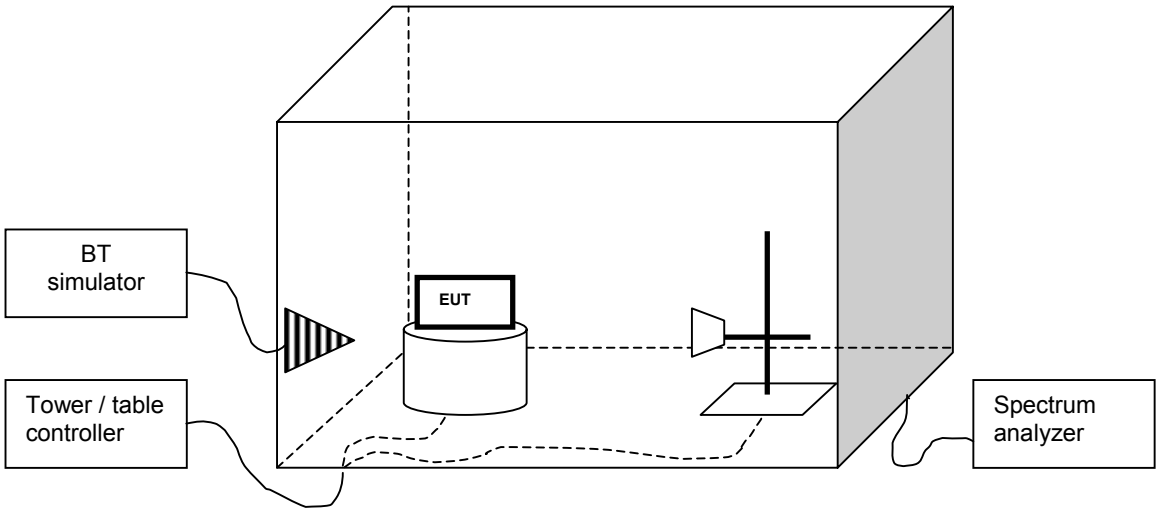
6.2 EUT test set-up B (radiated measurement)

The EUT was set on a non-conductive turn table in a semi anechoic chamber. In the corner of the chamber there was a communication antenna, which was connected to the BT simulator located outside the chamber. The radiated power from the EUT was measured with an antenna fixed to a antenna tower. The tower and turn table were remotely controlled to turn the EUT and change the antenna polarization. The measured signal was routed from the measuring antenna to the spectrum analyzer. The Bluetooth simulator was used to the same as in conducted measurements.

In tests, where absolute level reporting were required, the results were corrected with all applicable factors as detailed in the result section of each measurement.



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7. CARRIER FREQUENCY SEPARATION

Specification: FCC Part 15.247(a)(1); RSS-210 6.2.2(o), a1

7.1 Setup

Used test set-up: A (see section 6)

7.2 Test Results

Test Operator	Darreyl Roberts
Date of Measurement	11 January, 2005
Temperature	22°C
Humidity	62%RH
Test Result	Complies

7.3 EUT operation mode

EUT operation mode	Connected, DH5, Static PRBS
EUT channel	Hopping mode (Euro/US)
EUT TX power level	Nominal

7.4 Pass/Fail Criteria

Limit (MHz)	Measured value (MHz)
≥ 0.025 or 20dB	1MHz

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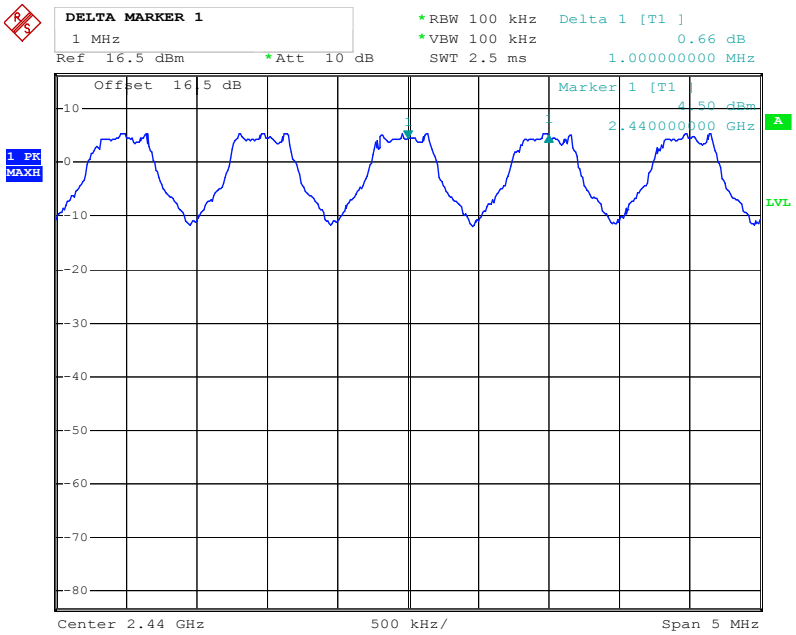
7.5 Results

Carrier Frequency Separation of Channels 38 and 39



Date: 11.JAN.2005 08:50:00

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8. NUMBER OF HOPPING FREQUENCIES

Specification: FCC Part 15.247(a)(1)(iii); RSS-210 6.2.2(o), a3

8.1 Setup

Used test set-up: A (see section 6)

8.2 Test Results

Test Operator	Darreyl Roberts
Date of Measurement	11 January, 2005
Temperature	22°C
Humidity	62%RH
Test Result	Complies

8.3 EUT operation mode

EUT operation mode	Connected, DH5, Static PRBS
EUT channel	Hopping Mode
EUT TX power level	Nominal

8.4 Pass/Fail Criteria

Number	Measured value
≥ 75	79

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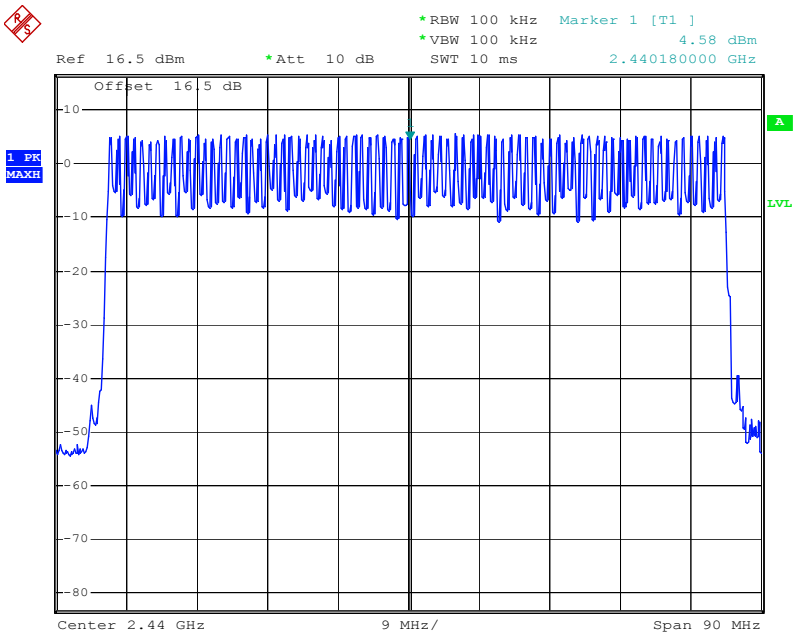
8.5 Results

Number of Hopping Channels



Date: 11.JAN.2005 08:53:33

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9. TIME OF OCCUPANCY

Specification: FCC Part 15.247(a)(1)(iii); RSS-210 6.2.2(o), a3

9.1 Setup

Used test set-up: A (see section 6)

9.2 Test Results

Test Operator	Darreyl Roberts
Date of Measurement	11 January, 2005
Temperature	22.0°C
Humidity	62%RH
Test Result Connected mode	Complies

9.3 EUT operation mode: Connected mode

EUT operation mode	Connected, DH5, static PRBS
EUT channel	Hopping mode
EUT TX power level	Nominal

9.4 Pass/Fail Criteria

Limit (s)	Measured value (ms)
≤ 0.4	297.6ms

Time of Occupancy = $TX_n * TX_d$

Where: TX_n = Number of transmissions in 31.6 seconds (0.4 seconds * 79 channels)
TX_d = Duration of transmission.

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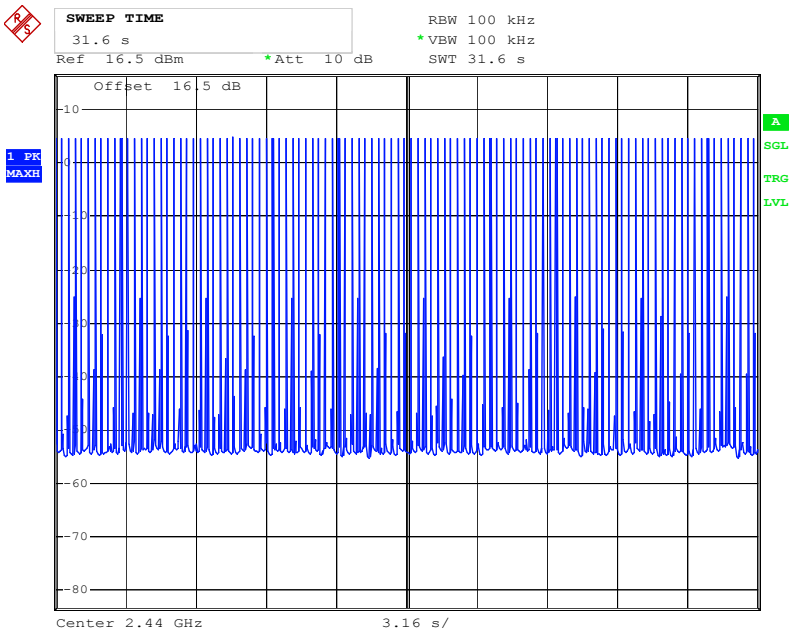
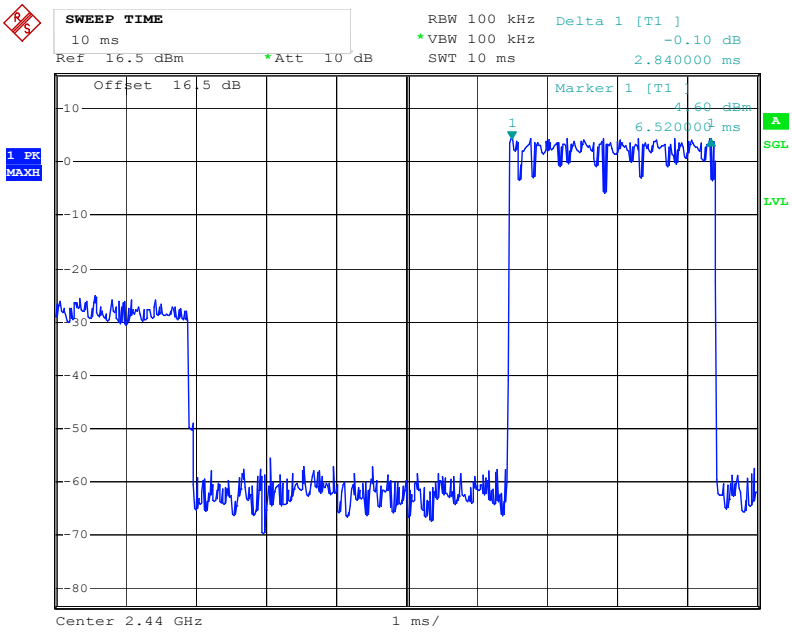
9.5 Results

Number of transmissions on channel 38



Date: 11.JAN.2005 09:02:06

Duration of one transmission, channel 38



Date: 11.JAN.2005 08:59:14

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10. 20dB BANDWITH

Specification: FCC Part 15.247(a)(1); RSS-210 6.2.2(o), a1

10.1 Setup

Used test set-up: A (see section 6)

10.2 Test Results

Test Operator	Darreyl Roberts
Date of Measurement	11 January, 2005
Temperature	22°C
Humidity	62%RH
Test Result	**Complies**

10.3 EUT operation mode

EUT operation mode	Connected, DH5, Static PRBS
EUT channel	0 (2402 MHz), 38 (2440 MHz), 78 (2480MHz)
EUT TX power level	Nominal

10.4 Pass/Fail Criteria

EUT channel	Limit (MHz)	Measured value (MHz)
0	≤ 1.0	792Khz
38		678Khz
78		678Khz

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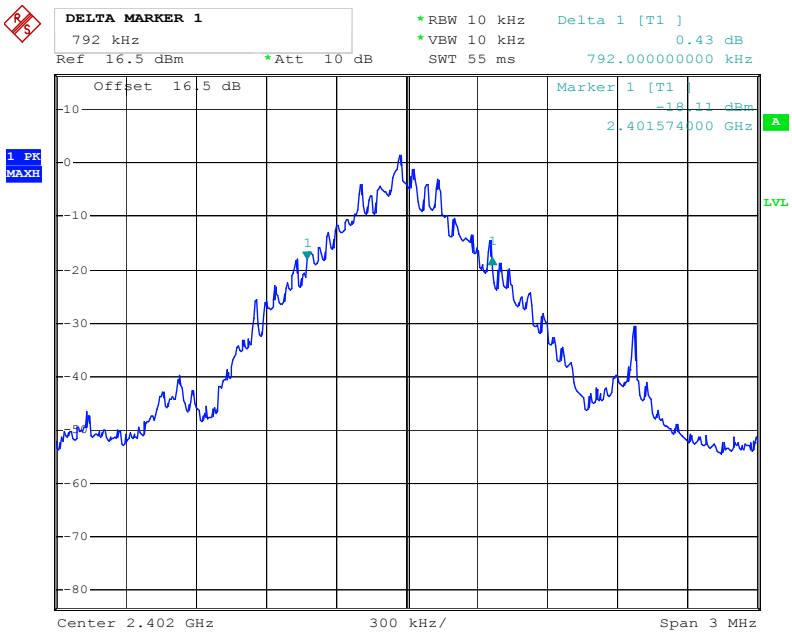
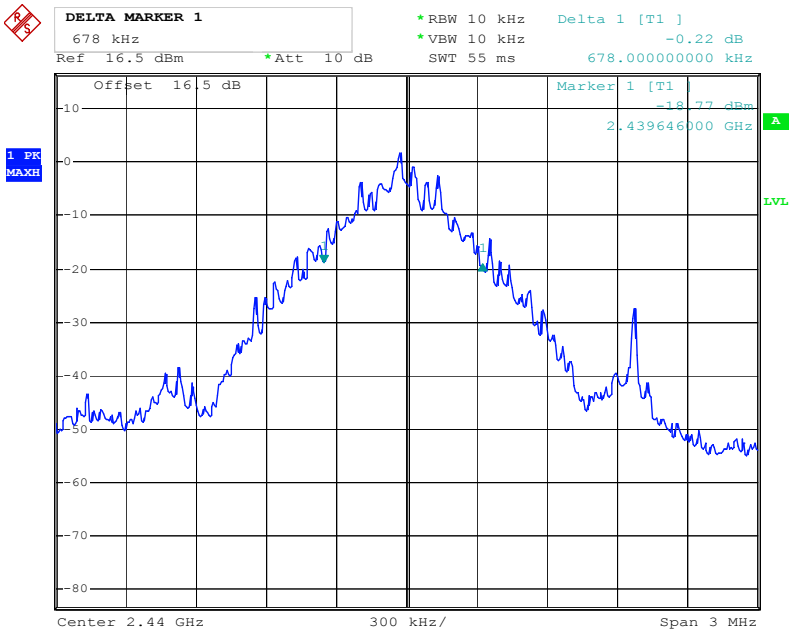
10.5 Results

20dB bandwidth, channel 0



Date: 11.JAN.2005 09:07:22

20dB bandwidth, channel 38



Date: 11.JAN.2005 09:10:59

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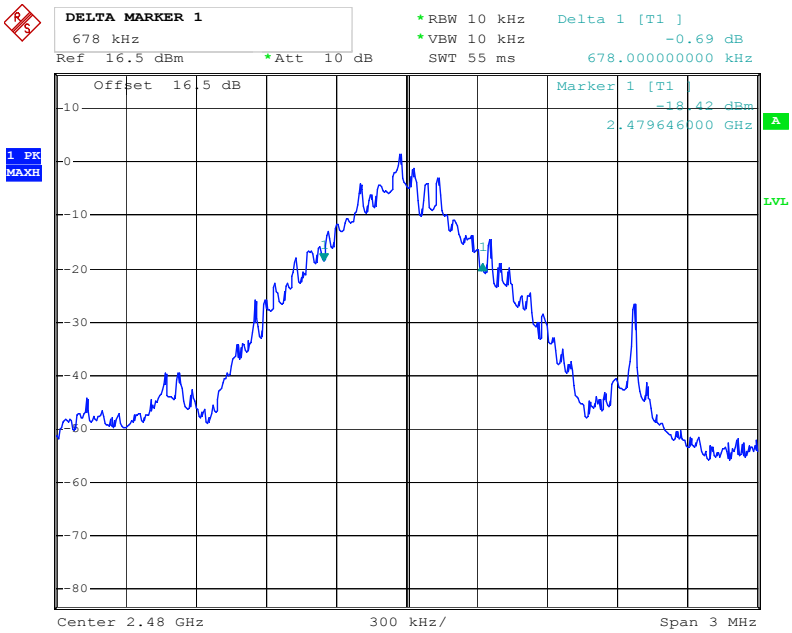
20dB bandwidth, channel 78



Date: 11.JAN.2005 09:13:47

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11. PEAK OUTPUT POWER

Specification: FCC Part 15.247(b)(1); RSS-210 6.2.2(o), a3

11.1 Setup

Used test set-up: A (see section 6)

11.2 Test Results

Test Operator	Jesse Torres
Date of Measurement	March 23, 2005
Temperature	24.0°C
Humidity	36%RH
Test Result	Complies

11.3 EUT operation mode

EUT operation mode	Connected, DH5, Static PRBS
EUT channel	0 (2402 MHz), 38 (2440 MHz), 78 (2480MHz)
EUT TX power level	Nominal

11.4 Pass/Fail Criteria

EUT channel	Limit (W)	Test result (mW)
0	≤ 1.0	1.26
38		1.35
78		1.26

The measured power values were corrected with the attenuation of the cables, attenuator and power divider using the formula:

EUT channel	Peak output power (dBm)	Peak output power (W)
0	1.0dBm	0.001
38	1.3dBm	0.001
78	1.0dBm	0.001

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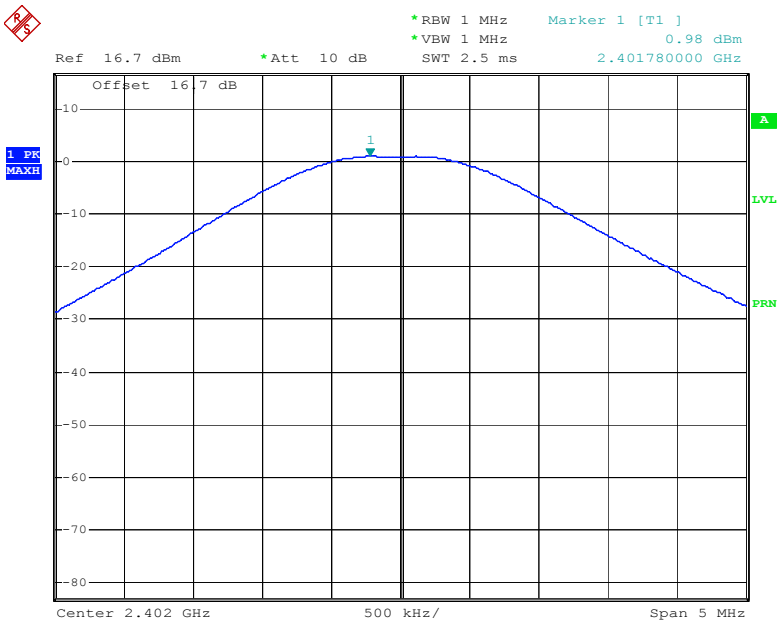
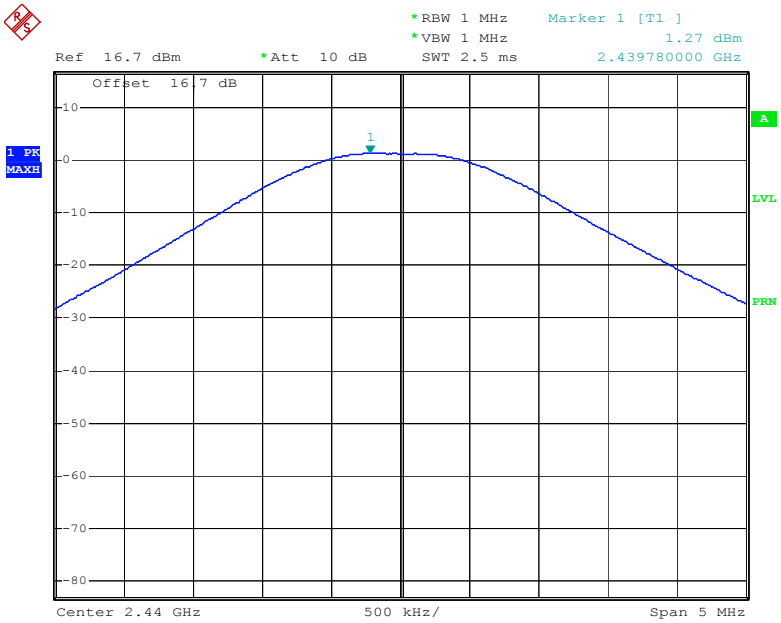
11.5 Results

Peak output power, channel 0



Date: 23.MAR.2005 07:48:54

Peak output power, channel 38



Date: 23.MAR.2005 07:50:29

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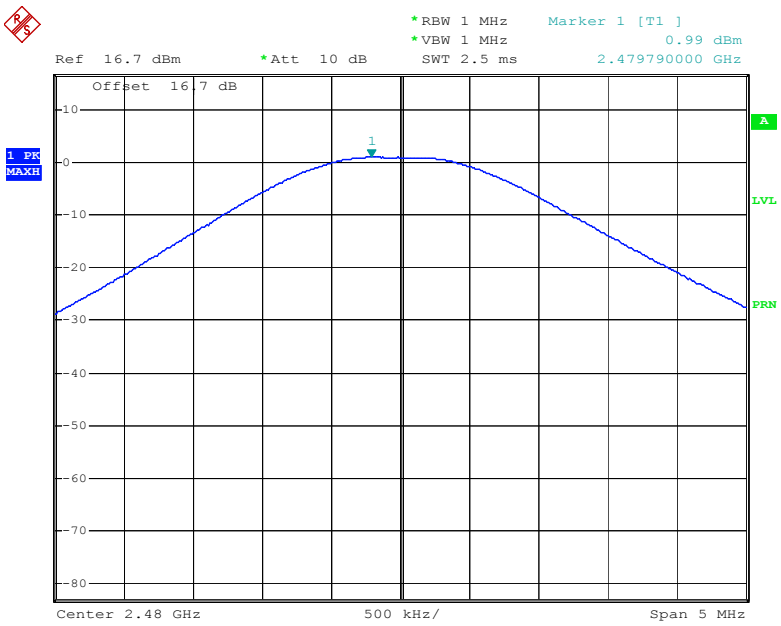
Peak output power, channel 78



Date: 23.MAR.2005 07:51:02

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12. BAND-EDGE COMPLIANCE OF RF CONDUCTED EMISSIONS

Specification: FCC Part 15.247(c); RSS-210 6.2.2(o), e1

12.1 Setup

Used test set-up: A (see section 6)

12.2 Test Results

Test Operator	Darreyl Roberts
Date of Measurement	11 January, 2005
Temperature	22.0 °C
Humidity	62%RH
Test Result	Complies

12.3 EUT operation mode

EUT operation mode	Connected, DH5, Static PRBS
EUT channel	Hopping mode, 0 (2402 MHz); 78 (2480 MHz)
EUT TX power level	Nominal

12.4 Pass/Fail Criteria

EUT channel	Limit (dBc)	Measured value (dBc)
Low End, Hopping Mode	≤ -20`	-46.95dBc
High End, Hopping Mode		-28.98dBc
0		-48.39dBc
78		-28.79dBc

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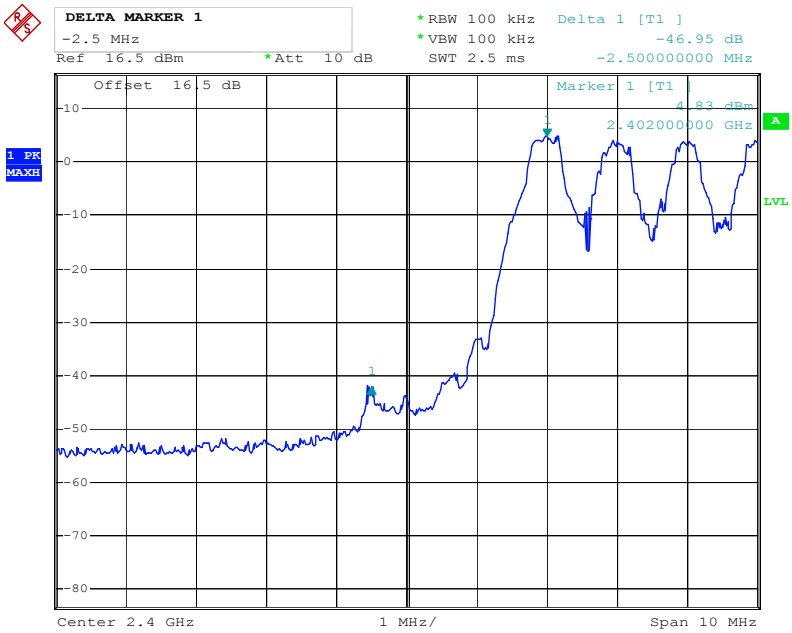
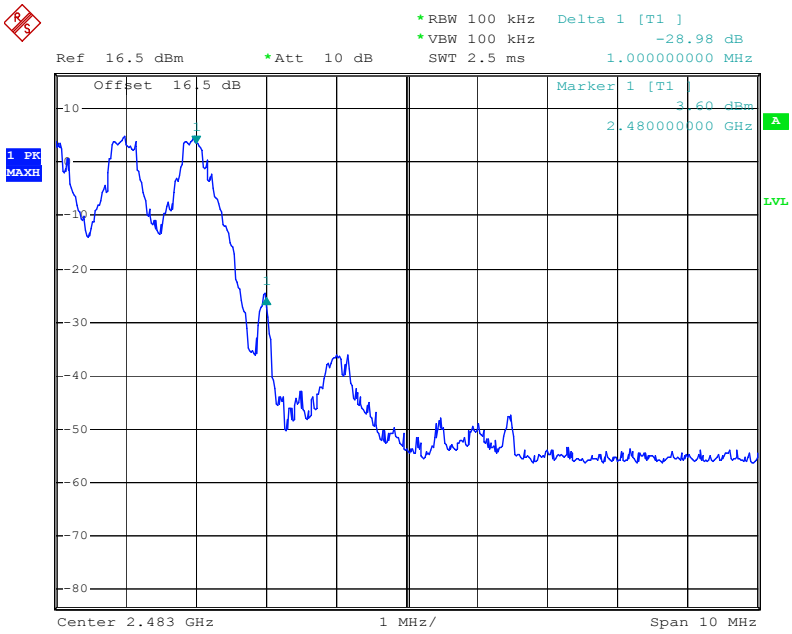
12.5 Results

Bandedge Compliance, Low end, hopping mode



Date: 11.JAN.2005 09:25:01

Bandedge Compliance, High end, hopping mode



Date: 11.JAN.2005 09:33:34

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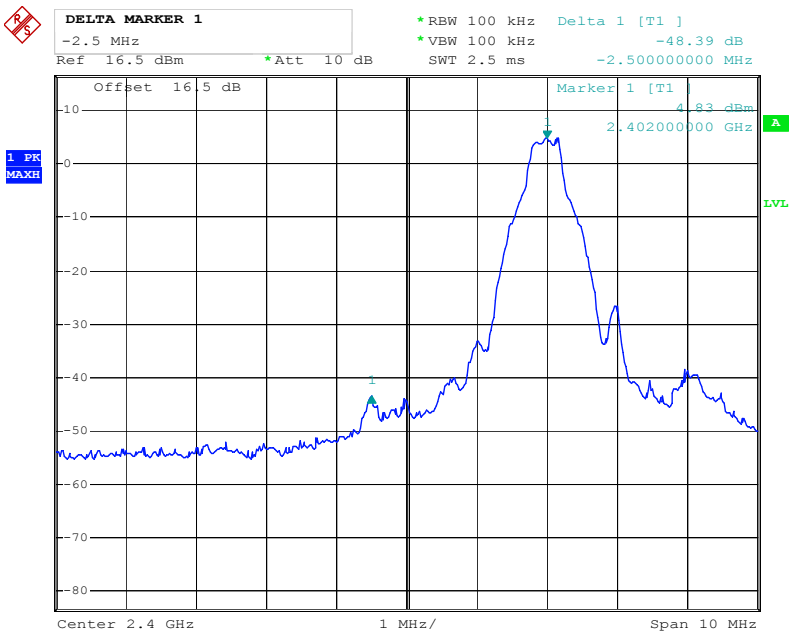
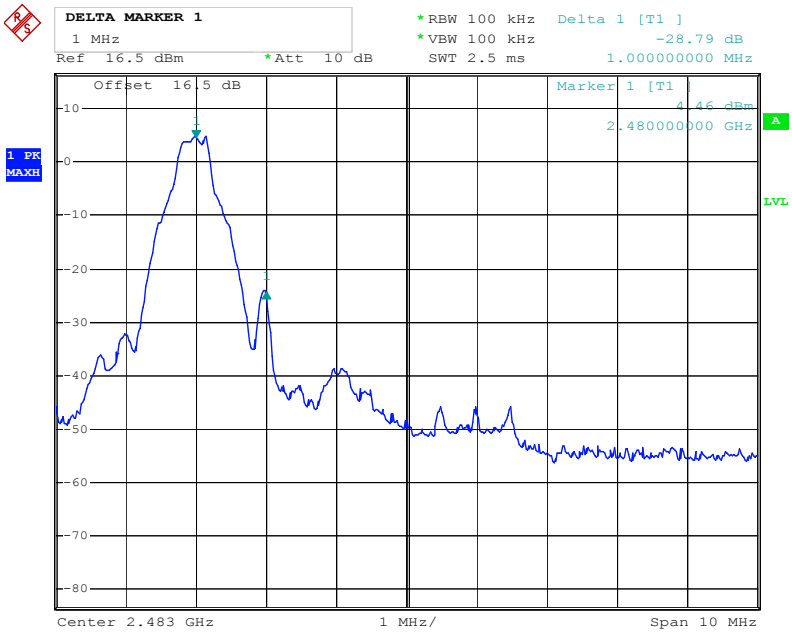
Bandedge Compliance, Low end, channel 0



Date: 11.JAN.2005 09:23:41

Bandedge Compliance, High end, channel 78



Date: 11.JAN.2005 09:35:23

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13. AC CONDUCTED EMISSIONS

Specification: FCC Part 15.207; RSS-210 6.6

13.1 Setup

Testing was performed in accordance with ANSI C63.4, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz.

13.2 Test Results

Test Operator	Darreyl Roberts
Date of Measurement	12 January, 2005
Temperature	27 °C
Humidity	43.0 %RH
Test Result	Complies

13.3 Pass/Fail Criteria

Frequency Range	**AC Conducted Emission Limits (CISPR 22)**	
	Quasi-peak (dBµV)	**Average (dBµV)**
0.15MHz - 0.5MHz	66 - 56	56 - 46
0.5MHz - 5MHz -	56	46
5MHz - 30MHz	60	50

13.4 EUT operation mode

Note: The mobile was set up using Phoenix. The sample is in Test mode and the BT software operation mode has been set to (DUT) Device Under Test.

EUT operation mode	Connected, DH5, Static PRBS
EUT channel	0 (2402 MHz), 38 (2440 MHz), 78 (2480MHz)
EUT TX power level	Nominal

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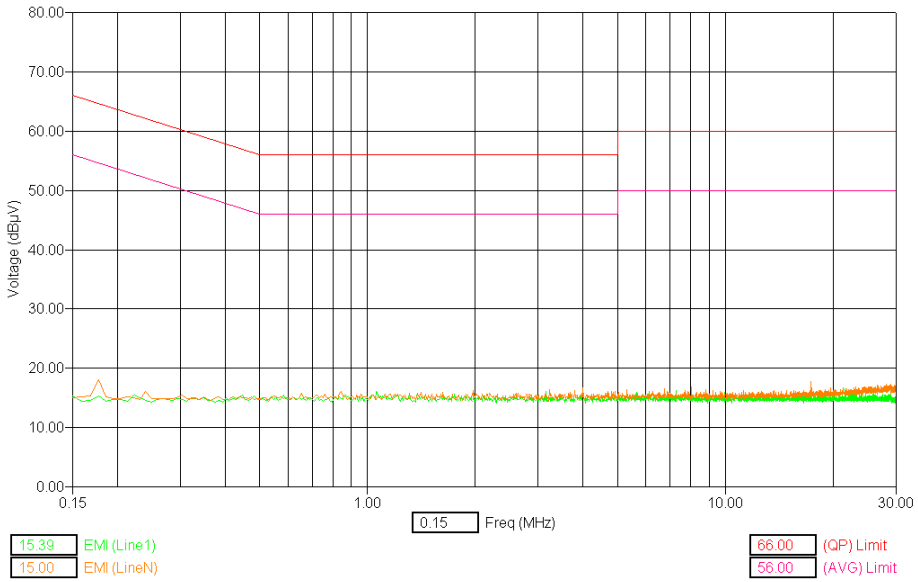
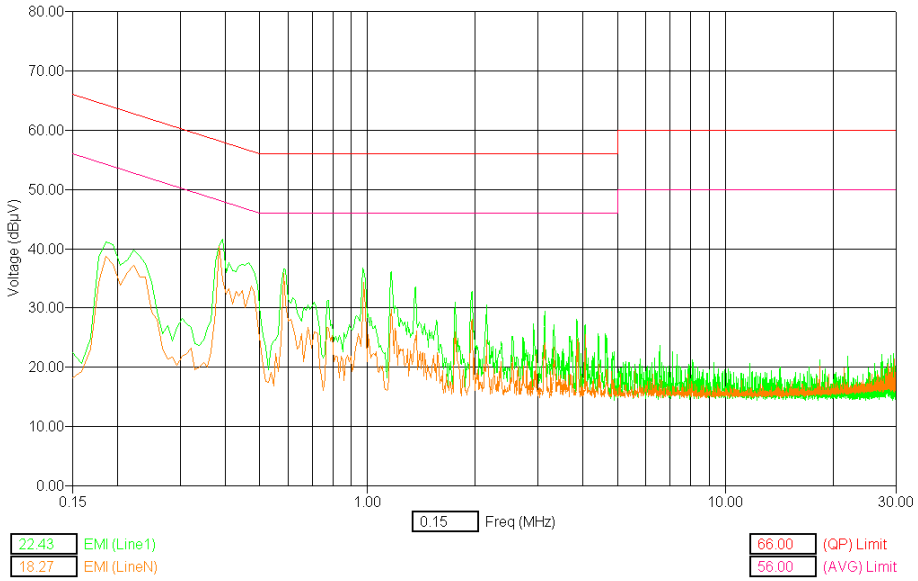
13.5 Results

Ambient Scan



Bluetooth Paired, with AC-1U Charger & HBD-4 Headset



Freq (Max) (MHz)	(AVG) Trace (dBµV)	(QP) Trace (dBµV)	Transducer (dB)	Cable (dB)	Line	(AVG) EMI (dBµV)	(QP) EMI (dBµV)	(AVG) Limit (dBµV)	(QP) Limit (dBµV)
0.2	14.8	33.7	0.2	0.1	N	15.0	33.9	54.2	64.2
0.2	17.3	37.3	0.2	0.1	L1	17.5	37.5	54.2	64.2
0.4	18.0	38.8	0.2	0.1	L1	18.3	39.1	48.0	58.0
0.4	12.3	31.8	0.2	0.1	N	12.6	32.0	48.2	58.2
0.6	8.8	27.3	0.3	0.1	N	9.1	27.7	46.0	56.0
1.0	12.3	32.1	0.3	0.1	L1	12.7	32.5	46.0	56.0

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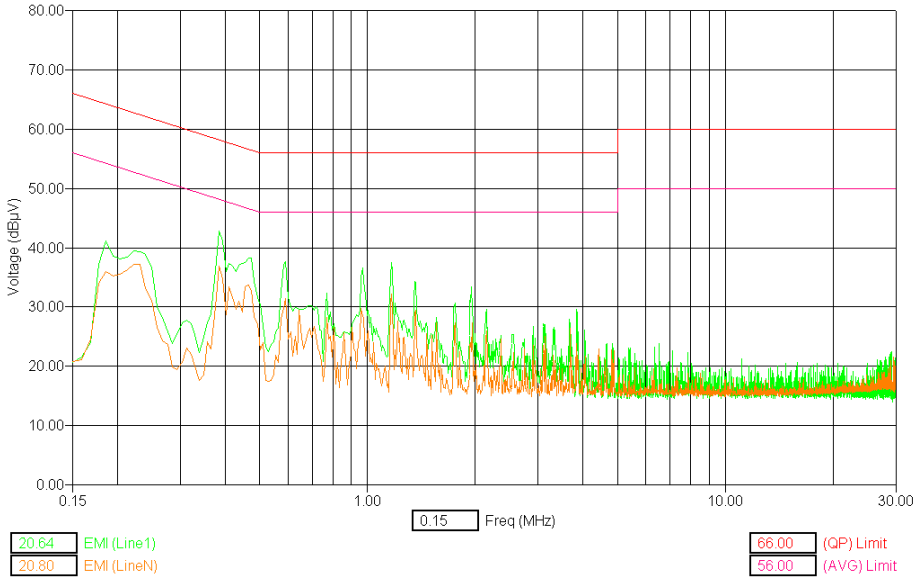
Bluetooth Connected (Hopping Mode), with AC-1U Charger & HBD-4 Headset



Freq (Max) (MHz)	(AVG) Trace (dBµV)	(QP) Trace (dBµV)	Transducer (dB)	Cable (dB)	Line	(AVG) EMI (dBµV)	(QP) EMI (dBµV)	(AVG) Limit (dBµV)	(QP) Limit (dBµV)
0.2	17.4	37.5	0.2	0.1	L1	17.7	37.7	54.2	64.2
0.2	11.8	30.7	0.2	0.1	N	12.1	31.0	52.4	62.4
0.4	18.1	39.0	0.2	0.1	L1	18.4	39.2	48.2	58.2
0.4	11.0	32.8	0.2	0.1	N	11.3	33.1	48.2	58.2
0.5	9.0	27.3	0.2	0.1	N	9.3	27.6	46.6	56.6
1.2	11.8	32.7	0.3	0.1	L1	12.3	33.1	46.0	56.0

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14. RADIATED EMISSIONS

Specification: FCC Part 15.247(c)(1); RSS-210 6.2.2(o), e1

14.1 Setup

Testing was performed in accordance with ANSI C63.4, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz.

Used test set-up: B (see section 6)

14.2 Test Results

Test Operator	Bob Alexander
Date of Measurement	Jan 11, 2004
Temperature	22 °C
Humidity	44 %RH
Test Result	Complies

14.3 EUT operation mode

EUT operation mode	Connected, DH5, Static PRBS
EUT channel	0 (2402 MHz), 38 (2440 MHz), 78 (2480 MHz) and Hopping mode
EUT TX power level	Nominal

14.4 Pass/Fail Criteria

Band	Frequency Range (MHz)	FCC Class B Limit (dBµV/m at 3m)	Detector
BT	30 – 88	40	QP
BT	88 – 216	43.5	QP
BT	216 – 960	46	QP
BT	960 – 1000	54	QP
BT	> 1000	74.0/ 54.0	PK/ AV

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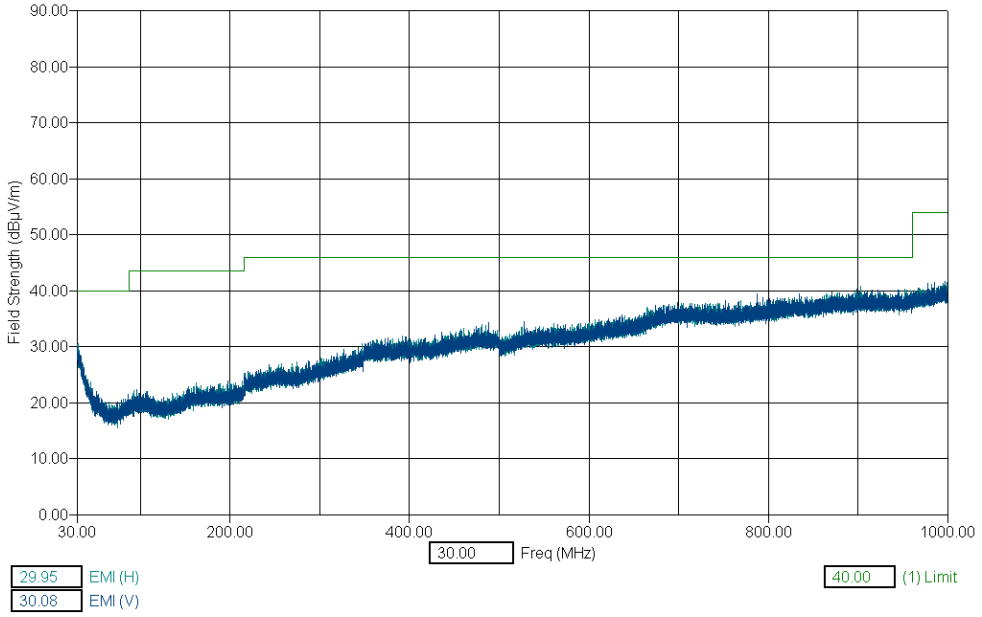
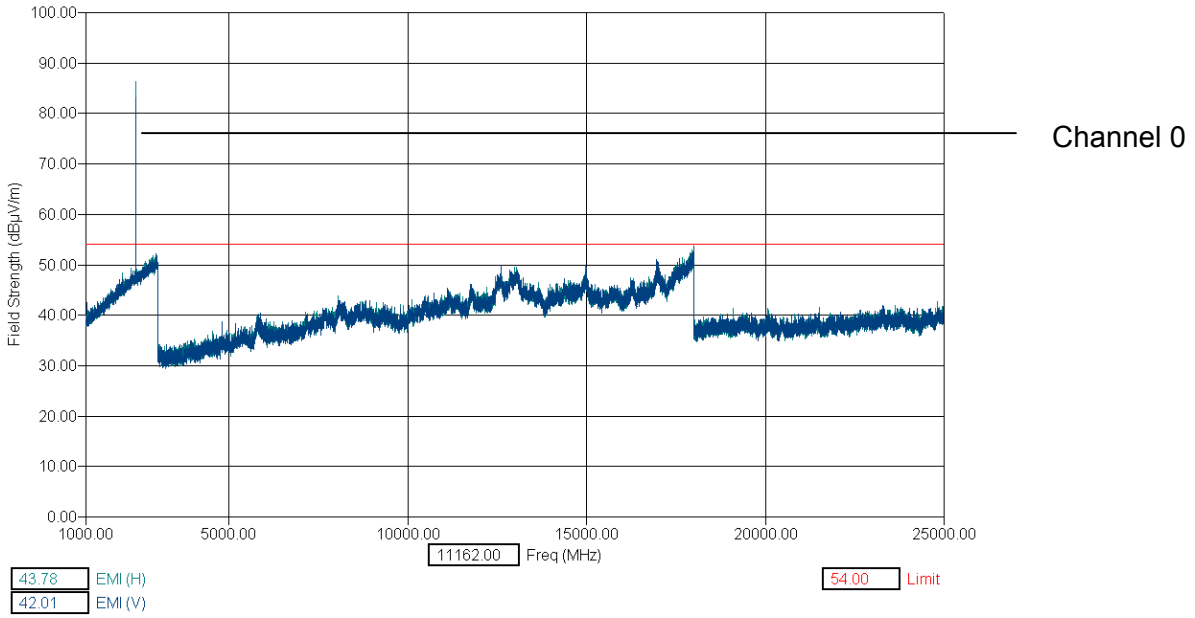
14.5 Results

Note: measurements were performed with the AC-1U Charger & HBD-4 Headset

Channel 0, 30GHz to 1GHz



Channel 0, 1GHz to 25GHz



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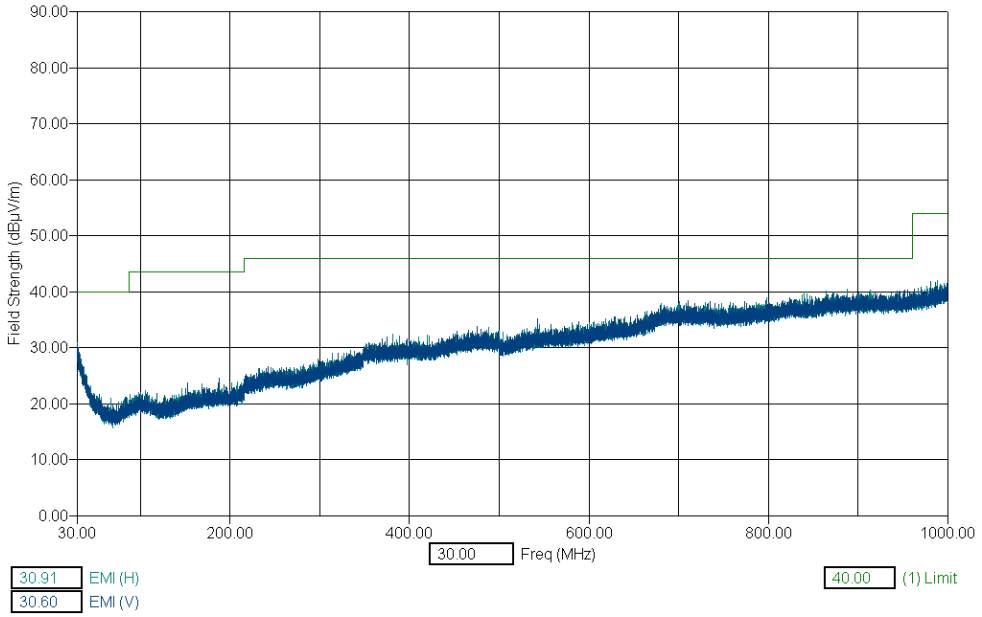
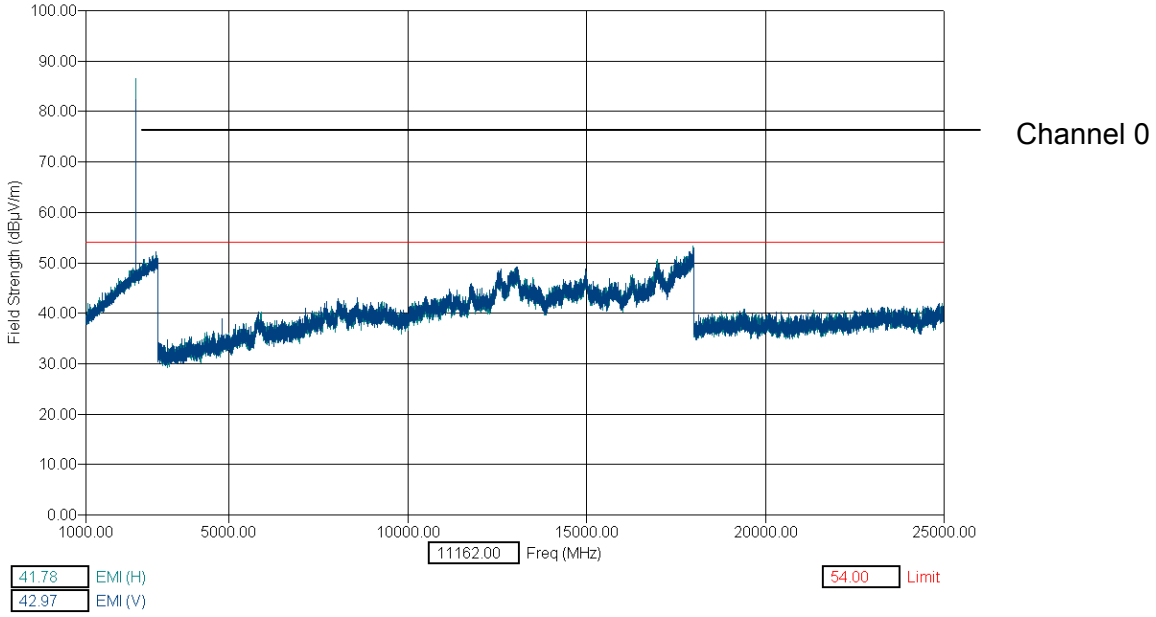
Channel 0, 30GHz to 1GHz, antenna extended



Channel 0, 1GHz to 25GHz, antenna extended



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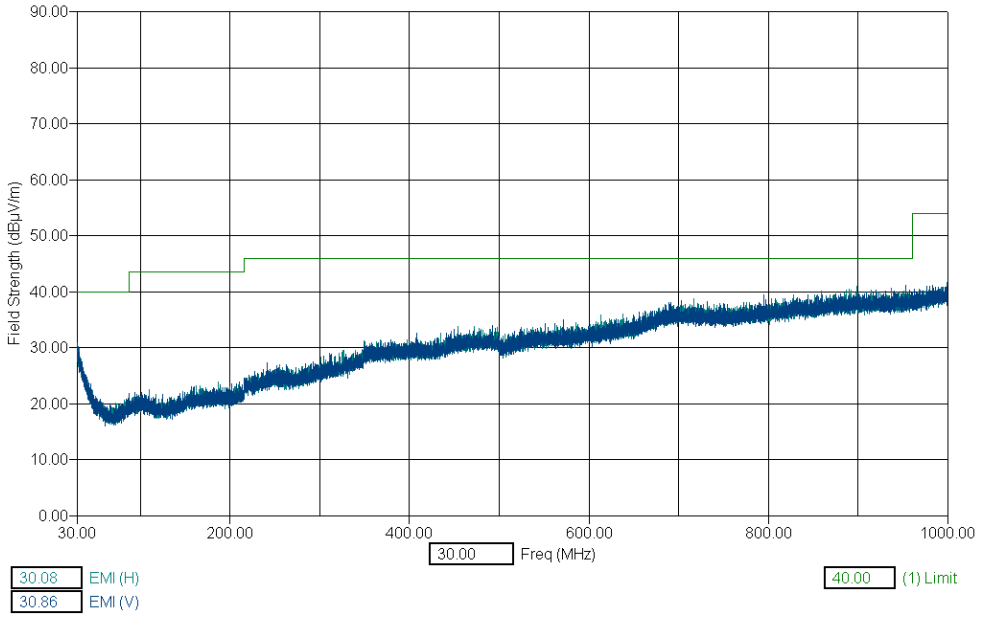
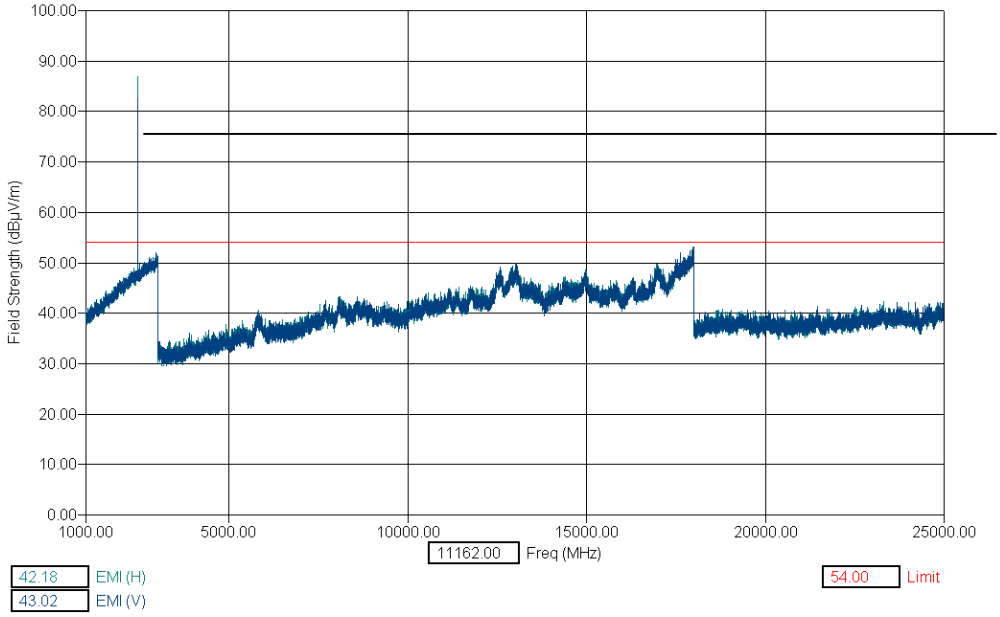
Channel 38, 30GHz to 1GHz



Channel 38, 1GHz to 25GHz



Channel 38

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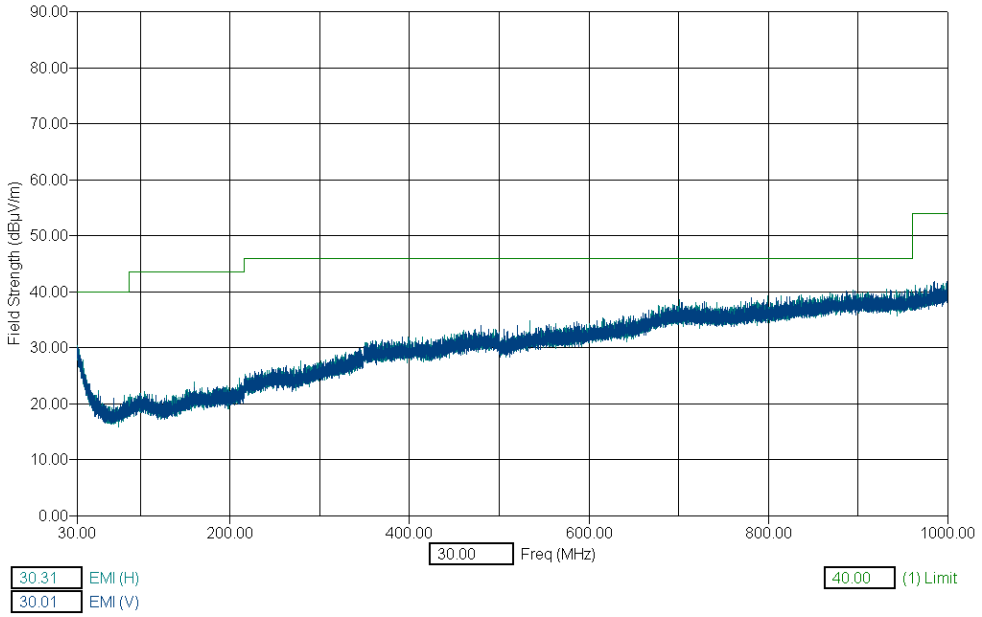
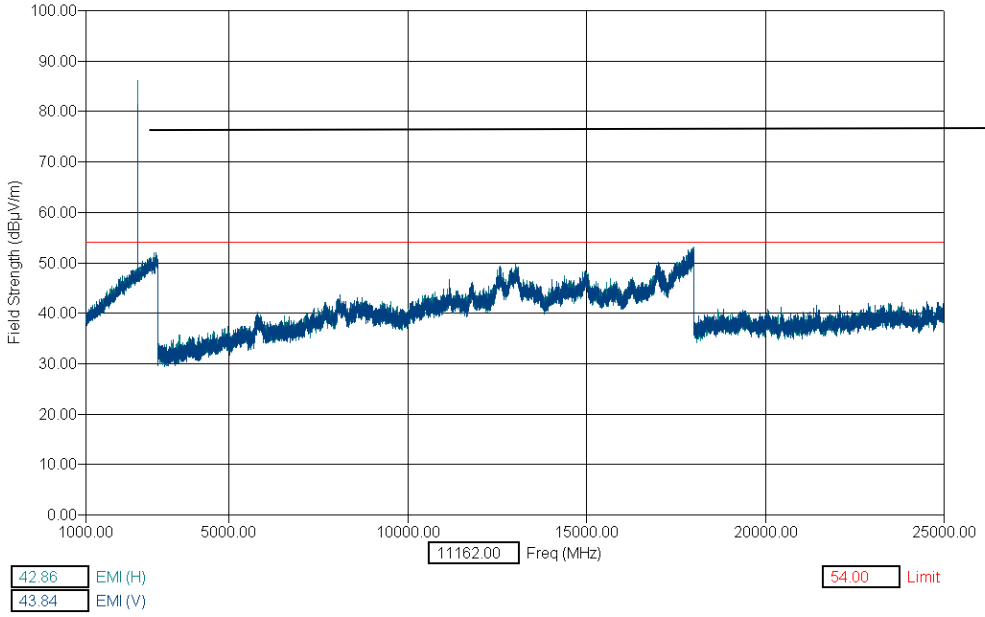
Channel 38, 30GHz to 1GHz, antenna extended



Channel 38, 1GHz to 25GHz, antenna extended



Channel 38

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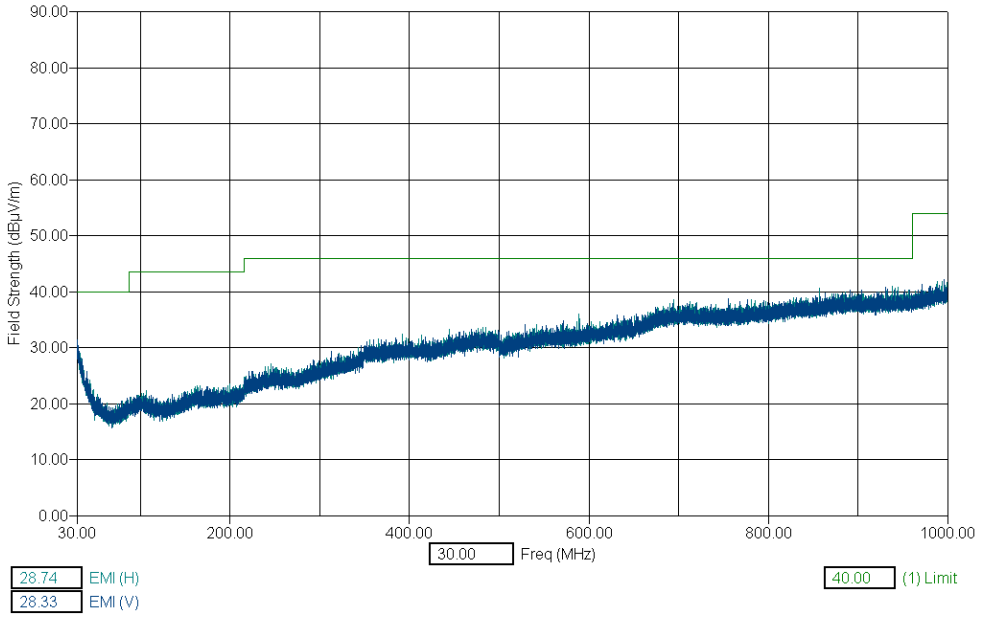
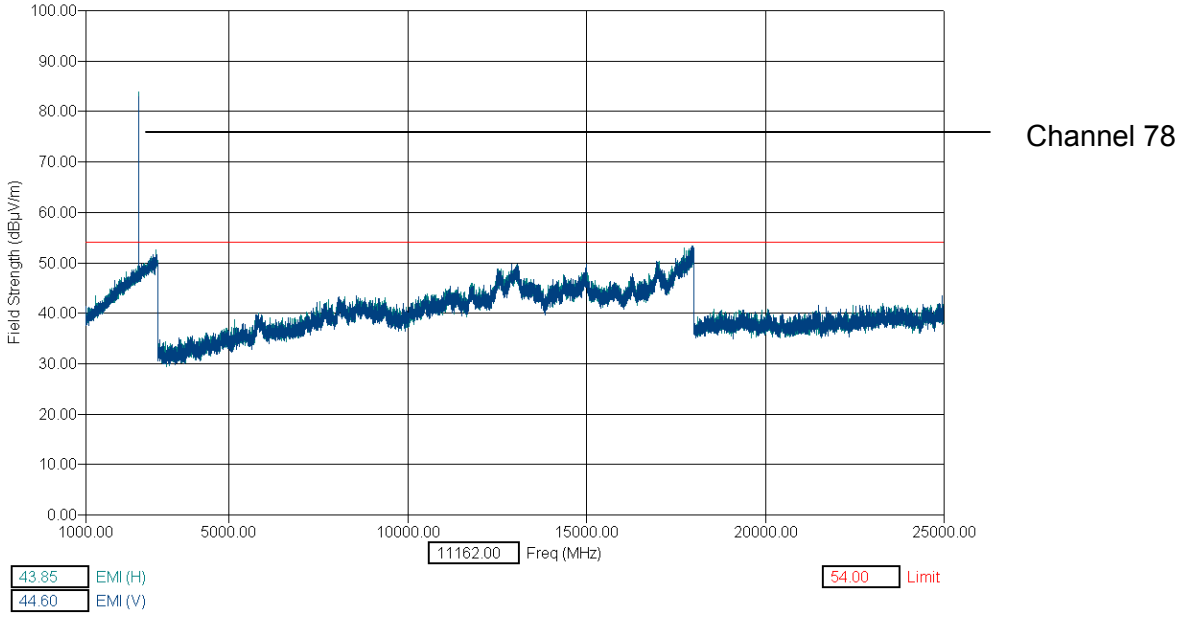
Channel 78, 30GHz to 1GHz



Channel 78, 1GHz to 25GHz



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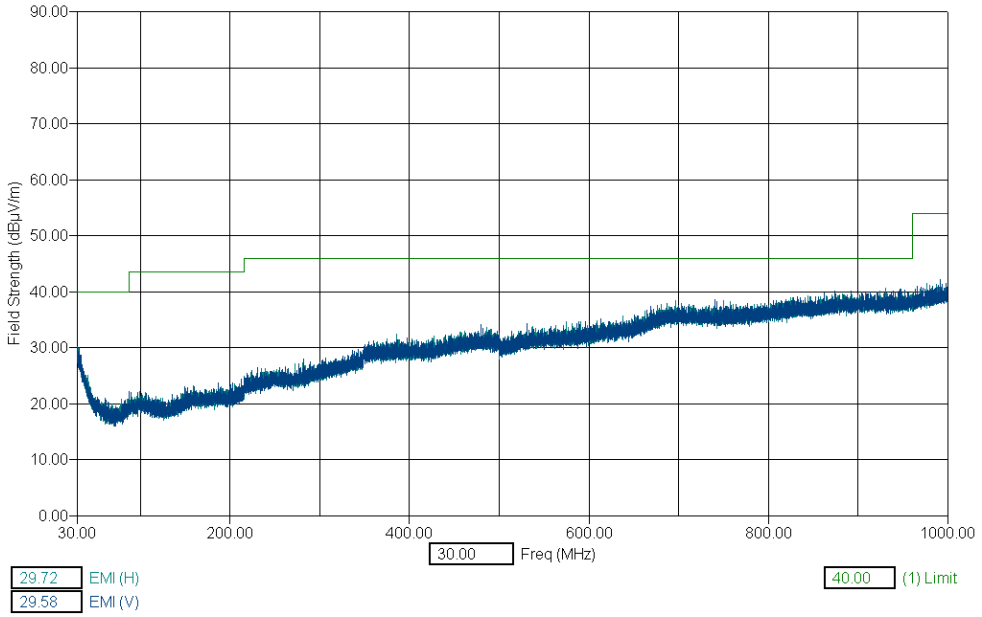
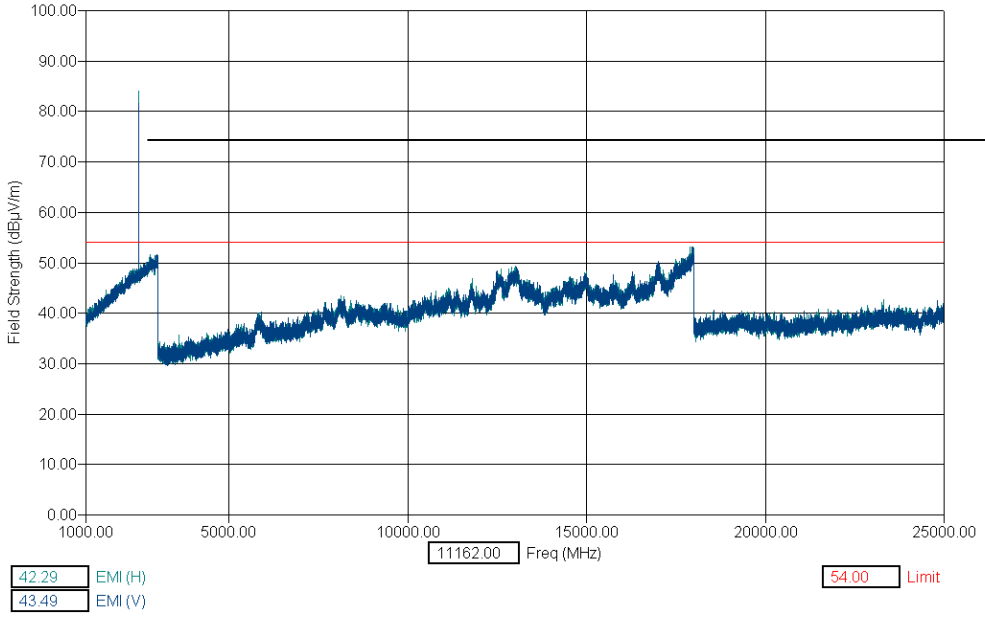
Channel 78, 30GHz to 1GHz, antenna extended



Channel 78, 1GHz to 25GHz, antenna extended



Channel 78

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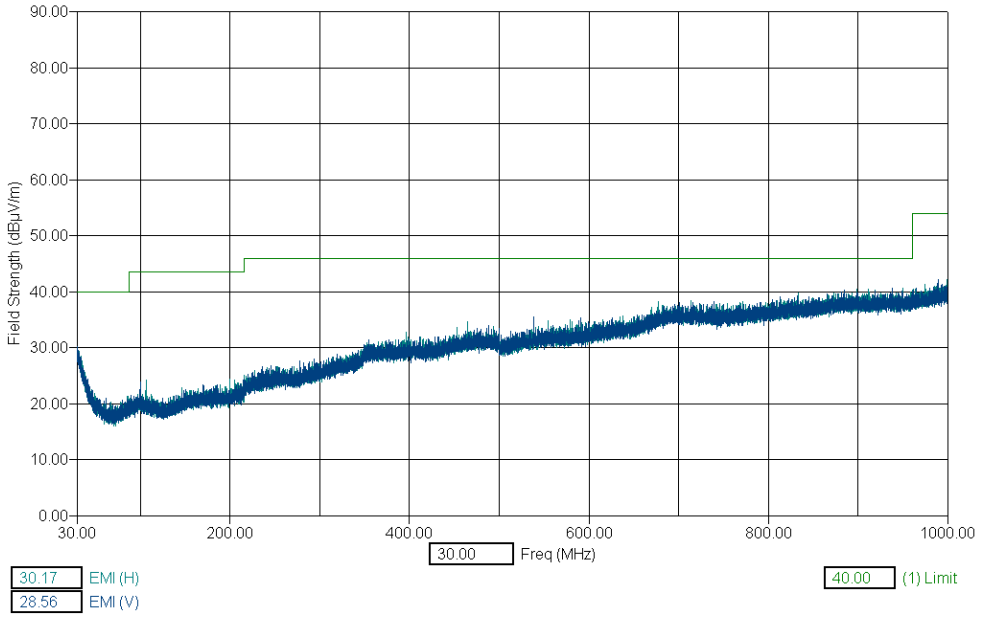
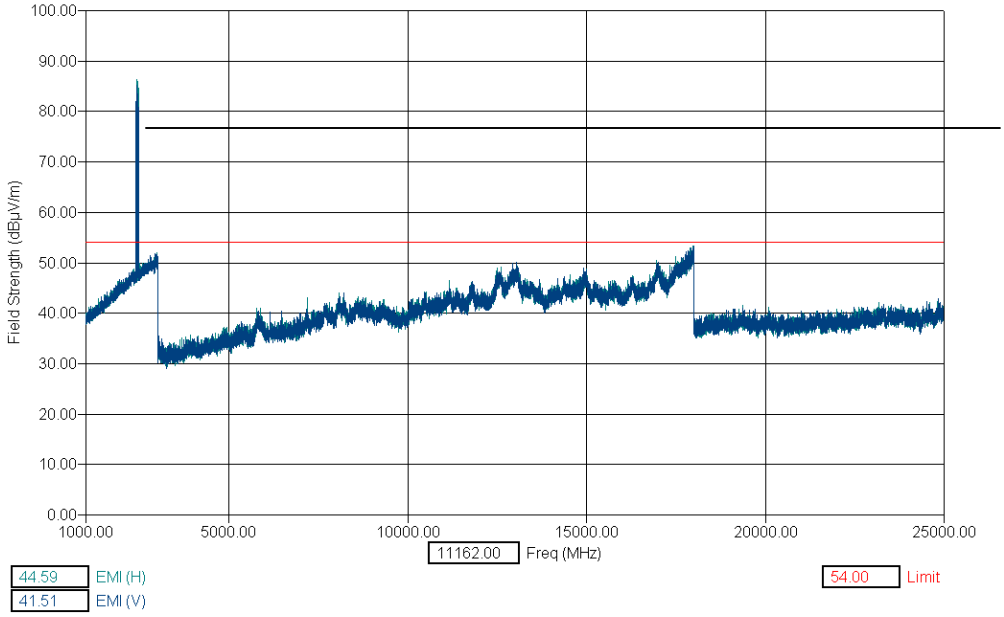
Hopping Mode, 30GHz to 1GHz



Hopping Mode, 1GHz to 25GHz



Hopping Mode

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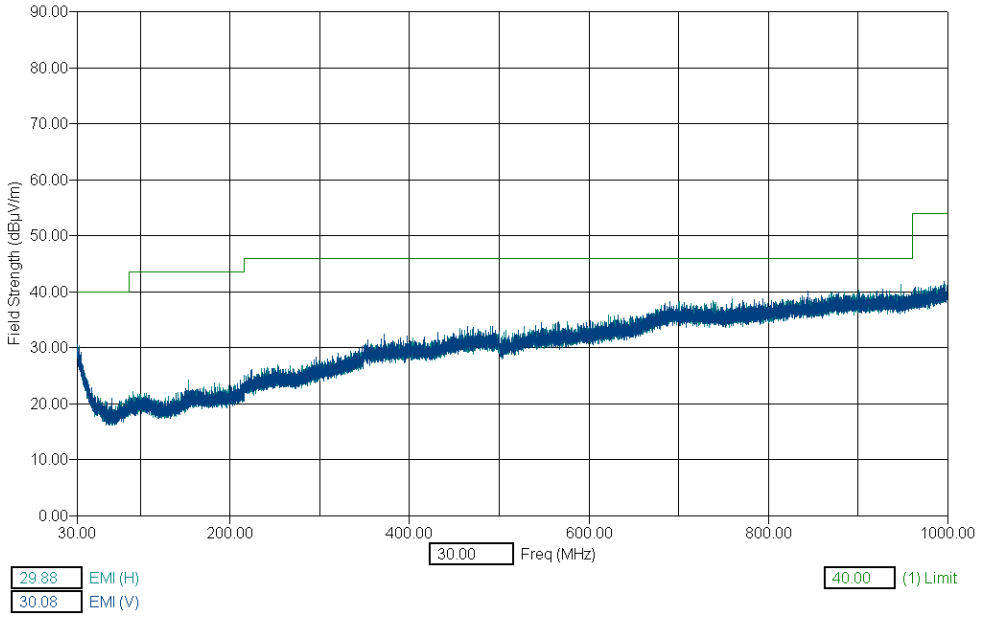
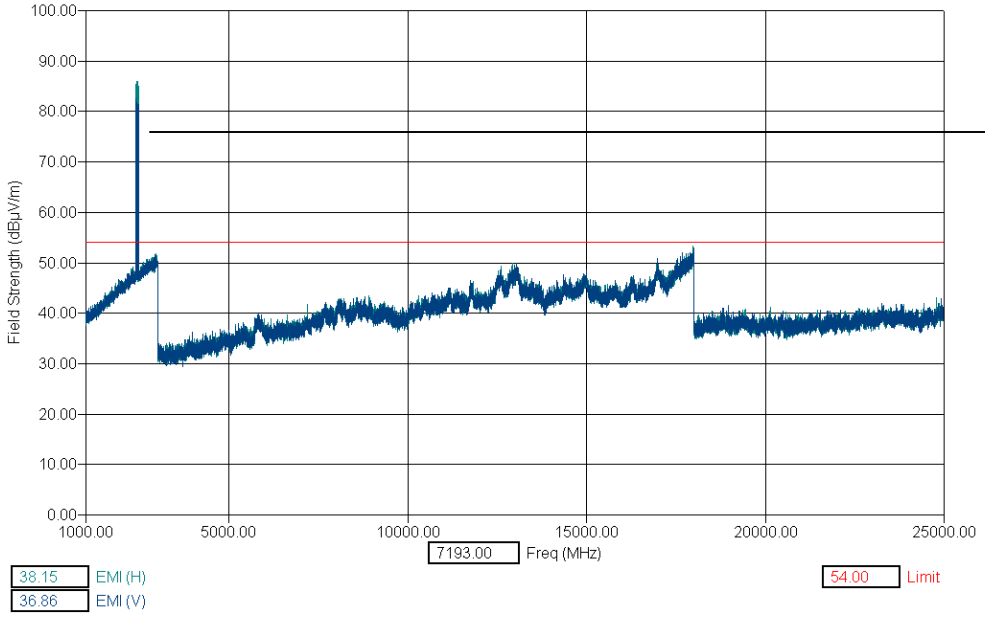
Hopping Mode, 30GHz to 1GHz, antenna extended



Hopping Mode, 1GHz to 25GHz, antenna extended



Hopping Mode

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14.6 Emission measurement data, 1GHz - 25GHz

The measurement results were obtained as described below.

$$E[uV/m] = U_{RX} + A_{CABLE} + AF - G_{PREAMP} - C_{DISTANCE}$$

Where

U_{RX} receiver reading

A_{CABLE} Attenuation of the cable

AF Antenna factor

G_{PREAMP} Gain of the preamplifier

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